AB

COMMONWEALTH OF MASSACHUSETTS

CONTRACT DOCUMENTS AND SPECIAL PROVISIONS

PROPOSAL NO.	609211-132091
P.V. =	$7,233,000.00
PLANS	YES

FOR

Federal Aid Project No. TAP/CMQ-0034(027)X
Independence Greenway Extension

in the City of

PEABODY

In accordance with the STANDARD SPECIFICATIONS
for HIGHWAYS and BRIDGES dated 2025

This Proposal to be opened and read: **TUESDAY, SEPTEMBER 23, 2025 at 2:00 P.M.**

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT 00010

TABLE OF CONTENTS

DOCUMENT 00010
TABLE OF CONTENTS ..... 00010-1 through 4

DOCUMENT 00104
NOTICE TO CONTRACTORS ..... 00104- 1 through 4

DOCUMENT 00210
REQUIREMENTS OF MASSACHUSETTS GENERAL
LAWS CHAPTER 30 SECTION 39R; CHAPTER 30, SECTION 39O ..... 00210-1 through 4

DOCUMENT 00331
LOCUS MAP ..... 00331-1 through 2

DOCUMENT 00439
CONTRACTOR PROJECT EVALUATION FORM ..... 00439-1 through 2

DOCUMENT 00440
SUBCONTRACTOR PROJECT EVALUATION FORM ..... 00440-1 through 2

DOCUMENT 00710
GENERAL CONTRACT PROVISIONS ..... 00710-1 through 2

DOCUMENT 00715
SUPPLEMENTAL SPECIFICATIONS ..... 00715-1 through 8

DOCUMENT 00719
SPECIAL PROVISIONS FOR PARTICIPATION BY DISADVANTAGED
BUSINESS ENTERPRISES ..... 00719-1 through 18

DOCUMENT 00760
REQUIRED CONTRACT PROVISIONS FOR FEDERAL-AID
CONSTRUCTION CONTRACTS ..... 00760-1 through 14

DOCUMENT 00811
MONTHLY PRICE ADJUSTMENT FOR HOT MIX ASPHALT
(HMA) MIXTURES ..... 00811-1 through 2

DOCUMENT 00812
MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE ..... 00812-1 through 2

DOCUMENT 00813
PRICE ADJUSTMENT FOR STRUCTURAL STEEL
AND REINFORCING STEEL ..... 00813-1 through 4

DOCUMENT 00814
PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES ..... 00814-1 through 2

DOCUMENT 00820
THE COMMONWEALTH OF MASSACHUSETTS
SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY,
NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM ..... 00820-1 through 6

DOCUMENT 00821
ELECTRONIC REPORTING REQUIREMENTS
CIVIL RIGHTS PROGRAM AND CERTIFIED PAYROLL ..... 00821-1 through 2

DOCUMENT 00859
CONTRACTOR/SUBCONTRACTOR CERTIFICATION FORM ..... 00859-1 through 2

TABLE OF CONTENTS (Continued)

DOCUMENT 00860
COMMONWEALTH OF MASSACHUSETTS PUBLIC EMPLOYMENT LAWS ..... 00860-1 through 2

DOCUMENT 00861
STATE PREVAILING WAGE RATES ..... 00861-1 through 38

DOCUMENT 00870
STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS ..... 00870-1 through 8

DOCUMENT 00880
MINIMUM WAGES FOR FEDERAL AND FEDERALLY
ASSISTED CONTRACTS..... 00880-1 through 54

DOCUMENT A00801
SPECIAL PROVISIONS ..... A00801-1 through 260

DOCUMENT A00802
DETAIL SHEETS..... A00802-1 through 18

DOCUMENT A00805
TRAFFIC MANAGEMENT PLANS ..... A00805-1 through 10

DOCUMENT A00808
PROJECT UTILITY COORDINATION FORM..... A00808-1 through 6

DOCUMENT A00810
MASS DOT HERBICIDE REPORT ..... A00810-1 through 2

DOCUMENT A00811
WATERING LOG..... A00811-1 through 2

DOCUMENT A00820
REQUEST FOR RELEASE OF MASSDOT AUTOCAD FILES FORM..... A00820-1 through 2

DOCUMENT A00829
ARMY CORPS OF ENGINEERS AND
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMBINED APPLICATION..... A00829-1 through 540

DOCUMENT A00830
ARMY CORPS OF ENGINEERS
PERMIT APPLICATION ..... A00830-1 through 156

DOCUMENT A00831
ARMY CORPS OF ENGINEERS
GENERAL PERMIT..... A00831-1 through 180

DOCUMENT A00840
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER QUALITY CERTIFICATE APPLICATION..... A00840-1 through 238

DOCUMENT A00841
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER QUALITY CERTIFICATE..... A00841-1 through 26

DOCUMENT A00844
U.S. FISH AND WILDLIFE SERVICE
NLAA CONCURRENCE VERIFICATION LETTER..... A00844-1 through 10

TABLE OF CONTENTS (Continued)

DOCUMENT A00860
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
NOTICE OF INTENT ..... A00860-1 through 496

DOCUMENT A00861
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
ORDER OF CONDITIONS ..... A00861-1 through 96

DOCUMENT A00875
POLICY DIRECTIVE P-22-001 AND POLICY DIRECTIVE P-22-002 ..... A00875-1 through 8

DOCUMENT B00420
PROPOSAL.....B00420-1 through 24

DOCUMENT B00853
SCHEDULE OF PARTICIPATION BY DISADVANTAGED
BUSINESS ENTERPRISES (DBEs) .....B00853-1 through 2

DOCUMENT B00854
DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION
LETTER OF INTENT.....B00854-1 through 2

DOCUMENT B00855
DBE JOINT CHECK ARRANGEMENT APPROVAL FORM.....B00855-1 through 2

DOCUMENT B00856
JOINT VENTURE AFFIDAVIT .....B00856-1 through 4

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00104

NOTICE TO CONTRACTORS

Electronic proposals for the following project will be received through the internet using www.bidx.com until the date and time stated below and will be posted on www.bidx.com forthwith after the bid submission deadline. No paper copies of bids will be accepted. All Bidders must have a valid vendor code issued by MassDOT in order to bid on projects. Bidders need to apply for a Digital ID at least 14 days prior to a scheduled bid opening date with www.bidx.com.

TUESDAY, SEPTEMBER 23, 2025 at 2:00 P.M. **
PEABODY
Federal Aid Project No. TAP/CMQ-0034(027)X
Independence Greenway Extension

****Date Subject to Change**

PROJECT VALUE = $7,233,000.00

Bidders must be pre-qualified by the Department in the HIGHWAY - CONSTRUCTION or HIGHWAY – BIKE PATHS category to bid on the above project. An award will not be made to a Contractor who is not pre-qualified by the Department prior to the opening of Proposals.

All prospective Bidders who intend to bid on this project must obtain "Request Proposal Form (R109)". The blank "Request Proposal Form (R109)" can be obtained at: https://www.mass.gov/prequalification-of-horizontal-construction-firms.

All prospective Bidders must complete and e-mail an electronic copy of "Request Proposal Form (R109)" to the MassDOT Director of Prequalification for approval: prequal.r109@dot.state.ma.us.

Proposal documents for official bidders are posted on www.bidx.com. Other interested parties may receive informational Contract Documents containing the Plans and Special Provisions, free of charge.

Bids will be considered, and the contract awarded in accordance with statutes governing such contracts in accordance with Massachusetts General Laws Chapter 30 § 39M.

The Project Bids File Attachments folder for proposals at www.bidx.com shall be used for submitting at the time of bid required information such as the Bid Bond required document, and other documents that may be requested in the proposal.

NOTICE TO CONTRACTORS (Continued)

All parties who wish to have access to information plans and specification must send a "Request for Informational Documents" to MassDOTBidDocuments@dot.state.ma.us.

A Proposal Guaranty in the amount of 5% of the value of the bid is required.

This project is subject to the schedule of prevailing wage rates as determined by the Commissioner of the Massachusetts Department of Labor and Workforce Development, and the Division of Occupational Safety, and the United States Department of Labor.

The Massachusetts Department of Transportation, in accordance with Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby affirmatively ensures that for any contract entered into pursuant to this advertisement, all bidders, including disadvantaged business enterprises, will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration for an Award.

This Proposal contains the "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)". The goals and timetables applicable to this proposal for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all work, are contained in Appendices A and B-80 of the above specifications.

The Contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this Contract as contained in Appendices C and D of the above specifications.

NOTICE TO CONTRACTORS (Continued)

PRICE ADJUSTMENTS

This Contract contains price adjustments for hot mix asphalt and Portland cement mixtures, diesel fuel, and gasoline. For reference the base prices are as follows: liquid asphalt $635.00 per ton, Portland cement $425.13 per ton, diesel fuel $2.924 per gallon, and gasoline $2.449 per gallon, and Steel Base Price Index 354.8. MassDOT posts the **Price Adjustments** on their Highway Division's website at
https://www.mass.gov/massdot-contract-price-adjustments

This Contract contains Price Adjustments for steel. See Document 00813 - PRICE ADJUSTMENT FOR STRUCTURAL STEEL AND REINFORCING STEEL for their application and base prices.

MassDOT projects are subject to the rules and regulations of the Architectural Access Board (521 CMR 1.00 et seq.)

Prospective bidders and interested parties can access this information and more via the internet at WWW.COMMBUYS.COM.

BY: Monica G. Tibbits-Nutt, Secretary and CEO, MassDOT
Jonathan L. Gulliver, Administrator, MassDOT Highway Division
SATURDAY, AUGUST 23, 2025

THIS PAGE IS LEFT BLANK INTENTIONALLY

DOCUMENT 00210

REQUIREMENTS OF MASSACHUSETTS GENERAL LAWS
CHAPTER 30, SECTION 39R;
CHAPTER 30, SECTION 39O

July 1, 1981, updated October 2016

M.G.L. c. 30, § 39R. Award of Contracts; Accounting Statements; Annual Financial Statements; Definitions.

(a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) “Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

(3) “Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

(4) “Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

(5) “Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

(7) “Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

(b) Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

(1) The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

(2) Until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

(3) If the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and

(4) If the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) If the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and

ii. to maintain accountability for assets;

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he has examined the statement of management on internal accounting controls, and expressing an opinion as to:

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the awarding authority upon request.

(e) The office of inspector general, the commissioner of capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

(f) Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b).

M.G.L. c. 30, § 39O: Suspension, Delay, or Interruption or Failure to Act by Awarding Authority; Adjustment in Contract Price; Submission of Claims.

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

<<<<<<<<<<>>>>>>>>>>

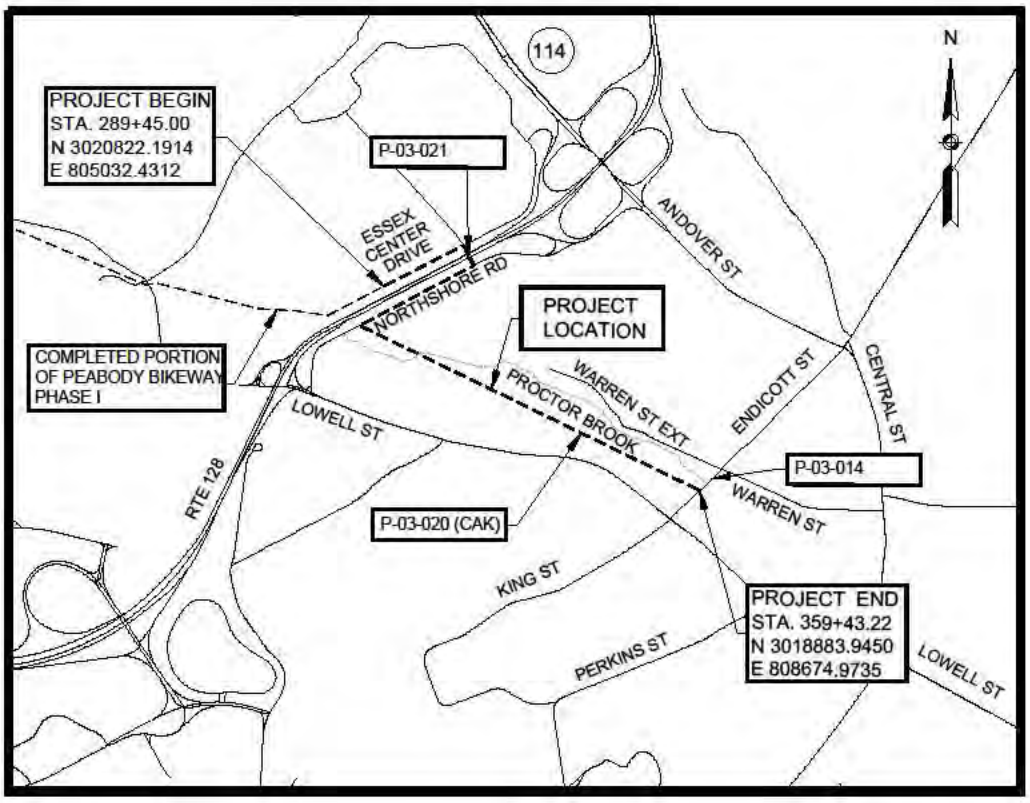
END OF DOCUMENT

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00331

LOCUS MAP

PEABODY
Federal Aid Project No. TAP/CMQ-0034(027)X
Independence Greenway Extension



NOT TO SCALE

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT 00439

Final Report ☐

Interim Report ☐

CONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Contractor:_____

Project: _____ Address:_____

F.A. No. _____ Contract Number: _____

Bid Price: _____ Notice to Proceed: _____

Funds: State:_____ Fed Aid:_____ Current Contract Completion Date:_____

Date Work Started: _____ Date Work Completed*: _____

Contractor's Superintendent: _____

Division: (indicates class of work) Highway:_____Bridge:_____Maintenance: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1=
5. Subcontractors Performance								x 1=
6. Field Supervision/ Superintendent								x 1=
7. Contract Compliance								x 0.5=
8. Equipment								x 0.5=
9. Payment of Accounts								x 0.5=
(use back for additional comments)						**Overall Rating:**		

(Give explanation of items 1 through 9 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____

Contractor's Signature Acknowledging Report/Date

Contractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held:_____

Contractor's Comments/Meeting Notes (extra sheets may be added to this form and noted here if needed):_____

_____

_____

CONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number:_____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late:_____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 9:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

_____

_____

_____

_____

_____

_____

Revised: 04/28/17

*** END OF DOCUMENT ***

DOCUMENT 00440

Final Report ☐

Interim Report ☐

SUBCONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Subcontractor: _____

Project: _____ Address: _____

F.A. No.: _____ Contract Number: _____

Prime Contractor _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Subcontractor's Superintendent: _____

Type of Work Performed by Subcontractor: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1.5=
5. Field Supervision/ Superintendent								x 1=
6. Contract Compliance								x 1=
7. Equipment								x 0.5=
8. Payment of Accounts								x 0.5=
(use back for additional comments)							**Overall Rating:**	

(Give explanation of items 1 through 8 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____ _____

Contractor Signature Acknowledging Report/Date Subcontractor Signature Acknowledging Report/Date

Subcontractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held: _____

Subcontractor's Comments / Meeting Notes (extra sheets may be added to this form and noted here if needed):

_____

_____

Contractor's Comments: _____

_____

SUBCONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number:_____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late:_____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 8: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

_____

_____

_____

_____

_____

_____

Revised: 04/28/17

*** END OF DOCUMENT ***

DOCUMENT 00710
GENERAL CONTRACT PROVISIONS
Revised: 04-16-25

NOTICE OF AVAILABILITY

The STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES dated 2025, the SUPPLEMENTAL SPECIFICATIONS, the 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS; the 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING and the CONSTRUCTION STANDARD DETAILS are available online at https://www.mass.gov/massdot-highway-division-manuals-and-publications

SPECIAL PROVISIONS FOR RIGHT-TO-KNOW ACT REQUIREMENTS

The Contractor's attention is directed to Massachusetts General Laws, Chapter 111F, commonly known as the Right-To-Know Act, and to the regulations promulgated pursuant thereto. Among the provisions of the Right-To-Know Act is a requirement that employers make available to employees Materials Safety Data Sheets (MSDS) for any substance on the Massachusetts Substance List (MSL) to which employees are, have been, or may be exposed.

To ensure prompt compliance with these regulations and legislation, the Contractor shall:

1. Deliver to the Department, prior to the start of any work under this contract, copies of MSDS for all MSL substances to be used, stored, processed or manufactured at the worksite by the Contractor.

2. Train employees of the Department, who may be exposed to MSL substances as a result of the Contractor's work under this contract, with regard to those specific substances in accordance with requirements of the Right-To-Know Act.

3. Observe all safety precautions recommended on the MSDS for any MSL substance to be used, stored, processed, or manufactured at the worksite by the Contractor.

4. Inform the Department in writing regarding specific protective equipment recommended in the MSDS for MSL substances to which employees of the Department may be exposed as a result of the Contractor's work under this contract.

The Department shall not be liable for any delay or suspension of work caused by the refusal of its employees to perform any work due to the Contractor's failure to comply with the Right-To-Know Act. The Contractor agrees to hold the Department or the Commissioner of the Department harmless and fully indemnified for any and all claims, demands, fines, actions, complaints, and causes of action resulting from or arising out of the Contractor's failure to comply with the requirements of the Right-To-Know Act.

ALTERNATIVE DISPUTE RESOLUTION
Forum, Choice of Law and Mediations:

Any actions arising out of a contract shall be governed by the laws of Massachusetts and shall be brought and maintained in a State or federal court in Massachusetts which shall have exclusive jurisdiction thereof. MassDOT and the Contractor may both agree to mediation of any claim and will share the costs of such mediation pro rata based on the number of parties involved.

*** END OF DOCUMENT ***

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT 00715

SUPPLEMENTAL SPECIFICATIONS

JUNE 30, 2025

The 2025 *Standard Specifications for Highways and Bridges* are amended by the following modifications, additions and deletions. These Supplemental Specifications prevail over those published in the Standard Specifications.

The Specifications Committee has issued these Supplemental Specifications for inclusion into each proposal until such time as they are updated or incorporated into the next Standard Specifications.

Contractors are cautioned that these Supplemental Specifications are dated and will change as they are updated.

DIVISION I

GENERAL REQUIREMENTS AND COVENANTS

SECTION 2.00: PROPOSAL REQUIREMENTS AND CONDITIONS

Subsection 2.09: Rejection of Proposals
Replace the first bullet in the third paragraph with the following:

- award of the contract would result in the Bidder exceeding the Aggregate Bonding Capacity or the Single Bonding Capacity established by its Surety Company, or the Bidder's Proposal exceeds its Single Contract Limit, or the Bidder was not prequalified in the specified class of work on or before the time of bid opening; or

SECTION 7.00: LEGAL RELATIONS AND RESPONSIBILITY TO PPUBLIC

Subsection 7.05: Insurance Requirements
Change the title of paragraph A to Workers' Compensation Insurance

Subsection 7.22: Labor, Lodging, Board, Maximum Hours of Employment, Weekly Payment, Keeping of Payroll Records.
In the second paragraph replace the word "workman" to "worker" and the word "workmen" to "workers".

Replace the third paragraph with the following:

Attention of Bidders is called to MGL Chapter 149, Section 148 requiring the weekly payment of employee wages.

SECTION 9.00: MEASUREMENT AND PAYMENT

Subsection 9.03: Payment for Extra Work

Replace paragraph B., first paragraph, numbers (2) and (3) with the following.

(2) Plus 13 percent of direct labor, for the estimated costs of Federal Insurance Contribution Act (FICA) including Medicare; Federal Unemployment Tax Act (FUTA); State Unemployment Tax Act (SUTA), which includes Unemployment Insurance, the Workforce Training Fund Program,-Employer Medical Assistance Contribution, and COVID-19 Recovery Assessment; Earned Sick Time (EST) Law (940 CMR 33.00); and Paid Family and Medical Leave (PFML) Act (458 CMR 2.00); or, as an alternative to the above 13 percent, the Contractor may elect to use actual rates for FICA, FUTA, SUTA, EST and PFML provided the actual rates are supported with verifiable documentation and shall be subject to review by MassDOT Audit Operations.

(3) Plus the estimated cost of Workers' Compensation and Liability Insurance, Health, Welfare and Pension benefits, and such additional fringe benefits which the Contractor is required to pay as a result of Union Labor Agreements and/or is required by authorized governmental agencies;

In paragraph B., second paragraph, number (3), replace the word "Workmen's" with "Workers'".

DIVISION II

CONSTRUCTION DETAILS

SECTION 300: WATER SYSTEMS

SUBSECTION 301: WATER SYSTEMS

Subsection 301.60G: Laying Pipe
Revise the third paragraph to read as follows:

Pipe sections shall be laid with the bell on the upgrade end. Before laying the pipe, the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry.

Subsection 301.80: Method of Measurement
Delete the words cast iron in the first paragraph.

Replace the second paragraph with the following:

Fittings, consisting of bends, tees, caps, wyes, sleeves, reducers, increasers, blow-off fittings and other special fittings, apply only when new materials are necessary and which are not specifically provided for under other items in the Proposal. Fittings other than new will not be paid separately but only under the applicable pipe items. When new fittings are measured separately for payment, the length of pipe occupied by the fittings will not be measured for payment.

SECTION 800: TRAFFIC CONTROL DEVICES

SUBECTION 850: TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE OPERATIONS

Subsection 850.29: Temporary Barrier and Temporary Barrier Removed and Reset
Delete this subsection.

Subsection 850.49: Temporary Barrier
Delete this subsection.

Subsection 850.69: Temporary Barrier and Temporary Barrier Removed and Reset
Delete this subsection.

Subsection 850.80: Method of Measurement
Delete the fifth paragraph from the end of this subsection.

Subsection 850.81: Basis of Payment
Delete the sixth and seventh paragraphs from the end of this subsection.

SUBECTION 853: TEMPORARY BARRIER

Subsection 853.: Temporary Barrier
Add this new subsection:

DESCRIPTION

853.20: General

Work under this Subsection consists of furnishing, placing, adjusting, resetting, maintaining, and removing temporary barrier.

MATERIALS

853.40: General

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Material	Section
Precast, Prestressed, and Prefabricated Concrete Products	M4.09.0
Temporary Barrier	M10.16.0
Limited Deflection Temporary Barrier	M10.16.1
Delineators for Temporary Barrier	M10.16.2

The Contractor shall supply a temporary barrier system that meets or exceeds the Test Level (TL) designated in the description of the bid item.

If the Contractor uses a proprietary temporary barrier system, it shall be listed on the QTCE.

Temporary barrier segments that appear to be damaged or in otherwise unsuitable condition may be rejected or ordered to be replaced by the Engineer at no additional cost.

853.41: Deflection

The deflection of a temporary barrier system is defined as the measured deflection, permanent and/or dynamic, during MASH Test Designation 2-11 (for TL-2) or Test Designation 3-11 (for TL-3).

The Contractor shall supply a temporary barrier system that is equal to or less than the maximum allowable deflection (permanent and/or dynamic) for each run of temporary barrier, as shown in the Plans or stated in the Special Provisions. If no distinction between permanent and temporary deflection is shown in the plans or Special Provisions, then dynamic deflection shall govern.

853.42: Precast Concrete Barriers

Precast Concrete Barriers used as temporary barriers shall be fabricated in accordance with M4.09.0: Precast, Prestressed, and Prefabricated Concrete Products. The Contractor shall submit a Certificate of Compliance (CoC) attesting to meeting this requirement.

853.43: Delineation

Delineators installed at 20-ft intervals throughout the entire barrier run shall be included. The delineators shall conform to M10.16.2: Delineators for Temporary Barrier. Delineators that may act as a washer on a bolted connection shall not be used unless specifically allowed by the barrier manufacturer. Delineators that are damaged, are no longer reflective, or go missing while temporary barrier is deployed shall be replaced in kind by the Contractor.

Delineators may be top or side-mounted to the barrier and oriented in a manner to maximize reflectivity to approaching traffic.

Temporary barrier placed on the right side of the travel way, or top-mounted and separating two or more lanes traveling in the same direction, shall use white delineators. Temporary barrier placed on the left side of the travel way shall use amber or yellow delineators; if separating two-way traffic and top-mounted, the delineator shall be double-sided.

853.44: Anchored Barrier

Temporary barrier systems that include an anchor system in order to meet performance requirements of the contract and/or meet MASH testing requirements may be accepted for use at the discretion of the Department.

Barrier that utilizes an anchor system shall use the same pattern, placement, and material of anchors that was used in MASH crash testing.

853.45: Shop Drawings

Within 30 days of the Notice to Proceed, the Contractor shall provide Shop Drawings showing the proposed temporary barrier system and confirming that it conforms to 853.40: General and will meet the allowable deflection requirements as described in 853.41: Deflection.

If anchors are proposed, the means, methods, pattern, placement, and materials for anchoring and subsequent pavement and/or deck repairs following removal of the temporary barrier system shall be included in the Shop Drawing submittal. If the use of an anchor system is rejected by the Department, the Contractor shall select an unanchored system that meets or exceeds the contract specified performance requirements, at no additional cost.

Shop Drawings for proprietary barrier systems shall include manufacturer's instructions for installation.

CONSTRUCTION METHODS

853.60: General

A Traffic Management Plan approved by the Department is required prior to the installation of the temporary barrier system.

The Contractor shall install temporary barrier systems in accordance with the Plans.

Barrier ends shall not be exposed to approaching traffic during installation. Crashworthy shielding or attenuation shall be provided at all times.

Proprietary temporary barrier systems shall be installed per the manufacturer's instructions.

The Contractor shall not place any breaks in the temporary barrier system that will result in sections that are shorter than the tested minimum length-of-need (LON) under MASH Test 2-11 (for TL-2) or 3-11 (for TL-3). Exceptions shall be allowed for gate systems or changeable length segments placed over expansion joints, if those barrier segment types have been determined to be crashworthy per MASH.

Temporary barrier shall not be placed on unpaved surfaces, unless otherwise shown in the Plans.

The Contractor shall not store materials, vehicles, or other equipment within the measured dynamic deflection envelope, as defined in 853.41: Deflection.

853.61: Temporary Barrier Removed and Reset

Temporary Barrier Removed and Reset consists of relocating a string of temporary barrier from one alignment to another to support the sequence and phasing of construction, as shown in the Plans.

Temporary Barrier Removed and Reset does not include moving all or a portion of the temporary barrier system to gain access to a work area, for the convenience of the Contractor, or to realign units that have moved due to construction activities or a traffic incident.

853.62: Quality Control Inspection

After temporary barrier installation is completed, the Contractor shall perform a Quality Control (QC) Inspection in the presence of the Engineer. QC Inspection activities shall include, but are not limited to the following reviews:

- Installation location per the approved Plans.
- Alignment and connection mechanism between adjacent barrier segments.
- Alignment and connection mechanism between barrier segment and attenuator, if present.
- Anchor system installation, if present.

For proprietary barrier systems, the QC Inspection shall also include any manufacturer-specific inspection details or criteria found in the installation instructions.

Work behind the barrier shall not commence until the QC Inspection has been accepted by the Engineer.

COMPENSATION

853.80: Method of Measurement

Temporary Barrier will be measured by the foot installed, in place.

Temporary Barrier Removed and Reset will be measured by the foot removed and reset.

853.81: Basis of Payment

Temporary Barrier will be paid for at the contract unit price per foot which shall provide full compensation for fabrication, storage, transport, furnishment, installation, delineation, alignment, maintenance, repair, and final removal of the temporary barrier.

Temporary Barrier Removed and Reset will be paid for at the contract unit price per foot which shall provide full compensation for removing, relocating, transporting, and installing new anchorage (if used). If more than one accepted temporary barrier system is approved for use in a single contract, the unit cost for Temporary Barrier Removed and Reset shall not differ among systems.

All costs associated with fabrication, installation, and maintenance of temporary barrier delineators shall be considered incidental to the cost of the item.

All costs associated with Shop Drawings and COCs shall be considered incidental to the item.

All costs associated with patching or repairing the road surface or bridge deck due to the installation and removal of temporary barrier and/or anchors for a temporary barrier system shall be considered incidental to the cost of the item.

853.82: Payment Items

Item number	Description	Unit
853.2	Temporary Barrier (TL-2)	Foot
853.21	Temporary Barrier Removed and Reset	Foot
853.23	Temporary Barrier (TL-3)	Foot
853.33	Temporary Barrier – Limited Deflection (TL-3)	Foot

SECTION 900: STRUCTURES

SUBECTION 902: ULTA HIGH PERFORMANCE CONCRETE

Subsection 902.32: Mockup
In Table 902.32-1 change the Link Slab width to 2 ft – 0 in. and change the Joint Header width to 0 ft – 6 in.

Subsection 902.32: - 902.38
Renumber section 902.32 Surface Preparation to 902.33 Surface Preparation and renumber section 902.33 through 902.38 to 902.34 through 902.39.

DIVISION III

MATERIALS SPECIFICATIONS

SECTION M2: AGGREGATES AND RELATED MATERIALS

Subsection M2.01.0 Crushed Stone
Replace the fourth paragraph and the associated asterisk notes with the following;

The crushed stone shall have a maximum 45% wear as determined by the Los Angeles Abrasion Test (AASHTO T 96)

SECTION M5: PIPE, CULVERT SECTIONS AND CONDUIT

Subsection M5.01.0 Joint Materials for Pipe
Replace this subsection with the following:

- Jute or oakum furnished for use in pipe joints shall be of an accepted grade approved for common usage.
- Mortar shall conform to the requirements of M4.04.0: Cementitious Grout, Mortar and Concrete Products
- Standard couplers as approved by the manufacturer shall be used to join corrugated metal pipe
- Rubber ring or plastic gaskets for concrete pipe joints, or manholes section joints shall be of tough, flexible, chemical-resistant material, and of such size and shape as to ensure satisfactory pipe joints when incorporated in the work and shall conform to AWWA C153.
- Rubber gasket joints for ductile iron pipe shall be Styrene-Butadiene Rubber (SBR), Ethylene Propylene Diene Monomer (EPDM) or Nitrile and conform to AWWA C111

Subsection M5.05.03.B Gate Valves
Replace this subsection with the following:

Gate valves shall conform to the requirements of AWWA Standard C500 and/or to the type used by the municipality as specified in the Special Provisions.

SECTION M7: PAINTS, PROTECTIVE COATINGS AND PAVEMENT MARKINGS

Subsection M7.01.04 Fast Drying White and Yellow Waterborne Traffic Paint
Replace the subsection with the following:

Approved waterborne traffic paint shall be tested in accordance with AASHTO M 348 and be listed on the QCML The dry paint film shall be under the Toxicity Characteristic Leaching Procedure (TCLP) limits for all contaminants listed in 40 CFR 261.24. The markings shall be installed using reflective glass beads meeting the requirements of M7.01.07. For waterborne yellow paint use Organic Yellow No. 65 or No. 75 pigment.

SECTION M9: MISCELLANEOUS MATERIALS

Subsection M9.12.0 Reflectors for Barriers
Delete this subsection.

SECTION M10: TRAFFIC CONTROL DEVICES

Subsection M10.16.0: Temporary Barrier
Subsection M10.16.1: Limited Deflection Temporary Barrier
Subsection M10.16.2: Delineators for Temporary Barrier
Add these new subsections.

M10.16.0: Temporary Barrier

All Temporary Barrier shall be tested to MASH crash testing standards and the results of the following crash test designations must fall within the acceptable impact tolerances and evaluation criteria shown in Table 2-2A of MASH:

- Test Level 2: 2-10, 2-11
- Test Level 3: 3-10, 3-11

M10.16.1: Limited Deflection Temporary Barrier

To be classified as a Limited Deflection Temporary Barrier, the results of MASH Test Designation 3-11 must result in a measured dynamic deflection of 24 in. or less.

M10.16.2: Delineators for Temporary Barrier

Delineators for Temporary Barrier shall consist of a housing, retroreflective material, and an adhesive or mechanical fastener.

Housings for Delineators for Temporary Barrier shall be fabricated from a lightweight polymer material. Metal housings shall not be permitted.

Retroreflection shall be achieved using an acrylic reflector or retroreflective sheeting directly applied to the housing. If used, retroreflective sheeting shall be factory applied and conform to ASTM D4956 Type IV, Type V, or Type IX. A minimum of 8 $in.^2$ of reflective material shall be visible on any traffic-facing portion of the delineator.

Delineators shall be attached to temporary barriers using a manufacturer-approved adhesive or mechanical fastener.

<<<<<<<<<<>>>>>>>>>>

END OF SUPPLEMENTAL SPECIFICATIONS

DOCUMENT 00719

(Revised September 14, 2023 – for all Federally Aided Projects)

SPECIAL PROVISIONS FOR PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES

(IMPLEMENTING TITLE 49 OF THE CODE OF FEDERAL REGULATIONS, PART 26)

Section: Page 00719-

POLICY 2
1. DEFINITIONS 3
2. DBE PARTICIPATION 5
   a. Goal 5
   b. Bidders List 5
3. CONTRACTOR ASSURANCES 6
4. REQUIRED SUBCONTRACT PROVISIONS 6
5. ELIGIBILITY OF DBES 6
   a. Massachusetts DBE Directory 6
   b. DBE Certification 6
   c. Joint Venture Approval 7
6. COUNTING DBE PARTICIPATION TOWARDS DBE PARTICIPATION GOALS 7
   a. Commercially Useful Function 7
   b. Counting Participation Toward The Contract Participation Goal 7
   c. Joint Check Policy 9
   d. Joint Check Procedure(s) 10
7. AWARD DOCUMENTATION AND PROCEDURES 11
8. COMPLIANCE 13
9. SANCTIONS 16
10. FURTHER INFORMATION; ENFORCEMENT, COOPERATION AND CONFIDENTIALITY 16
11. LIST OF ADDITIONAL DOCUMENTS 18

POLICY

The Massachusetts Department of Transportation (MassDOT) receives Federal financial assistance from the Federal Highway Administration (FHWA), United States Department of Transportation (U.S. DOT), and as a condition of receiving this assistance, has signed an assurance that it will comply with 49 CFR Part 26 (Participation By Disadvantaged Business Enterprises In Department Of Transportation Financial Assistance Programs). The U.S. DOT Disadvantaged Business Enterprise Program is authorized by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users ("SAFETEA-LU"), as amended, at Title 23, United States Code, § 1101.

Accordingly, MassDOT has established a Disadvantaged Business Enterprise (DBE) Program in accordance with 49 CFR Part 26. It is the policy of MassDOT to ensure that DBEs have an equal opportunity to receive and participate in U.S. DOT assisted Contracts, without regard to race, color, national origin, or sex. To this end, MassDOT shall not directly, or through contractual or other arrangements, use criteria or methods of administration that have the effect of defeating or substantially impairing accomplishment of the program objectives stated below:

- To ensure nondiscrimination in the award and administration of U.S. DOT assisted Contracts;
- To create a level playing field on which DBEs can compete fairly for U.S. DOT assisted Contracts;
- To ensure that the DBE Program is narrowly tailored in accordance with applicable law;
- To ensure that only firms that fully meet 49 CFR Part 26 eligibility standards are permitted to participate as DBEs;
- To help remove barriers to the participation of DBEs in U.S. DOT assisted Contracts; and
- To assist the development of firms that can compete successfully in the market place outside the DBE Program.

The Director of Civil Rights of MassDOT has been designated as the DBE Liaison Officer. The DBE Liaison Officer is responsible for implementing all aspects of the DBE Program. Other MassDOT employees are responsible for assisting the Office of Civil Rights in carrying out this obligation. Implementation of the DBE Program is accorded the same priority as compliance with all other legal obligations incurred by MassDOT in its financial assistance agreements with each operating administration of the U.S. DOT. Information on the Federal requirements and MassDOT's policies and information can be found at:

Type of Info	***Website***	***Description***
MassDOT Highway Division Policies and Info	https://www.mass.gov/disadvantaged-business-enterprise-goals-2019-2022	*MassDOT– Highway Div'n Page*
For copies of the Code of Federal Regulations	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR	FDsys – US Gov't Printing Office
For information about the U.S.DOT DBE Program	https://www.transportation.gov/civil-rights/disadvantaged-business-enterprise	U.S. DOT/ FHWA page

1. DEFINITIONS

As used in these provisions, the terms set out below are defined as follows:

"Broker", for purposes of these provisions, shall mean a DBE Entity that has entered into a legally binding relationship to provide goods or services delivered or performed by a third party. A broker may be a DBE Entity that arranges or expedites transactions but performs no work or installation services.

"Contractor", "General" or "Prime" Contractor, "Bidder," and "DB Entity" shall mean a person, firm, or other entity that has contracted directly with MassDOT to provide contracted work or services.

"Contract" shall mean the Contract for work between the Contractor and MassDOT.

"DBB" or "Design-Bid-Build" shall mean the traditional design, bid and project delivery method consisting of separate contracts between awarding authority and a designer resulting in a fully designed project; and a separate bidding process and Contract with a construction Contractor or Bidder.

"DB" or "Design-Build" shall mean an accelerated design, bid and project delivery method consisting of a single contract between the awarding authority and a DB Entity, consisting of design and construction companies that will bring a project to full design and construction.

"Disadvantaged Business Enterprise" or "DBE" shall mean a for-profit, small business concern:

(a) that is at least fifty-one (51%) percent owned by one or more individuals who are both socially and economically disadvantaged, or, in the case of any corporation, in which at least fifty-one (51%) percent of the stock is owned by one or more such individuals; and

(b) where the management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

"FHWA" shall mean the Federal Highway Administration," an agency within U.S. DOT that supports State and local governments in the design, and maintenance of the Nation's highway system (Federal Aid Highway Program).

"Good faith efforts" shall mean efforts to achieve a DBE participation goal or other requirement of these Special Provisions that, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement. Such efforts must be deemed acceptable by MassDOT.

"Joint Venture" shall mean an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which the parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the Contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

"Approved Joint Venture" shall mean a joint venture, as defined above, which has been approved by MassDOT's Prequalification Office and Office of Civil Rights for DBE participation on a particular Contract.

"Manufacturer" shall mean a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles or equipment required under the contract and of the general character described by the specifications.

"Regular Dealer" shall mean a DBE firm that owns, operates, or maintains a store, warehouse, or other establishment in which materials, supplies, articles or equipment of the general character described by the specifications and required under the Contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.

(a) To be a regular dealer, the firm must be an established, regular business that engages, as its principal business, and under its own name, in the purchase and sale of the products in question.

(b) A person may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business as provided above if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by long term lease agreement and not on an ad hoc or contract by contract basis.

(c) Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not regular dealers within the meaning of this definition.

"Responsive" and "Responsible" refers to the bidder's submittal meeting all of the requirements of the advertised request for proposal. The term responsible refers to the ability of the Contractor to perform the work. This ability can be determined prior to bid invitations.

"Small Business or Small Business Concern" shall mean a small business concern or company as defined in Section 3 of the Small Business Act and SBA regulations implementing it (13 CFR Part 121); and is a business that does not exceed the cap on annual average gross receipts established by the U.S. Secretary of Transportation pursuant to 49 CFR Part 26.65; see also 49 CFR Part 26.39.

"SDO" shall mean the Massachusetts Supplier Diversity Office, formerly known as the State Office of Minority and Women Business Assistance (SOMWBA). In 2010, SOMWBA was abolished and the SDO was established. *See* St. 2010, c. 56. The SDO has assumed all the functions of SOWMBA. SDO is an agency within the Commonwealth of Massachusetts Executive office of Administration and Finance (ANF) Operational Services Division (OSD). The SDO mandate is to help promote the development of business enterprises and non-profit organizations owned and operated by minorities and women.

"Socially and economically disadvantaged individuals" shall mean individuals who are citizens of the United States (or lawfully admitted permanent residents) and who are:

(a) Individuals found by SDO to be socially and economically disadvantaged individuals on a case by case basis.

(b) Individuals in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

(1) "Black Americans" which includes persons having origin in any of the Black racial groups of Africa; (2) "Hispanic Americans" which include persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race; (3) "Native Americans" which include persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians; (4) "Asian Pacific Americans" which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Tuvalu, Nauru, Federated States of Micronesia, or Hong Kong; (5) "Subcontinent Asian Americans" which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka; (6) Women; or (7) Any additional groups whose members are designated as socially and economically disadvantaged by the Small Business Administration (SBA), at such time as the SBA designation becomes effective.

Other terms and definitions applicable to the U.S. DOT DBE Program may be found at 49 CFR Part 26 and related appendices and guidance pages.

2. DBE PARTICIPATION

a. Goal

On this Contract, MassDOT has established the following goal(s) for participation by firms owned and controlled by socially and economically disadvantaged persons. At least half of the goal must be met in the form of DBE Subcontractor construction activity as opposed to material supplies or other services. The applicable goal remains in effect throughout the life of the contract regardless of whether pre-identified DBE Subcontractors remain on the Project or under Contract.

☒ Design-Bid-Build Projects: DBE Participation Goal **0 %**
(*One half of this goal shall be met in the form of Subcontractor construction activity*)

☐ Design-Build Projects: DBE Design Participation Goal ____**%** and DBE Construction Participation Goal **%**
(One half of the Construction Goal shall be met in the form of Subcontractor construction activity)

b. Bidders List

Pursuant to the provisions of 49 CFR Part 26.11(c), Recipients such as MassDOT, must collect from all Bidders who seek work on Federally assisted Contracts the firm full company name(s), addresses and telephone numbers of all firms that have submitted bids or quotes to the Bidders in connection with this Project. All bidders should refer to the Special Provision Document "A00801" of the Project proposal for this requirement.

In addition, MassDOT must provide to U.S. DOT, information concerning contractors firm status as a DBE or non-DBE, the age of the firm, and the annual gross receipts of the firm within a series of brackets (e.g., less than $500,000; $500,000–$1 million; $1–2 million; $2–5 million, etc.). The status, firm age, and annual gross receipt information will be sought by MassDOT regularly prior to setting its DBE participation goal for submission to U.S. DOT. MassDOT will survey each individual firm for this information directly.

Failure to comply with a written request for this information within fifteen (15) business days may result in the suspension of bidding privileges or other such sanctions, as provided for in Section 9 of this provision, until the information is received.

3. CONTRACTOR ASSURANCES

No Contractor or any Subcontractor shall discriminate on the basis of race color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in all respects and as applicable prior to, or subsequent to, award of U.S. DOT assisted Contracts. The Contractor agrees to affirmatively seek out and consider DBE firms as Contractors, Subcontractors, and/or suppliers of materials and services for this Contract. No Contract will be approved until MassDOT has reviewed Bidders'/Contractors' affirmative actions concerning DBEs. Failure to carry out these requirements is a material breach of this Contract which may result in the termination of the Contract or such other remedy as MassDOT or FHWA deem appropriate.

4. REQUIRED SUBCONTRACT PROVISIONS

The Prime Contractor shall include the provisions of Section 3 above in every subcontract, making those provisions binding on each Subcontractor; in addition, the Prime Contractor shall include a copy of this Special Provision, in its entirety, in every subcontract with a DBE firm which is, or may be, submitted for credit toward the Contract participation goal.

5. ELIGIBILITY OF DBES

Only firms that have been certified by SDO and confirmed by MassDOT as eligible in accordance with 49 CFR Part 26 to participate as DBEs on federally aided MassDOT Contracts may be used on this Contract for credit toward the DBE participation goal.

a. Massachusetts DBE Directory

MassDOT makes available to all bidders the most current Massachusetts Disadvantaged Business Enterprise Directory. This directory is made available for Contractors' convenience and is informational only. The Directory lists those firms that have been certified as eligible in accordance with the criteria of 49 CFR Part 26 to participate as DBEs on federally aided MassDOT contracts. The Directory also lists the kinds of work each firm is certified to perform but does not constitute an endorsement of the quality of performance of any business and does not represent MassDOT Subcontractor approval.

Contractors are encouraged to make use of the DBE Directory maintained by SDO on the Internet. This listing is updated daily and may be accessed at the SDO's website at:
https://www.diversitycertification.mass.gov/BusinessDirectory/BusinessDirectorySearch.aspx

b. DBE Certification

A firm must apply to SDO, currently acting as certification agent for MassDOT, for DBE certification to participate on federally aided MassDOT Contracts. A DBE application may be made in conjunction with a firm's application to SDO for certification to participate in state-funded minority and women business enterprise programs or may be for DBE certification only. An applicant for DBE certification must identify the area(s) of work it seeks to perform on U.S. DOT funded projects.

c. Joint Venture Approval

To obtain recognition as an approved DBE Joint Venture, the parties to the joint venture must provide to MassDOT's Office of Civil Rights and Prequalification Office, at least fourteen (14) business days before the bid opening date, an Affidavit of DBE/Non-DBE Joint Venture in the form attached hereto, and including, but not limited to the following:

1. a copy of the Joint Venture Agreement;
2. a description of the distinct, clearly defined portion of the contract work that the DBE will perform with its own forces; and,
3. all such additional information as may be requested by MassDOT for the purpose of determining whether the joint venture is eligible.

6. COUNTING DBE PARTICIPATION TOWARDS DBE PARTICIPATION GOALS

In order for DBE participation to count toward the Contract participation goal, the DBE(s) must have served a commercially useful function in the performance of the Contract and must have been paid in full for acceptable performance.

a. Commercially Useful Function

(1) In general, a DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. With respect to materials and supplies used on the Contract, the DBE must be responsible for negotiating price, determining quality and quantity, ordering the material, installing (where applicable) and paying for the material itself.

(2) To determine whether a DBE is performing a commercially useful function, MassDOT will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the Contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and other relevant factors.

(3) A DBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation. In determining whether a DBE is such an extra participant, MassDOT will examine similar transactions, particularly those in which DBEs do not participate.

b. Counting Participation Toward The Contract Participation Goal

DBE participation which serves a commercially useful function shall be counted toward the DBE participation goal in accordance with the Provisions of 49 CFR Part 26.55(a) to (h), as follows:

(1) When a DBE participates in a construction Contract, MassDOT will count the value of the work performed by the DBE's own forces. MassDOT will count the cost of supplies and materials obtained by the DBE for the work of its contract, including supplies purchased or equipment leased by the DBE. Supplies, labor, or equipment the DBE Subcontractor uses, purchases, or leases from the Prime Contractor or any affiliate of the Prime Contractor will not be counted.

(2) MassDOT will count the entire amount of fees or commissions charged by a DBE firm for providing bona fide services, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a U.S. DOT assisted Contract, toward DBE participation goals, provided it is determined that the fee is reasonable and not excessive as compared with fees customarily allowed for similar services.

(3) When a DBE performs as a participant in a joint venture, MassDOT will count toward DBE participation goals a portion of the total dollar value of the contract that is equal to the distinct, clearly defined portion of the work of the Contract that the DBE performs with its own forces.

(4) MassDOT will use the following factors in determining whether a DBE trucking company is performing a commercially useful function:

(i) the DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract; there cannot be a contrived arrangement for the purpose of meeting DBE participation goals.

(ii) the DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the Contract.

(iii) the Contractor will receive DBE credit for the total value of the transportation services the DBE provides on the Contract using trucks owned, insured, and operated by the DBE itself and using drivers the DBE employs alone.

(iv) the DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The Contractor who has a contract with a DBE who leases trucks from another DBE will receive credit for the total value of the transportation services of the lease.

(v) the DBE may also lease trucks from a non-DBE firm, including an owner-operator. The Contractor who has a Contract with a DBE who leases trucks from a non-DBE is entitled to credit for the total value of the transportation services provided by non-DBE lessees not to the exceed the value of transportation services provided by DBE-owned trucks on the Contract. Additional participation by non-DBE lessees receives credit only for the fee or commission it receives as a result of the lease arrangement, fee or commission it receives as a result of the lease arrangement. The DBE does not receive credit for the total value of the transportation services provided by the lessee, since these services are not provided by a DBE.

(vi) the lease must indicate that the DBE has exclusive use of, and control over, the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

(5) MassDOT will count the Prime Contractor's expenditures with DBEs for materials or supplies toward DBE participation goals as follows:

(i) if the materials or supplies are obtained from a DBE manufacturer, as defined in Section 1 above, MassDOT will count one hundred (100%) percent of the cost of the materials or supplies toward DBE participation goals, provided the DBE meets the other requirements of the regulations.

(ii) if the materials or supplies are purchased from a DBE regular dealer, as defined in Section 1 above, MassDOT will count sixty (60%) percent of the cost of the materials or supplies toward the Contract participation goal, provided the DBE meets the other requirements of the regulations.

(iii) for materials or supplies purchased from a DBE which is neither a manufacturer nor a regular dealer, MassDOT will count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site toward the Contract participation goal, provided that MassDOT determines the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services; the cost of the materials and supplies themselves will not be counted; and provided the DBE meets the other requirements of the regulations.

c. Joint Check Policy

MassDOT recognizes that the use of joint checks may be a business practice required by material suppliers and vendors in the construction industry. A joint check is a two-party check issued by a/the Prime Contractor to a DBE third party such as a regular dealer of material or supplies. The Prime Contractor issues the check as payor to the DBE and the third party jointly as payees to guarantee payment to the third party for materials or supplies obtained or to be used by the DBE. FHWA has established criteria to ensure that DBEs are in fact performing a commercially useful function ("CUF") while using a joint check arrangement. Contractors and DBEs must meet and conform to these conditions and criteria governing the use of joint checks.

In the event that a Contractor or DBE Subcontractor desires to a use joint check, MassDOT will require prior notice and will closely monitor the arrangement for compliance with FHWA regulations and guidance. MassDOT may allow a joint check arrangement and give credit to a Contractor for use of the DBE where one or more of the following conditions exist:

- The use of a joint check is in fact required by this type of vendor or supplier as a standard industry practice that applies to all Contractors (DBEs and non-DBEs); or is required by a specific vendor or supplier;
- Payment for supplies or materials would be delayed for an unreasonably extended period without the joint check arrangement;
- The DBE (or any of its Subcontractors) has a pattern or history of not paying a vendor or supplier within a reasonable time or has not established enough of a credit history with the supplier or vendor; and/or
- The presence of severe adverse economic conditions, where credit resources may be limited and such practices may be necessary or required to effect timely payments.

Other factors MassDOT may consider:

- Whether there is a requirement by the Prime Contractor that a DBE should use a specific vendor or supplier to meet their Subcontractor specifications;
- Whether there is a requirement that a DBE use the Prime Contractor's negotiated price;
- The independence of the DBE;
- Whether approval has been sought prior to use of a joint check arrangement; and
- Whether any approved joint check arrangement has exceeded a reasonable period of use;
- The operation of the joint check arrangement; and
- Whether the DBE has made an effort to establish alternate arrangements for following periods (i.e., the DBE must show it can, or has, or why it has not, established or increased a credit line with the vendor or supplier).

Even with the use of a Joint Check, both the Contractor and DBE remain responsible for compliance with all other elements under 49 CFR § 26.55 (c) (1), and must still be able to prove that a commercially useful function is being performed for the Contractor.

d. Joint Check Procedure(s)

- The DBE advises its General or Prime Contractor that it will have to use a Joint Check and provide proof of such requirement.
- The General or the Prime Contractor submits a request for approval to MassDOT, using MassDOT's approved Joint Check Request form (Document B00855) and by notification on the DBE Letter of Intent (Document B00854), and any other relevant documents. Requests that are not initiated during the bid process should be made in writing and comply with the procedure.
- The MassDOT Office of Civil Rights will review the request and render a decision as part of the approval process for DBE Schedules and Letters of Intent.
- Review and Approval will be project specific and relevant documents will be made part of the project Contract file.
- Payments should be made in the name of both the DBE and vendor or supplier. Payments should be issued and signed by the Contractor as only the guarantor for prompt payment of purchases to the vendor or supplier. The payment to the vendor or supplier should be handled by the DBE (i.e. if possible, funds or the joint check should be processed by the DBE and sent by the DBE to the vendor or supplier).
- MassDOT may request copies of cancelled checks (front and back) and transmittal information to verify any payments made to the DBE and vendor or supplier.
- MassDOT may request other information and documents, and may ask questions of the Contractor, Subcontractor and vendor or supplier prior to, during, and after the project performance to ascertain whether the Subcontractor is performing a commercially useful function and all parties are complying with DBE Program policies and procedures as part of the Subcontractor approval process.

7. AWARD DOCUMENTATION AND PROCEDURES

a. The two lowest bidders/the two bidders with the lowest price per quality score point, shall submit, by the close of business on the third (3rd) business day after the bid opening, a completed Schedule of Participation by DBEs (Document B00853) which shall list:

(1) The full company name, address and telephone number of each DBE with whom the bidder intends to make a commitment.

(2) The contract item(s), by number(s) and quantity(ies), if applicable, or specific description of other business activity to be performed by each DBE as set forth in the Letters of Intent. The Bidder shall list only firms which have the capacity to perform, manage and supervise the work proposed in accordance with the requirements of 49 CFR Part 26 and Section **6.b** of these Special Provisions.

(3) The total dollar amount to be paid to each DBE. (Bidders are cautioned that at least one half of the participation goal must be met with construction activity work.)

(4) The total dollar amount to be paid to each DBE that is eligible for credit toward the DBE participation goal under the counting rules set out in Section **6.b**.

(5) The total creditable DBE participation as a percentage of the total bid price.

b. All firms listed on the Schedule must be currently certified.

c. The two lowest bidders/the two bidders with the lowest price per quality score point, shall each submit, with their Schedules of Participation, fully completed, signed Letters of Intent (Document B00854) from each of the DBEs listed on the Schedule. The Letters of Intent shall be in the form attached and shall identify specifically the contract activity the DBE proposes to perform, expressed as contract item number, if applicable, description of the activity, NAICS code, quantity, unit price and total price. In the event of discrepancy between the Schedule and the Letter of Intent, the Letter of Intent shall govern.

d. Evidence of good faith efforts will be evaluated by MassDOT in the selection of the lowest responsible bidder.

All information requested by MassDOT for the purpose of evaluating the Contractor's efforts to achieve the participation goal must be provided within three (3) calendar days and must be accurate and complete in every detail. The apparent low bidder's attainment of the DBE participation goal or a satisfactory demonstration of good faith efforts is a prerequisite for award of the Contract.

e. Failure to meet, or to demonstrate good faith efforts to meet, the requirements of these Special Provisions shall render a bid non-responsive. Therefore, in order to be eligible for award, the bidder (1) must list all DBE's it plans to employ on the Schedule of Participation; and provide the required Letters of Intent for, DBE participation which meets or exceeds the Contract goal in accordance with the terms of these Special Provisions or (2) must demonstrate, to the satisfaction of MassDOT, that good faith efforts were made to achieve the participation goal. MassDOT will adhere to the guidance provided in Appendix A to 49 CFR Part 26 on the determination of a Contractor's good faith efforts to meet the DBE participation goal(s) set forth in Section 2 herein.

f. If MassDOT finds that the percentage of DBE participation submitted by the bidder on its Schedule does not meet the Contract participation goal, or that Schedule and Letters of Intent were not timely filed, and that the bidder has not demonstrated good faith efforts to comply with these requirements, it shall propose that the bidder be declared ineligible for award. In that case, the bidder may request administrative reconsideration. Such requests must be sent in writing within three (3) calendar days of receiving notice of proposed ineligibility to: The Office of the General Counsel, Massachusetts Department of Transportation, 10 Park Plaza, Boston, MA, 02116.

g. If, after administrative reconsideration, MassDOT finds that the bidder has not shown that sufficient good faith efforts were made to comply with the requirements of these Special Provisions, it shall reject the bidder's proposal and may retain the proposal guaranty.

h. Actions which constitute evidence of good faith efforts to meet a DBE participation goal include, but are not limited to, the following examples, which are set forth in 49 CFR Part 26, Appendix A:

(1) Soliciting through all reasonable and available means (e.g., attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the Contract. The bidder must solicit this interest within sufficient time to allow the DBEs to respond to the solicitation. The bidder must determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.

(2) Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE participation goal will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Prime Contractor might otherwise prefer to perform these work items with its own forces.

(3) Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

(4) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE Subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE Subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone number of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.

A bidder using good business judgment would consider a number of factors in negotiating with Subcontractors, including DBE Subcontractors, and would take a firm's price and capabilities as well as Contract participation goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the Contract DBE participation goal, as long as such costs are reasonable. Also, the ability or desire of a Prime Contractor to perform the work of a Contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Prime Contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

(5) Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. Contractors should be careful of adding additional requirements of performance that would in effect limit participation by DBEs or any small business. The Contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. nonunion employee status) are not legitimate causes for the rejection or non-solicitation of bids in the Contractor's efforts to meet the Contract participation goal.

(6) Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

(7) Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.

(8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case by case basis to provide assistance in the recruitment and placement of DBEs.

8. COMPLIANCE

a. All activity performed by a DBE for credit toward the Contract participation goal must be performed, managed and supervised by the DBE in accordance with all commercially useful function requirements of 49 CFR Part 26. The Prime Contractor shall not enter into, or condone, any other arrangement.

b. The Prime Contractor shall not perform with its own organization, or assign to any other business, an activity designated for the DBE(s) named on the Schedule(s) submitted by the Prime Contractor under Section 7 or under paragraph **8.f** of this section, without the approval of MassDOT in accordance with the requirements of paragraphs **8.f** and **8.j** of this section.

c. MassDOT may suspend payment for any activity that was not performed by the DBE to whom the activity was committed on the approved Schedule of Participation, or that was not performed in accordance with the requirements of Section 6.

d. MassDOT retains the right to approve or disapprove of any or all Subcontractors. Requests by the Prime Contractor for approval of participation by a DBE Subcontractor for credit toward the Contract participation goal must include, in addition to any other requirements for Subcontractor approval, the following:

(1) A copy of the proposed subcontract. The subcontract must be for at least the dollar amount, and for the work described, in the Bidder's Schedule of Participation.

(2) A resume stating the qualifications and experience of the DBE Superintendent and/or foreperson who will supervise the on-site work. A new resume will be required for any change in supervisory personnel during the progress of the work.

(3) A Schedule of Operations indicating when the DBE is expected to perform the work.

(4) A list of (1) equipment owned by the DBE to be used on the Project, and (2) equipment to be leased by the DBE for use on the Project.

(5) A list of: (1) all projects (public and private) which the DBE is currently performing; (2) all projects (public and private) to which the DBE is committed; and (3) all projects (public and private) to which the DBE intends to make a commitment. For each Contract, list the contracting organization, the name and telephone number of a contact person for the contracting organization, the dollar value of the work, a description of the work, and the DBE's work schedule for each project.

e. If, pursuant to the Subcontractor approval process, MassDOT finds that a DBE Subcontractor does not have sufficient experience or resources to perform, manage and supervise work of the kind proposed in accordance with the requirements of 49 CFR Part 26, approval of the DBE Subcontractor may be denied. In the event of such denial, the Prime Contractor shall proceed in accordance with the requirements paragraphs **8.f** and **8.j** of this section.

f. If, for reasons beyond its control, the Prime Contractor cannot comply with its DBE participation commitment in accordance with the Schedule of Participation submitted under Section 7, the Prime Contractor shall submit to MassDOT the reasons for its inability to comply with its obligations and shall submit, and request approval for, a revised Schedule of Participation. If approved by MassDOT, the revised Schedule shall govern the Prime Contractor's performance in meeting its obligations under these Special Provisions.

g. A Prime Contractor's compliance with the participation goal in Section 2 shall be determined by reference to the established percentage of the total contract price, provided, however, that no decrease in the dollar amount of a bidder's commitment to any DBE shall be allowed without the approval of MassDOT.

h. If the contract amount is increased, the Prime Contractor may be required to submit a revised Schedule of Participation in accordance with paragraphs **8.f** and **8.j** of this section.

i. In the event of the decertification of a DBE scheduled to participate on the Contract for credit toward the participation goal, but not under subcontract, the Contractor shall proceed in accordance with paragraphs **8.f** and **8.j** of this section.

j. The Prime Contractor shall notify MassDOT immediately of any facts that come to its attention indicating that it may or will be unable to comply with any aspect of its DBE obligation under this Contract.

k. Any notice required by these Special Provisions shall be given in writing to: (1) the Resident Engineer; (2) the District designated Compliance Officer; and (3) the DBE Liaison Officer, MassDOT Office of Civil Rights, 10 Park Plaza, – 3rd Floor - West, Boston, MA, 02116 and cc'd to the Deputy Chief of External Programs.

l. The Prime Contractor and its Subcontractors shall comply with MassDOT's Electronic Reporting System Requirements (MassDOT Document 00821) and submit all information required by MassDOT related to the DBE Special Provisions through the Equitable Business Opportunity Solution ("EBO"). MassDOT reserves the right to request reports in the format it deems necessary anytime during the performance of the Contract.

m. Termination of DBE by Prime Contractor

(1) A Prime Contractor shall not terminate a DBE Subcontractor or an approved substitute DBE firm without the prior written consent of MassDOT. This includes, but is not limited to, instances in which a Prime Contractor seeks to perform work originally designated for a DBE Subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm.

(2) MassDOT may provide such written consent only if MassDOT agrees, for reasons stated in its concurrence document, that the Prime Contractor has good cause to terminate the DBE firm.

(3) For purposes of this paragraph, good cause includes the following circumstances:

(i) The DBE Subcontractor fails or refuses to execute a written contract;

(ii) The DBE Subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Good cause, however, does not exist if the failure or refusal of the DBE Subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the Prime Contractor;

(iii) The DBE Subcontractor fails or refuses to meet the Prime Contractor's reasonable, nondiscriminatory bond requirements.

(iv) The DBE Subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;

(v) The DBE Subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1,200 or applicable State law;

(vi) (vii) MassDOT has determined that the listed DBE Subcontractor is not a responsible contractor;

(vii) The listed DBE Subcontractor voluntarily withdraws from the Project and provides written notice of its withdrawal;

(viii) The listed DBE is ineligible to receive DBE credit for the type of work required;

(ix) A DBE owner dies or becomes disabled with the result that the listed DBE Contractor is unable to complete its work on the Contract;

(x) Other documented good cause that MassDOT determines compels the termination of the DBE Subcontractor. Good cause, however, does not exist if the Prime Contractor seeks to terminate a DBE it relied upon to obtain the Contract so that the Prime Contractor can self-perform the DBE work or substitute another DBE or non-DBE Contractor after Contract Award.

(4) Before transmitting to MassDOT a request to terminate and/or substitute a DBE Subcontractor, the Prime Contractor must give notice in writing to the DBE Subcontractor, with a copy to MassDOT, of its intent to request to terminate and/or substitute, and the reason for the request.

(5) The Prime Contractor must give the DBE five (5) business days to respond to the Prime Contractor's notice. The DBE must advise MassDOT and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why MassDOT should not approve the Prime Contractor's action. If required in a particular case as a matter of public necessity (e.g., safety), MassDOT may provide a response period shorter than five (5) business days.

(6) In addition to post-award terminations, the provisions of this section apply to pre-award deletions of or substitutions for DBE firms.

n. Prompt Payment.

Contractors are required to promptly pay Subcontractors under this Prime Contract within ten (10) business days from the receipt of each payment the Prime Contractor receives from MassDOT. Failure to comply with this requirement may result in the withholding of payment to the Prime Contractor until such time as all payments due under this provision have been received by the Subcontractor(s) and/or referral to the Prequalification Committee for action which may affect the Contractor's prequalification status.

9. SANCTIONS

If the Prime Contractor does not comply with the terms of these Special Provisions and cannot demonstrate to the satisfaction of MassDOT that good faith efforts were made to achieve such compliance, MassDOT may, in addition to any other remedy provided for in the Contract, and notwithstanding any other provision in the Contract:

a. Retain, in connection with final acceptance and final payment processing, an amount determined by multiplying the total contract amount by the percentage in Section 2, less the amount paid to approved DBE(s) for work performed under the Contract in accordance with the provisions of Section 8.

b. Suspend, terminate or cancel this Contract, in whole or in part, and call upon the Prime Contractor's surety to perform all terms and conditions in the Contract.

c. In accordance with 720 CMR 5.05(1)(f), modify or revoke the Prime Contractor's Prequalification status or recommend that the Prime Contractor not receive award of a pending Contract. The Prime Contractor may appeal the determination of the Prequalification Committee in accordance with the provisions of 720 CMR 5.06.

d. Initiate debarment proceedings pursuant to M.G.L. c. 29 §29F and, as applicable, 2 CFR Parts 180, 215 and 1,200.

e. Refer the matter to the Massachusetts Attorney General for review and prosecution, if appropriate, of any false claim or pursuant to M.G.L. c. 12, §§ 5A to 5O (the Massachusetts False Claim Act).

f. Refer the matter to the U.S. DOT's Office of the Inspector General or other agencies for prosecution under Title 18, U.S.C. § 1001, 49 CFR Parts 29 and 31, and other applicable laws and regulations.

10. FURTHER INFORMATION; ENFORCEMENT, COOPERATION AND CONFIDENTIALITY.

a. Any proposed DBE, bidder, or Contractor shall provide such information as is necessary in the judgment of MassDOT to ascertain its compliance with the terms of this Special Provision. Further, pursuant to 49 CFR, Part 26.107:

(1) If you are a firm that does not meet the eligibility criteria of 49 CFR, Parts 26.61 to 26.73 ("subpart D"), that attempts to participate in a DOT- assisted program as a DBE on the basis of false, fraudulent, or deceitful statements or representations or under circumstances indicating a serious lack of business integrity or honesty, MassDOT or FHWA may initiate suspension or debarment proceedings against you under 49 CFR Part 29.

(2) If you are a firm that, in order to meet DBE Contract participation goals or other DBE Program requirements, uses or attempts to use, on the basis of false, fraudulent or deceitful statements or representations or under circumstances indicating a serious lack of business integrity or honesty, another firm that does not meet the eligibility criteria of subpart D, FHWA may initiate suspension or debarment proceedings against you under 49 CFR Part 29.

(3) In a suspension or debarment proceeding brought either under subparagraph a.(1) or b.(2) of this section, the concerned operating administration may consider the fact that a purported DBE has been certified by a recipient. Such certification does not preclude FHWA from determining that the purported DBE, or another firm that has used or attempted to use it to meet DBE participation goals, should be suspended or debarred.

(4) FHWA may take enforcement action under 49 CFR Part 31, Program Fraud and Civil Remedies, against any participant in the DBE Program whose conduct is subject to such action under 49 CFR Part 31.

(5) FHWA may refer to the Department of Justice, for prosecution under 18 U.S.C. 1001 or other applicable provisions of law, any person who makes a false or fraudulent statement in connection with participation of a DBE in any DOT-assisted program or otherwise violates applicable Federal statutes.

b. Pursuant to 49 CFR Part 26.109, the rules governing information, confidentiality, cooperation, and intimidation or retaliation are as follows:

(1) Availability of records.

(i) In responding to requests for information concerning any aspect of the DBE Program, FHWA complies with provisions of the Federal Freedom of Information and Privacy Acts (5 U.S.C. 552 and 552a). FHWA may make available to the public any information concerning the DBE Program release of which is not prohibited by Federal law.

(ii) MassDOT shall safeguard from disclosure to unauthorized persons information that may reasonably be considered as confidential business information, consistent with Federal and Massachusetts General Law (M.G.L. c. 66, § 10, M.G.L. c. 4, §7 (26), 950 CMR 32.00).

(2) Confidentiality of information on complainants. Notwithstanding the provisions of subparagraph b.(1) of this section, the identity of complainants shall be kept confidential, at their election. If such confidentiality will hinder the investigation, proceeding or hearing, or result in a denial of appropriate administrative due process to other parties, the complainant must be advised for the purpose of waiving the privilege. Complainants are advised that, in some circumstances, failure to waive the privilege may result in the closure of the investigation or dismissal of the proceeding or hearing.

(3) Cooperation. All participants in FHWA's DBE Program (including, but not limited to, recipients, DBE firms and applicants for DBE certification, complainants and appellants, and Contractors using DBE firms to meet Contract participation goals) are required to cooperate fully and promptly with U.S. DOT and recipient compliance reviews, certification reviews, investigations, and other requests for information. Failure to do so shall be a ground for appropriate action against the party involved (e.g., with respect to recipients, a finding of noncompliance; with respect to DBE firms, denial of certification or removal of eligibility and/or suspension and debarment; with respect to a complainant or appellant, dismissal of the complaint or appeal; with respect to a Contractor which uses DBE firms to meet participation goals, findings of non-responsibility for future Contracts and/or suspension and debarment).

(4) Intimidation and retaliation. No recipient, Contractor, or any other participant in the program, may intimidate, threaten, coerce, or discriminate against any individual or firm for the purpose of interfering with any right or privilege secured by this part or because the individual or firm has made a complaint, testified, assisted, or participated in any manner in an investigation, proceeding, or hearing under this part. If any recipient or contractor violates this prohibition, that entity is in noncompliance with this 49 CFR Part 26.

11. LIST OF ADDITIONAL DOCUMENTS.

a. The following documents shall be completed and signed by the bidder and designated DBEs in accordance with Section 7 - Award Documentation and Procedures. These documents must be returned by the bidder to MassDOT's Bid Document Distribution Center:

- □ Schedule of DBE Participation (Document B00853)
- □ Letter of Intent (Document B00854)
- □ DBE Joint Check Arrangement Approval Form (Document B00855), if Contractor and DBE plan, or if DBE is required to use a Joint Check

b. The following document shall be signed and returned by Contractor and Subcontractors/DBEs to the MassDOT District Office overseeing the Project, as applicable:

- □ Contractor/Subcontractor Certification Form (Document No. 00859) (a checklist of other documents to be included with every subcontract (DBEs and non-DBEs alike)).

c. The following document shall be provided to MassDOT's Office of Civil Rights and Prequalification Office at least fourteen (14) business days before the bid opening date, if applicable:

- □ Affidavit of DBE/Non-DBE Joint Venture (Document B00856)

d. The following document shall be provided to MassDOT's District Office of Civil Rights within 30 calendar days after the work of the DBE is completed, or no later than 30 calendar days after the work of the DBE is on a completed and processed CQE. This document shall be completed and submitted by the Prime Contractor:

- □ Certificate of Completion by a Minority/Women or Disadvantaged Business Enterprise (M/W/DBE) (Form No. CSD-100)

*** END OF DOCUMENT ***

DOCUMENT 00760

FHWA-1273 – Revised October 23, 2023

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Non-segregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
XI. Certification Regarding Use of Contract Funds for Lobbying
XII. Use of United States-Flag Vessels:

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the “Statement of Compliance” required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily

excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B) This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

DOCUMENT 00811

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR HOT MIX ASPHALT (HMA) MIXTURES
Revised: 02/03/2023

This provision applies to all projects using greater than 100 tons of hot mix asphalt (HMA) mixtures containing liquid asphalt cement as stipulated in the Notice to Contractors section of the bid documents.

Price Adjustments will be based on the variance in price, for the liquid asphalt component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis.

Base Price
The Base Price of liquid asphalt on a project as listed in the Notice to Contractors section of the bid documents is a fixed price determined by the Department at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

Period Price
The Period Price is the price of liquid asphalt for each monthly period as determined by the Department using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The Department will post this Period Price on its website at https://www.mass.gov/service-details/massdot-current-contract-price-adjustments following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the Department the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor.

Price Adjustment Determination, Calculation and Payment
The Contract Price of the HMA mixture will be paid under the respective item in the Contract. Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed.

Price Adjustments will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the approved Job Mix Formula.

Price Adjustments will be separate payment items. The pay item numbers are 999.401 for a positive price adjustment (a payment) and 999.402 for a negative price adjustment (a deduction). Price Adjustments will be calculated using the following equation:

Price Adjustment = Tons of HMA Placed X Liquid Asphalt Content % X RAP Factor X (Period Price - Base Price)

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

******** END OF DOCUMENT ********

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00812

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE –
ENGLISH UNITS
Revised: 02/01/2021

This monthly fuel price adjustment is inserted in this contract because the national and worldwide energy situation has made the future cost of fuel unpredictable. This adjustment will provide for either additional compensation to the Contractor or repayment to the Commonwealth, depending on an increase or decrease in the average price of diesel fuel or gasoline.

This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price.

The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department's web site https://www.mass.gov/service-details/massdot-current-contract-price-adjustments for the month in which the contract was bid, which includes State Tax.

The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

This adjustment will be effected only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No adjustment will be paid for work done beyond the extended completion date of any contract.

Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity.

The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

ITEMS COVERED	FUEL FACTORS	
	Diesel	Gasoline
Excavation: and Borrow Work: Items 120, 120.1, 121, 123, 124, 125, 127, 129.3, 140, 140.1, 141, 142, 143, 144, 150, 150.1, 151 and 151.1 (Both Factors used)	0.29 Gallons / CY.	0.15 Gallons / CY
Surfacing Work: All Items containing Hot Mix Asphalt	2.90 Gallons / Ton	Does Not Apply

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00813

SPECIAL PROVISIONS

PRICE ADJUSTMENTS FOR STRUCTURAL STEEL AND REINFORCING STEEL

August 14, 2025

This special provision applies to all projects containing the use of structural steel and/or reinforcing steel as specified elsewhere in the Contract work. It applies to all structural steel and all reinforcing steel, as defined below, on the project. Compliance with this provision is mandatory, i.e., there are no "opt-in" or "opt-out" clauses. Price adjustments will be handled as described below and shall only apply to unfabricated reinforcing steel bars and unfabricated structural steel material, consisting of rolled shapes, plate steel, sheet piling, pipe piles, steel castings and steel forgings.

Price adjustments will be variances between Base Prices and Period Prices. Base Prices and Period Prices are defined below.

Price adjustments will only be made if the variances between Base Prices and Period Prices are 5% or more. A variance can result in the Period Price being either higher or lower than the Base Price. Once the 5% threshold has been achieved, the adjustment will apply to the full variance between the Base Price and the Period Price.

Price adjustments will be calculated by multiplying the number of pounds of unfabricated structural steel material or unfabricated reinforcing steel bars on a project by the index factor calculated as shown below under Example of a Period Price Calculation.

Price adjustments will ***not*** include guardrail panels or the costs of shop drawing preparation, handling, fabrication, coatings, transportation, storage, installation, profit, overhead, fuel costs, fuel surcharges, or other such charges not related to the cost of the unfabricated structural steel and unfabricated reinforcing steel.

The weight of steel subject to a price adjustment shall not exceed the final shipping weight of the fabricated part by more than 10%.

Base Prices and Period Prices are defined as follows:

Base Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are fixed prices determined by the Department and found in the table below. While it is the intention of the Department to make this table comprehensive, some of a project's unfabricated structural steel and/or unfabricated reinforcing steel may be inadvertently omitted. Should this occur, the Contractor shall bring the omission to the Department's attention so that a contract alteration may be processed that adds the missing steel to the table and its price adjustments to the Contract.

The Base Price Date is the month and year of the most recent finalized period price index at the time that MassDOT opened bids for the project. The Base Price Index for this contract is the Steel PPI listed in the Notice to Contractors.

Period Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are variable prices that have been calculated using the Period Price Date and an index of steel prices to adjust the Base Price.

The Period Price Date is the date the steel was delivered to the fabricator as evidenced by an official bill of lading submitted to the Department containing a description of the shipped materials, weights of the shipped materials and the date of shipment. This date is used to select the Period Price Index.

The index used for the calculation of Period Prices is the U.S. Department of Labor Bureau of Labor Statistics Producer Price Index (PPI) Series ID WPU101702 (Not Seasonally Adjusted, Group: Metals and Metal Products, Item: Semi-finished Steel Mill Products.) As this index is subject to revision for a period of up to four (4) months after its original publication, no price adjustments will be made until the index for the period is finalized, i.e., the index is no longer suffixed with a "(P)".

Period Prices are determined as follows:

Period Price = Base Price X Index Factor
Index Factor = Period Price Index / Base Price Index

Example of a Period Price Calculation:

Calculate the Period Price for December 2009 using a Base Price from March 2009 of $0.82/Pound for 1,000 Pounds of ASTM A709 (AASHTO M270) Grade A36 Structural Steel Plate.

The Period Price Date is December 2009. From the PPI website*, the Period Price Index = 218.0.

The Base Price Date is March 2009. From the PPI website*, the Base Price Index = 229.4.

Index Factor = Period Price Index / Base Price Index = 218.0 / 229.4 = 0.950
Period Price = Base Price X Index Factor = $0.82/Pound X 0.950 = $0.78/Pound

Since $0.82 - $0.78 = $0.04 is less than 5% of $0.82, no price adjustment is required.

If the $0.04 difference shown above was greater than 5% of the Base Price, then the price adjustment would be 1,000 Pounds X $0.04/Pound = $40.00. Since the Period Price of $0.78/Pound is less than the Base Price of $0.82/Pound, indicating a drop in the price of steel between the bid and the delivery of material, a credit of $40.00 would be owed to MassDOT. When the Period Price is higher than the Base Price, the price adjustment is owed to the Contractor.

* To access the PPI website and obtain a Base Price Index or a Period Price Index, go to http://data.bls.gov/cgi-bin/srgate

End of example.

The Contractor will be paid for unfabricated structural steel and unfabricated reinforcing steel under the respective contract pay items for all components constructed of either structural steel or reinforced Portland cement concrete under their respective Contract Pay Items.

Price adjustments, as herein provided for, will be paid separately as follows:

Structural Steel
Pay Item Number 999.449 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.457 for negative (-) pay adjustments (credits to MassDOT Highway Division)

Reinforcing Steel
Pay Item Number 999.466 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.467 for negative (-) pay adjustments (credits to MassDOT Highway Division)

No price adjustment will be made for price changes after the Contract Completion Date, unless the MassDOT Highway Division has approved an extension of Contract Time for the Contract.

TABLE

Steel Type		Price per Pound
1	ASTM A615/A615M Grade 60 (AASHTO M31 Grade 60 or 420) Reinforcing Steel	$0.55
2	ASTM A27 (AASHTO M103) Steel Castings, H-Pile Points & Pipe Pile Shoes (See Note below.)	$0.76
3	ASTM A668 / A668M (AASHTO M102) Steel Forgings	$0.76
4	ASTM A108 (AASHTO M169) Steel Forgings for Shear Studs	$0.78
5	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Plate	$0.82
6	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Shapes	$0.77
7	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Plate	$0.82
8	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Shapes	$0.77
9	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Plate	$0.85
10	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Shapes	$0.78
11	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W 345W Structural Steel Plate	$0.85
12	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W or 345W Structural Steel Shapes	$0.78
13	ASTM A709/A709M Grade HPS 50W / AASHTO M270M/M270 Grade HPS 50W or 345W Structural Steel Plate	$0.89
14	ASTM A709/A709M Grade HPS 70W / AASHTO M270M/M270 Grade HPS 70W or 485W Structural Steel Plate	$0.96
15	ASTM A514/A514M-05 Grade HPS 100W / AASHTO M270M/M270 Grade HPS 100W or 690W Structural Steel Plate	$1.47
16	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Plate	$0.85
17	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Shapes	$0.78
18	ASTM A276 Type 316 Stainless Steel	$4.42
19	ASTM A240 Type 316 Stainless Steel	$4.42
20	ASTM A148 Grade 80/50 Steel Castings (See Note below.)	$1.52
21	ASTM A53 Grade B Structural Steel Pipe	$0.96
22	ASTM A500 Grades A, B, 36 & 50 Structural Steel Pipe	$0.96
23	ASTM A252, Grades 240 (36 KSI) & 414 (60 KSI) Pipe Pile	$0.76
24	ASTM 252, Grade 2 Permanent Steel Casing	$0.76
25	ASTM A36 (AASHTO M183) for H-piles, steel supports and sign supports	$0.80
26	ASTM A328 / A328M, Grade 50 (AASHTO M202) Steel Sheetpiling	$1.45
27	ASTM A572 / A572M, Grade 50 Sheetpiling	$1.45
28	ASTM A36/36M, Grade 50	$0.82
29	ASTM A570, Grade 50	$0.80
30	ASTM A572 (AASHTO M223), Grade 50 H-Piles	$0.82
31	ASTM A1085 Grade A (50 KSI) Steel Hollow Structural Sections (HSS), heat-treated per ASTM A1085 Supplement S1	$0.96
32	AREA 140 LB Rail and Track Accessories	$0.50

NOTE: Steel Castings are generally used only on moveable bridges. Cast iron frames, grates and pipe are not “steel” castings and will not be considered for price adjustments.

END OF DOCUMENT

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT 00814

SPECIAL PROVISIONS
PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES

January 12, 2009

This provision applies to all projects using greater than 100 Cubic Yards (76 Cubic Meters) of Portland cement concrete containing Portland cement as stipulated in the Notice to Contractors section of the Bid Documents. This Price Adjustment will occur on a monthly basis.

The Price Adjustment will be based on the variance in price for the Portland cement component only from the Base Price to the Period Price. It shall not include transportation or other charges.

The Base Price of Portland cement on a project is a fixed price determined at the time of bid by the Department by using the same method as for the determination of the Period Price (see below) and found in the Notice to Contractors.

The Period Price of Portland cement will be determined by using the latest published price, in dollars per ton (U.S.), for Portland cement (Type I) quoted for Boston, U.S.A. in the **Construction Economics** section of *ENR Engineering News-Record* magazine or at the ENR website http://www.enr.com under **Construction Economics**. The Period Price will be posted on the MassDOT website the Wednesday immediately following the publishing of the monthly price in ENR, which is normally the first week of the month.

The Contract Price of the Portland cement concrete mix will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The price adjustment applies only to the actual Portland cement content in the mix placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of cubic yards of Portland cement concrete placed during each monthly period times the Portland cement content percentage times the variance in price between the Base Price and Period Price of Portland cement.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00820

THE COMMONWEALTH OF MASSACHUSETTS SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM

I. Definitions

For purposes of this contract,

"Minority" means a person who meets one or more of the following definitions:

(a) American Indian or Native American means: all persons having origins in any of the original peoples of North America and who are recognized as an Indian by a tribe or tribal organization.
(b) Asian means: All persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian sub-continent, or the Pacific Islands, including, but Not limited to China, Japan, Korea, Samoa, India, and the Philippine Islands.
(c) Black means: All persons having origins in any of the Black racial groups of Africa, including, but not limited to, African-Americans, and all persons having origins in any of the original peoples of the Cape Verdean Islands.
(d) Eskimo or Aleut means: All persons having origins in any of the peoples of Northern Canada, Greenland, Alaska, and Eastern Siberia.
(e) Hispanic means: All persons having their origins in any of the Spanish-speaking peoples of Mexico, Puerto Rico, Cuba, Central or South America, or the Caribbean Islands.

"State construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility, or a contract for the construction, reconstruction, alteration, remodeling or repair of a public work undertaken by a department, agency, board, or commission of the commonwealth.

"State assisted construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility undertaken by a political subdivision of the commonwealth, or two or more political subdivisions thereof, an authority, or other instrumentality and whose costs of the contract are paid for, reimbursed, grant funded, or otherwise supported, in whole or in part, by the commonwealth.

II. Equal Opportunity, Non-Discrimination and Affirmative Action

During the performance of this Contract, the Contractor and all subcontractors (hereinafter collectively referred to as "the Contractor") for a state construction contract or a state assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

In connection with the performance of work under this contract, the Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability, shall not discriminate in the selection or retention of subcontractors, and shall not discriminate in the procurement of materials and rentals of equipment.

The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion, or transfer; recruitment advertising, layoff or termination; rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship or on-the-job training opportunity. The Contractor shall comply with the provisions of chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this Contract.

The Contractor shall post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the Massachusetts Commission Against Discrimination setting forth the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter l51 B).

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. Such affirmative action measures shall entail positive and aggressive measures to ensure nondiscrimination and to promote equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, apprenticeship and on-the-job training programs. A list of positive and aggressive measures shall include, but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority, women and other community-based organizations of employment opportunities; validating all job specifications, selection requirements, and tests; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying the administering agency in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker. These and other affirmative action measures shall include all actions required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. One purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for this and future Commonwealth public construction projects.

III. Minority and Women Workforce Participation

Pursuant to his/her obligations under the preceding section, the Contractor shall strive to achieve on this project the labor participation goals contained herein. Said participation goals shall apply in each job category on this project including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers and those classes of work enumerated in Section 44F of Chapter 149 of the Massachusetts General Laws. The participation goals for this project shall be 15.3% for minorities and 6.9% for women. The participation goals, as set forth herein, shall not be construed as quotas or set-asides; rather, such participation goals will be used to measure the progress of the Commonwealth's equal opportunity, non-discrimination and affirmative action program. Additionally, the participation goals contained herein should not be seen or treated as a floor or as a ceiling for the employment of particular individuals or group of individuals.

IV. Liaison Committee

At the discretion of the agency that administers the contract for the construction project there may be established for the life of the contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the agency or agencies administering the contract for the construction project, hereinafter called the administering agency, a representative from the Office of Affirmative action, and such other representatives as may be designated by the administering agency. The Contractor (or his/her agent, if any, designated by him/her as the on-site equal employment opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

V. Reports and Records

The Contractor shall prepare projected workforce tables on a quarterly basis when required by the administering agency. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also, when updated, to the administering agency and the Liaison Committee when required.

The Contractor shall prepare weekly reports in a form approved by the administering agency, unless information required is required to be reported electronically by the administering agency, the number of hours worked in each trade by each employee, identified as woman, minority, or non-minority. Copies of these shall be provided at the end of each such week to the administering agency and the Liaison Committee.

Records of employment referral orders, prepared by the Contractor, shall be made available to the administering agency on request.

The Contractor will provide all information and reports required by the administering agency on instructions issued by the administering agency and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the administering agency to effect the employment of personnel. This provision shall apply only to information pertinent to the Commonwealth's supplementary non-discrimination, equal opportunity and access and opportunity contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the administering agency and shall set forth what efforts he has made to obtain the information.

VI. Access to Work Site

A designee of the administering agency and a designee of the Liaison Committee shall each have a right to access the work site.

VII. Solicitations for Subcontracts, and for the Procurement of Materials and Equipment

In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this contract relative to non-discrimination and equal opportunity.

VIII. Sanctions

Whenever the administering agency believes the General or Prime Contractor or any subcontractor may not be operating in compliance with the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter 151B), the administering agency may refer the matter to the Massachusetts Commission Against Discrimination ("Commission") for investigation.

Following the referral of a matter by the administering agency to the Massachusetts Commission Against Discrimination, and while the matter is pending before the MCAD, the administering agency may withhold payments from contractors and subcontractors when it has documentation that the contractor or subcontractor has violated the Fair Employment Practices Law with respect to its activities on the Project, or if the administering agency determines that the contractor has materially failed to comply with its obligations and the requirements of this Section. The amount withheld shall not exceed a withhold of payment to the General or Prime Contractor of 1/100 or 1% of the contract award price or $5,000, whichever sum is greater, or, if a subcontractor is in non-compliance, a withhold by the administering agency from the General Contractor, to be assessed by the General Contractor as a charge against the subcontractor, of 1/100 or 1% of the subcontractor price, or $1,000 whichever sum is greater, for each violation of the applicable law or contract requirements. The total withheld from anyone General or Prime Contractor or subcontractor on a Project shall not exceed $20,000 overall. No withhold of payments or investigation by the Commission or its agent shall be initiated without the administering agency providing prior notice to the Contractor.

If, after investigation, the Massachusetts Commission Against Discrimination finds that a General or Prime Contractor or subcontractor, in commission of a state construction contract or state-assisted construction contract, violated the provisions of the Fair Employment Practices Law, the administering agency may convert the amount withheld as set forth above into a permanent sanction, as a permanent deduct from payments to the General or Prime Contractor or subcontractor, which sanction will be in addition to any such sanctions, fines or penalties imposed by the Massachusetts Commission Against Discrimination.

No sanction enumerated under this Section shall be imposed by the administering agency except after notice to the General or Prime Contractor or subcontractor and an adjudicatory proceeding, as that term is used, under Massachusetts General Laws Chapter 30A, has been conducted.

IX. Severability

The provisions of this section are severable, and if any of these provisions shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

X. Contractor's Certification

After award and prior to the execution of any contract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall certify that it will comply with all provisions of this Document 00820 Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, by executing Document 00859 Contractor/Subcontractor Certification Form.

XI. Subcontractor Requirements

Prior to the award of any subcontract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall provide all prospective subcontractors with a complete copy of this Document 00820 entitled "Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program" and will incorporate the provisions of this Document 00820 into any and all contracts or work orders for all subcontractors providing work on the Project. In order to ensure that the said subcontractor's certification becomes a part of all subcontracts under the prime contract, the Prime or General Contractor shall certify in writing to the administering agency that it has complied with the requirements as set forth in the preceeding paragraph by executing Document 00859 Contractor/Subcontractor Certification Form.

Rev'd 03/07/14

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00821

ELECTRONIC REPORTING REQUIREMENTS
CIVIL RIGHTS PROGRAMS AND CERTIFIED PAYROLL

Implemented on March 2, 2009 Revised June 04, 2019

The Massachusetts Department Of Transportation (MassDOT) has replaced the CHAMP reporting system with Equitable Business Opportunity Solution (EBO), a new web-based civil rights reporting software system. This system is capable of handling both civil rights reporting requirements and certified payrolls. The program's functions include the administration of Equal Employment Opportunity (EEO) requirements, On-The-Job Training requirements (OJT), Disadvantage Business Enterprise (DBE) and/or Minority / Women's Business Enterprise (M/WBE) subcontracting requirements, and the electronic collection of certified payrolls associated with MassDOT projects. In addition, this system is used to generate various data required as part of the American Recovery and Reinvestment Act (ARRA). Contractors are responsible for all coordination with all sub-contractors to ensure timely and accurate electronic submission of all required data.

Contractor and Sub-Contractor EBO User Certification

All contractors and sub-contractors must use the EBO software system. The software vendor, Internet Government Solutions (IGS), has developed an online EBO Training Module that is available to contractors and sub-contractors. This module is a self-tutorial which allows all users in the company to access the training, complete the tutorial, and become certified as EBO users for a one time fee of $75.00. This is the only cost to contractors and sub-contractors associated with the EBO software system. The online EBO Training Module can be accessed at www.ebotraining.com. Click the "Register My Company" button on the login page to begin your training registration. Questions regarding EBO online training should be directed to Gerry Anguilano, IGS at (440) 238-1684.

MassDOT will track contractors and sub-contractors who have successfully completed the on-line training module. All persons performing civil rights program and/or certified payroll functions should be EBO certified.

Vetting of Firms and Designated Firm Individuals

Contractors must authorize a Primary Log-In ID Holder who has completed EBO on-line training to have access to the EBO system by completing and submitting the "Request For EBO System Log-In/Password Form" located on the MassDOT website at: https://www.mass.gov/how-to/how-to-get-an-ebo-login
Contractors must also agree to comply with the EBO system user agreement located on the MassDOT website.

All subcontracts entered into on a project must include language that identifies the submission and training requirements that the sub-contractor must perform. Sub-contractors will be approved by the respective District Office of MassDOT through the existing approval process. When new sub-contractors, who have not previously worked for MassDOT, are initially selected by a general contractor, the new sub-contractor must be approved by the District before taking the EBO on-line training module.

Interim Reporting Requirements

Until MassDOT is satisfied that the EBO system is fully operational and functioning as designed, contractors and sub-contractors will be required to submit certified payrolls manually. There will be a transition period where dual reporting, through manual and electronic submission, will be required. MassDOT, however, will notify contractors and sub-contractors when they may cease manual submission of certified payrolls.

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00859

CONTRACTOR/SUBCONTRACTOR CERTIFICATION FORM ‡

The contractor shall submit this completed document 00859 to MassDOT for each subcontract.

_____ **(Contractor)** **Date:**_____

_____**(Subcontractor)** ☐ District Approved Subcontractor

Contract No: 132091 **Project No.** 609211 **Federal Aid No.:** TAP/CMQ-0034(027)X

Location: PEABODY

Project Description: Independence Greenway Extension

PART 1 CONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that to the best of my knowledge, information and belief, the company is in compliance with all applicable federal and state laws, rules, and regulations governing fair labor and employment practices, that the company will not discriminate in their employment practices, that the company will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals and specific affirmative action steps contained in Contract Document 00820 The Commonwealth of Massachusetts Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, and that the company will comply with the special provisions and documentation indicated below (as checked).

I further hereby certify, as an authorized official of this company, that the special provisions and documentation indicated below (as checked) have been or are included in, and made part of, the Subcontractor Agreement entered into with the firm named above.

☐ **This is not a Federally-aided construction project**

Document #

☐ 00718 –Participation By Minority Or Women's Business Enterprises and SDVOBE†
☐ 00761 –Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination, and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs, and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00861 – Applicable State Wage Rates in the Contract Proposal**
☐ B00842 – MA Schedule of Participation By Minority or Women Business Enterprises (M/WBEs)†
☐ B00843 – MA Letter of Intent – M/WBEs†

** Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a M/WBE; only include these forms for the particular M/WBE Entity

☐ B00844 - Schedule of Participation By SDVOBE
☐ B00845 - Letter of Intent – SDVOBE
☐ B00846 – M/WBE or SDVOBE Joint Check Arrangement Approval Form
☐ B00847 – Joint Venture Affidavit

☐ **This is a Federally-aided construction project (Federal Aid Number is present)**

Document #

☐ 00719 – Special Provisions for Participation by Disadvantaged Business Enterprises†
☐ 00760 - Form FHWA 1273 - Required Contract Provisions for Federal-Aid Construction Contracts
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00870 – Standard Federal Equal Employment Opportunity Construction Contract Specifications Executive Order 11246, (41 CFR Parts 60-4.2 and 60-4.3 (Solicitations and Equal Opportunity Clauses)*
☐ 00875 – Federal Trainee Special Provisions

☐ B00853 – Schedule of Participation by Disadvantaged Business Enterprise†
☐ B00854 – Letter of Intent – DBEs†
☐ B00855 – DBE Joint Check Arrangement Approval Form
☐ B00856 – Joint Venture Affidavit
☐ 00861/00880 - Applicable state and federal wage rates from Contract Proposal**

*Applicable only to Contracts or Subcontracts in excess of $10,000
**Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a DBE; only include these forms for the particular DBE Entity

Signed this _____ Day of _____, 20_____ Under The Pains And Penalties Of Perjury.

_____ _____
(Print Name and Title) (Authorized Signature)

PART 2

PART 2 SUBCONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that the required documents in Part 1 above were physically incorporated in our Agreement/Subcontract with the Contractor and give assurance that this company will fully comply or make every good faith effort to comply with the same. I further certify that:

1. This company recognizes that if this is a Federal-Aid Project, then this Contract is covered by the equal employment opportunity laws administered and enforced by the United States Department of Labor ("USDOL"), Office of Federal Contract Compliance Programs ('OFCCP"). By signing below, we acknowledge that this company has certain reporting obligations to the OFCCP, as specified by 41 CFR Part 60-4.2.
2. This company further acknowledges that any contractor with fifty (50) or more employees on a Federal-aid Contract with a value of fifty-thousand ($50,000) dollars or more must annually file an EEO-1 Report (SF 100) to the EEOC, Joint Reporting Committee, on or before September 30th, each year, as specified by 41 CFR Part 60-1.7a.
3. For more information regarding the federal reporting requirements, please contact the USDOL, OFCCP Regional Office, at 1-646-264-3170 or EEO-1, Joint Reporting Committee at 1-866-286-6440.
4. This company ☐ has, ☐ has not, participated in a previous contract or subcontract subject to the Equal Opportunity clauses set forth in 41 CFR Part 60-4 and Executive Order 11246, and where required, has filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance Programs or the EEO Commission all reports due under the applicable filing requirements.
5. This company is in full compliance with applicable Federal and Commonwealth of Massachusetts laws, rules, and regulations and is not currently debarred or disqualified from bidding on or participating in construction contracts in any jurisdiction of the United States. See : https://www.mass.gov/service-details/contractors-and-vendors-suspended-or-debarred-by-massdot
6. This company is properly registered and in good standing with the Office of the Secretary of the Commonwealth.

Signed this _____ Day of _____, 20_____, Under The Pains And Penalties Of Perjury.

Firm: _____
Address: _____
_____
_____
Telephone Number:_____
Federal I.D. Number:_____
Estimated Start Date:_____
Estimated Completion Date:_____
Estimated Dollar Amount:_____

_____
(Print Name and Title)

_____
(Authorized Signature)

_____
(Date)

Rev'd 09/02/22

*** END OF DOCUMENT ***

DOCUMENT 00860

COMMONWEALTH OF MASSACHUSETTS PUBLIC EMPLOYMENT LAWS

Revised February 20, 2019

The Contractor's attention is directed to Massachusetts General Laws, Chapter 149, Sections 26 through 27H, and 150A. This contract is considered to fall within the ambit of that law, which provides that in general, the Prevailing Rate or Total Rate must be paid to employees working on projects funded by the Commonwealth of Massachusetts or any political subdivision including Massachusetts Department of Transportation (MassDOT).

A Federal Aid project is also subject to the Federal Minimum Wage Rate law for construction. When comparing a state minimum wage rate, monitored by the Massachusetts Attorney General, versus federal minimum wage rate, monitored by the U.S. Department of Labor Wage and Hour Division, for a particular job classification the higher wage is at all times to be paid to the affected employee.

Every contractor or subcontractor engaged in this contract to which sections twenty-seven and twenty-seven A apply will keep a true and accurate record of all mechanics and apprentices, teamsters, chauffeurs and laborers employed thereon, showing the name, address and occupational classification of each such employee on this contract, and the hours worked by, and the wages paid to, each such employee, and shall furnish to the MassDOT's Resident Engineer, on a weekly basis, a copy of said record, in a form approved by MassDOT and in accordance with M.G.L. c. 149, § 27B, signed by the employer or his/her authorized agent under the penalties of perjury.

Each such contractor or subcontractor shall preserve its payroll records for a period of three years from the date of completion of the contract.

The Prevailing Wage Rate generally includes the following:

> Minimum Hourly Wage + Employer Contributions to Benefit Plans = Prevailing Wage Rate or Total Rate
>
> Any employer who does not make contributions to Benefit Plans must pay the total Prevailing Wage Rate directly to the employee.

Any deduction from the Prevailing Wage Rate or Total Rate for contributions to benefit plans can only be for a Health & Welfare, Pension, or Supplementary Unemployment plan meeting the requirements of the Employee Retirement Income Security Act (ERISA) of 1974. The maximum allowable deduction for these benefits from the prevailing wage rate cannot be greater than the amount allowed by Executive Office of Labor (EOL) for the specified benefits. Any additional expense of providing benefits to the employees is to be borne by the employer and cannot be deducted from the Minimum Hourly Wage. If the employer's benefit expense is less than that so provided by EOL the difference will be paid directly to the employee. The rate established must be paid to all employees who perform work on the project.

When an employer makes deductions from the Minimum Hourly Wage for an employee's contribution to social security, state taxes, federal taxes, and/or other contribution programs, allowed by law, the employer shall furnish each employee a suitable pay slip, check stub or envelope notifying the employee of the amount of the deductions.

No contractor or subcontractor contracting for any part of the contract week shall require or permit any laborer or mechanic to be employed on such work in excess of forty hours in any workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

Apprentice Rates are permitted only when there is an Apprentice Agreement registered with the Massachusetts Division of Apprentice Training in accordance with M.G.L. c. 23, § 11E-11L.

The Prevailing Wage Rates issued for each project shall be the rates paid for the entire project. The Prevailing Wage Rates must be posted on the job site at all times and be visible from a public way.

In addition, each such contractor and subcontractor shall furnish to the MassDOT's Resident Engineer, within fifteen days after completion of its portion of the work, a statement, executed by the contractor or subcontractor or by any authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE

Date: _____

I , _____do hereby state:
(Name of signatory party) (Title)

That I pay or supervise the payment of the persons employed by:

_____
(Contractor or Subcontractor)

on the _____
(MassDOT Project Location and Contract Number)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____

The above-mentioned copies of payroll records and statements of compliance shall be available for inspection by any interested party filing a written request to the MassDOT's Resident Engineer for such inspection and copying.

Massachusetts General Laws c. 149, §27, requires annual updates to prevailing wage schedules for all public construction contracts lasting longer than one year. MassDOT will request the required updates and furnish them to the Contractor. The Contractor is required to pay no less than the wage rates indicated on the annual updated wage schedules.

MassDOT will request the updates no later that two week before the anniversary of the Notice to Proceed date of the contract to allow for adequate processing by the Department of Labor Standards (DLS). The effective date for the new rates will be the anniversary date of the contract (i.e. the notice to proceed date), regardless of the date of issuance on the schedule from DLS.

All bidders are cautioned that the aforementioned laws require that employers pay to covered employees no less than the applicable minimum wages. In addition, the same laws require that the applicable prevailing wages become incorporated as part of this contract. The prevailing minimum wage law establishes serious civil and criminal penalties for violations, including imprisonment and exclusion from future public contracts. Bidders are cautioned to carefully read the relevant sections of the Massachusetts General Laws.

*** END OF DOCUMENT ***

DOCUMENT 00861

STATE PREVAILING WAGE RATES

THIS PAGE INTENTIONALLY LEFT BLANK

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS
Prevailing Wage Rates

MAURA HEALY
Governor
KIM DRISCOLL
Lt. Governor

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

LAUREN JONES
Secretary
MICHAEL FLANAGAN
Director

Awarding Authority:	MassDOT Highway	**City/Town:**	PEABODY
Contract Number:	132091		
Description of Work:	PEABODY - Federal Aid Project No. TAP/CMQ-0034(027)X Independence Greenway Extension		
Job Location:	Independence Greenway Extension		

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, the awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. The updated wage schedule must be provided to all contractors, including general and sub-contractors, working on the construction project.
- This annual update requirement is generally not applicable to 27F “rental of equipment” contracts. For such contracts, the prevailing wage rates issued by DLS shall remain in effect for the duration of the contract term. However, if the prevailing wage rate sheet issued does not contain wage rates for each year covered by the contract term, the Awarding Authority must request updated rate sheets from DLS and provide them to the contractor to ensure the correct rates are being paid throughout the duration of the contract. Additionally, if an Awarding Authority exercises an option to renew or extend the contract term, they must request updated rate sheets form DLS and provide them to the contractor.
- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the “Wage Request Number” on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or a sub-contractor.
- Apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (DAS). Apprentices must keep their apprentice identification card on their persons during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DAS regardless of whether they are registered with another federal, state, local, or private agency must be paid the journeyworker's rate.**
- Every contractor or subcontractor working on the construction project must submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee’s name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. For a sample payroll reporting form go to http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Contractors must obtain the wage schedules from awarding authorities. Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may file a complaint with the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
(2 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$40.95	$15.57	$20.17	$0.00	$0.00	$76.69
	12/1/2025	$40.95	$15.57	$21.78	$0.00	$0.00	$78.30
	1/1/2026	$40.95	$16.17	$21.78	$0.00	$0.00	$78.90
	6/1/2026	$41.95	$16.17	$21.78	$0.00	$0.00	$79.90
	12/1/2026	$41.95	$16.17	$23.52	$0.00	$0.00	$81.64
	1/1/2027	$41.95	$16.77	$23.52	$0.00	$0.00	$82.24
(3 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$41.02	$15.57	$20.17	$0.00	$0.00	$76.76
	12/1/2025	$41.02	$15.57	$21.78	$0.00	$0.00	$78.37
	1/1/2026	$41.02	$16.17	$21.78	$0.00	$0.00	$78.97
	6/1/2026	$42.02	$16.17	$21.78	$0.00	$0.00	$79.97
	12/1/2026	$42.02	$16.17	$23.52	$0.00	$0.00	$81.71
	1/1/2027	$42.02	$16.77	$23.52	$0.00	$0.00	$82.31
(4 & 5 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$41.14	$15.57	$20.17	$0.00	$0.00	$76.88
	12/1/2025	$41.14	$15.57	$21.78	$0.00	$0.00	$78.49
	1/1/2026	$41.14	$16.17	$21.78	$0.00	$0.00	$79.09
	6/1/2026	$42.14	$16.17	$21.78	$0.00	$0.00	$80.09
	12/1/2026	$42.14	$16.17	$23.52	$0.00	$0.00	$81.83
	1/1/2027	$42.14	$16.77	$23.52	$0.00	$0.00	$82.43
ADS/SUBMERSIBLE PILOT PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1) For apprentice rates see "Apprentice- PILE DRIVER"	1/1/2024	$117.16	$10.08	$11.62	$12.67	$0.00	$151.53
AIR TRACK OPERATOR LABORERS LABORERS - ZONE 2	6/1/2025	$41.09	$9.90	$9.25	$9.11	$0.00	$69.35
	12/1/2025	$42.47	$9.90	$9.25	$9.11	$0.00	$70.73
	6/1/2026	$43.91	$9.90	$9.25	$9.11	$0.00	$72.17
	12/1/2026	$45.35	$9.90	$9.25	$9.11	$0.00	$73.61
	6/1/2027	$46.80	$9.90	$9.25	$9.11	$0.00	$75.06
	12/1/2027	$48.25	$9.90	$9.25	$9.11	$0.00	$76.51
	6/1/2028	$49.75	$9.90	$9.25	$9.11	$0.00	$78.01
	12/1/2028	$51.25	$9.90	$9.25	$9.11	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"							
AIR TRACK OPERATOR (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$41.09	$9.90	$9.25	$9.21	$0.00	$69.45
	12/1/2025	$42.47	$9.90	$9.25	$9.21	$0.00	$70.83
	6/1/2026	$43.91	$9.90	$9.25	$9.21	$0.00	$72.27
	12/1/2026	$45.35	$9.90	$9.25	$9.21	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. HEAT & FROST INSULATORS LOCAL 6 HEAT & FROST INSULATORS LOCAL 6 (BOSTON)	6/1/2025	$43.80	$14.50	$4.30	$6.75	$0.00	$69.35
	12/1/2025	$44.80	$14.50	$4.30	$6.75	$0.00	$70.35
ASPHALT RAKER LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
ASPHALT RAKER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
BACKHOE/FRONT-END LOADER OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
BARCO-TYPE JUMPING TAMPER LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER LABORERS LABORERS - ZONE 2	6/1/2025	$41.09	$9.90	$9.25	$9.11	$0.00	$69.35
	12/1/2025	$42.47	$9.90	$9.25	$9.11	$0.00	$70.73
	6/1/2026	$43.91	$9.90	$9.25	$9.11	$0.00	$72.17
	12/1/2026	$45.35	$9.90	$9.25	$9.11	$0.00	$73.61
	6/1/2027	$46.80	$9.90	$9.25	$9.11	$0.00	$75.06
	12/1/2027	$48.25	$9.90	$9.25	$9.11	$0.00	$76.51
	6/1/2028	$49.75	$9.90	$9.25	$9.11	$0.00	$78.01
	12/1/2028	$51.25	$9.90	$9.25	$9.11	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$41.09	$9.90	$9.25	$9.21	$0.00	$69.45
	12/1/2025	$42.47	$9.90	$9.25	$9.21	$0.00	$70.83
	6/1/2026	$43.91	$9.90	$9.25	$9.21	$0.00	$72.27
	12/1/2026	$45.35	$9.90	$9.25	$9.21	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
BOILER MAKER BOILERMAKERS LOCAL 29 BOILERMAKERS LOCAL 29	1/1/2024	$48.12	$7.07	$14.60	$6.00	$0.00	$75.79

Apprentice: BOILER MAKER

Effective Date: 1/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	65.00	$31.28	$7.07	$9.32	$3.90	$0.00	$51.57
2	65.00	$31.28	$7.07	$9.32	$3.90	$0.00	$51.57
3	70.00	$33.68	$7.07	$10.03	$4.20	$0.00	$54.98
4	75.00	$36.09	$7.07	$10.74	$4.50	$0.00	$58.40
5	80.00	$38.50	$7.07	$11.45	$4.80	$0.00	$61.82
6	85.00	$40.90	$7.07	$12.18	$5.10	$0.00	$65.25
7	90.00	$43.31	$7.07	$12.88	$5.40	$0.00	$68.66
8	95.00	$45.71	$7.07	$13.62	$5.70	$0.00	$72.10

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 (LYNN)	8/1/2025	$67.95	$11.49	$15.57	$8.02	$0.00	$103.03
	2/1/2026	$69.30	$11.49	$15.57	$8.02	$0.00	$104.38
	8/1/2026	$71.50	$11.49	$15.57	$8.02	$0.00	$106.58
	2/1/2027	$72.90	$11.49	$15.57	$8.02	$0.00	$107.98

Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$33.98	$11.49	$15.57	$8.02	$0.00	$69.06
2	60.00	$40.77	$11.49	$15.57	$8.02	$0.00	$75.85
3	70.00	$47.57	$11.49	$15.57	$8.02	$0.00	$82.65
4	80.00	$54.36	$11.49	$15.57	$8.02	$0.00	$89.44
5	90.00	$61.16	$11.49	$15.57	$8.02	$0.00	$96.24

Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$34.65	$11.49	$15.57	$8.02	$0.00	$69.73
2	60.00	$41.58	$11.49	$15.57	$8.02	$0.00	$76.66
3	70.00	$48.51	$11.49	$15.57	$8.02	$0.00	$83.59
4	80.00	$55.44	$11.49	$15.57	$8.02	$0.00	$90.52
5	90.00	$62.37	$11.49	$15.57	$8.02	$0.00	$97.45

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
BULLDOZER/GRADER/SCRAPER OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
CAISSON & UNDERPINNING BOTTOM MAN	6/1/2025	$48.85	$9.90	$9.25	$9.80	$0.00	$77.80
LABORERS	12/1/2025	$50.35	$9.90	$9.25	$9.80	$0.00	$79.30
LABORERS - FOUNDATION AND MARINE	6/1/2026	$51.90	$9.90	$9.25	$9.80	$0.00	$80.85
	12/1/2026	$53.40	$9.90	$9.25	$9.80	$0.00	$82.35
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING LABORER	6/1/2025	$47.70	$9.90	$9.25	$9.80	$0.00	$76.65
LABORERS	12/1/2025	$49.20	$9.90	$9.25	$9.80	$0.00	$78.15
LABORERS - FOUNDATION AND MARINE	6/1/2026	$50.75	$9.90	$9.25	$9.80	$0.00	$79.70
	12/1/2026	$52.25	$9.90	$9.25	$9.80	$0.00	$81.20
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING TOP MAN	6/1/2025	$48.03	$9.90	$9.25	$9.80	$0.00	$76.98
LABORERS	12/1/2025	$49.53	$9.90	$9.25	$9.80	$0.00	$78.48
LABORERS - FOUNDATION AND MARINE	6/1/2026	$51.08	$9.90	$9.25	$9.80	$0.00	$80.03
	12/1/2026	$52.58	$9.90	$9.25	$9.80	$0.00	$81.53
For apprentice rates see "Apprentice- LABORER"							
CARBIDE CORE DRILL OPERATOR	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
LABORERS	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
LABORERS - ZONE 2	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
CARPENTER	3/1/2025	$49.62	$9.83	$11.47	$8.50	$0.00	$79.42
CARPENTERS	9/1/2025	$50.87	$9.83	$11.47	$8.50	$0.00	$80.67
CARPENTERS -ZONE 2 (Eastern Massachusetts)	3/1/2026	$52.12	$9.83	$11.47	$8.50	$0.00	$81.92
	9/1/2026	$53.37	$9.83	$11.47	$8.50	$0.00	$83.17
	3/1/2027	$54.62	$9.83	$11.47	$8.50	$0.00	$84.42

Apprentice: CARPENTER

Effective Date: 3/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$22.33	$9.83	$0.00	$1.73	$0.00	$33.89
2	45.00	$22.33	$9.83	$0.00	$1.73	$0.00	$33.89
3	55.00	$27.29	$9.83	$0.00	$3.40	$0.00	$40.52
4	55.00	$27.29	$9.83	$0.00	$3.40	$0.00	$40.52
5	70.00	$34.73	$9.83	$11.41	$5.10	$0.00	$61.07
6	70.00	$34.73	$9.83	$11.41	$5.10	$0.00	$61.07
7	80.00	$39.70	$9.83	$11.44	$6.80	$0.00	$67.77
8	80.00	$39.70	$9.83	$11.44	$6.80	$0.00	$67.77

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
CARPENTER WOOD FRAME	10/1/2024	$26.65	$7.02	$3.80	$1.00	$0.00	$38.47
CARPENTERS	10/1/2025	$27.75	$7.02	$3.80	$1.00	$0.00	$39.57
CARPENTERS-ZONE 3 (Wood Frame)	10/1/2026	$28.85	$7.02	$3.80	$1.00	$0.00	$40.67

All Aspects of New Wood Frame Work

Apprentice: CARPENTER

Effective Date: 9/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$22.89	$9.83	$0.00	$1.73	$0.00	$34.45
2	45.00	$22.89	$9.83	$0.00	$1.73	$0.00	$34.45
3	55.00	$27.98	$9.83	$0.00	$3.40	$0.00	$41.21
4	55.00	$27.98	$9.83	$0.00	$3.40	$0.00	$41.21
5	70.00	$35.61	$9.83	$11.41	$5.10	$0.00	$61.95
6	70.00	$35.61	$9.83	$11.41	$5.10	$0.00	$61.95
7	80.00	$40.70	$9.83	$11.44	$6.80	$0.00	$68.77
8	80.00	$40.70	$9.83	$11.44	$6.80	$0.00	$68.77

Apprentice: CARPENTER WOOD FRAME

Effective Date: 10/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$15.99	$7.02	$0.00	$0.00	$0.00	$23.01
2	60.00	$15.99	$7.02	$0.00	$0.00	$0.00	$23.01
3	65.00	$17.32	$7.02	$0.00	$1.00	$0.00	$25.34
4	70.00	$18.66	$7.02	$0.00	$1.00	$0.00	$26.68
5	75.00	$19.99	$7.02	$3.80	$1.00	$0.00	$31.81
6	80.00	$21.32	$7.02	$3.80	$1.00	$0.00	$33.14
7	85.00	$22.65	$7.02	$3.80	$1.00	$0.00	$34.47
8	90.00	$23.99	$7.02	$3.80	$1.00	$0.00	$35.81

Apprentice: CARPENTER WOOD FRAME

Effective Date: 10/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$16.65	$7.02	$0.00	$0.00	$0.00	$23.67
2	60.00	$16.65	$7.02	$0.00	$0.00	$0.00	$23.67
3	65.00	$18.04	$7.02	$0.00	$1.00	$0.00	$26.06
4	70.00	$19.43	$7.02	$0.00	$1.00	$0.00	$27.45
5	75.00	$20.81	$7.02	$3.80	$1.00	$0.00	$32.63
6	80.00	$22.20	$7.02	$3.80	$1.00	$0.00	$34.02
7	85.00	$23.59	$7.02	$3.80	$1.00	$0.00	$35.41
8	90.00	$24.98	$7.02	$3.80	$1.00	$0.00	$36.80

CEMENT MASONRY/PLASTERING	7/1/2024	$49.19	$13.35	$16.43	$7.78	$1.80	$88.55

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 (LYNN)							

Apprentice: CEMENT MASONRY/PLASTERING

Effective Date: 7/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$24.60	$13.35	$16.43	$0.00	$0.00	$54.38
2	60.00	$29.51	$13.35	$16.43	$2.78	$1.80	$63.87
3	65.00	$31.97	$13.35	$16.43	$3.78	$1.80	$67.33
4	70.00	$34.43	$13.35	$16.43	$4.78	$1.80	$70.79
5	75.00	$36.89	$13.35	$16.43	$5.78	$1.80	$74.25
6	80.00	$39.35	$13.35	$16.43	$6.78	$1.80	$77.71
7	90.00	$44.27	$13.35	$16.43	$7.78	$1.80	$83.63

CHAIN SAW OPERATOR LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$59.51	$15.55	$13.25	$3.25	$0.00	$91.56
	12/1/2025	$60.98	$15.55	$13.25	$3.25	$0.00	$93.03
	6/1/2026	$62.31	$15.55	$13.25	$3.25	$0.00	$94.36
	12/1/2026	$63.79	$15.55	$13.25	$3.25	$0.00	$95.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
COMPRESSOR OPERATOR OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$37.52	$15.55	$13.25	$3.25	$0.00	$69.57
	12/1/2025	$38.47	$15.55	$13.25	$3.25	$0.00	$70.52
	6/1/2026	$39.33	$15.55	$13.25	$3.25	$0.00	$71.38
	12/1/2026	$40.28	$15.55	$13.25	$3.25	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
DELEADER (BRIDGE) PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 2	1/1/2025	$58.46	$9.95	$11.85	$12.10	$0.00	$92.36

Apprentice: DELEADER (BRIDGE)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$29.23	$9.95	$0.00	$0.00	$0.00	$39.18
2	55.00	$32.15	$9.95	$0.00	$6.66	$0.00	$48.76
3	60.00	$35.08	$9.95	$0.00	$7.26	$0.00	$52.29

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: DELEADER (BRIDGE)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
4	65.00	$38.00	$9.95	$0.00	$7.87	$0.00	$55.82
5	70.00	$40.92	$9.95	$11.85	$8.47	$0.00	$71.19
6	75.00	$43.85	$9.95	$11.85	$9.08	$0.00	$74.73
7	80.00	$46.77	$9.95	$11.85	$9.68	$0.00	$78.25
8	90.00	$52.61	$9.95	$11.85	$10.89	$0.00	$85.30

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
DEMO: ADZEMAN LABORERS LABORERS - ZONE 2	6/2/2025	$47.75	$9.90	$9.25	$9.65	$0.00	$76.55
	12/1/2025	$49.25	$9.90	$9.25	$9.65	$0.00	$78.05
	6/1/2026	$50.80	$9.90	$9.25	$9.65	$0.00	$79.60
	12/7/2026	$52.30	$9.90	$9.25	$9.65	$0.00	$81.10
	6/7/2027	$53.90	$9.90	$9.25	$9.65	$0.00	$82.70
	12/6/2027	$55.50	$9.90	$9.25	$9.65	$0.00	$84.30
	6/5/2028	$57.18	$9.90	$9.25	$9.65	$0.00	$85.98
	12/4/2028	$58.85	$9.90	$9.25	$9.65	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS LABORERS - ZONE 2	6/2/2025	$48.75	$9.90	$9.25	$9.65	$0.00	$77.55
	12/1/2025	$50.25	$9.90	$9.25	$9.65	$0.00	$79.05
	6/1/2026	$51.80	$9.90	$9.25	$9.65	$0.00	$80.60
	12/7/2026	$53.30	$9.90	$9.25	$9.65	$0.00	$82.10
	6/7/2027	$54.90	$9.90	$9.25	$9.65	$0.00	$83.70
	12/6/2027	$56.50	$9.90	$9.25	$9.65	$0.00	$85.30
	6/5/2028	$58.18	$9.90	$9.25	$9.65	$0.00	$86.98
	12/4/2028	$59.85	$9.90	$9.25	$9.65	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BURNERS LABORERS LABORERS - ZONE 2	6/2/2025	$48.50	$9.90	$9.25	$9.65	$0.00	$77.30
	12/1/2025	$50.00	$9.90	$9.25	$9.65	$0.00	$78.80
	6/1/2026	$51.55	$9.90	$9.25	$9.65	$0.00	$80.35
	12/7/2026	$53.05	$9.90	$9.25	$9.65	$0.00	$81.85
	6/7/2027	$54.65	$9.90	$9.25	$9.65	$0.00	$83.45
	12/6/2027	$56.25	$9.90	$9.25	$9.65	$0.00	$85.05
	6/5/2028	$57.93	$9.90	$9.25	$9.65	$0.00	$86.73
	12/4/2028	$59.60	$9.90	$9.25	$9.65	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: CONCRETE CUTTER/SAWYER LABORERS LABORERS - ZONE 2	6/2/2025	$48.75	$9.90	$9.25	$9.65	$0.00	$77.55
	12/1/2025	$50.25	$9.90	$9.25	$9.65	$0.00	$79.05
	6/1/2026	$51.80	$9.90	$9.25	$9.65	$0.00	$80.60
	12/7/2026	$53.30	$9.90	$9.25	$9.65	$0.00	$82.10
	6/7/2027	$54.90	$9.90	$9.25	$9.65	$0.00	$83.70
	12/6/2027	$56.50	$9.90	$9.25	$9.65	$0.00	$85.30
	6/5/2028	$58.18	$9.90	$9.25	$9.65	$0.00	$86.98
	12/4/2028	$59.85	$9.90	$9.25	$9.65	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
DEMO: JACKHAMMER OPERATOR	6/2/2025	$48.50	$9.90	$9.25	$9.65	$0.00	$77.30
LABORERS	12/1/2025	$50.00	$9.90	$9.25	$9.65	$0.00	$78.80
LABORERS - ZONE 2	6/1/2026	$51.55	$9.90	$9.25	$9.65	$0.00	$80.35
	12/7/2026	$53.05	$9.90	$9.25	$9.65	$0.00	$81.85
	6/7/2027	$54.65	$9.90	$9.25	$9.65	$0.00	$83.45
	12/6/2027	$56.25	$9.90	$9.25	$9.65	$0.00	$85.05
	6/5/2028	$57.93	$9.90	$9.25	$9.65	$0.00	$86.73
	12/4/2028	$59.60	$9.90	$9.25	$9.65	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: WRECKING LABORER	6/2/2025	$47.75	$9.90	$9.25	$9.65	$0.00	$76.55
LABORERS	12/1/2025	$49.25	$9.90	$9.25	$9.65	$0.00	$78.05
LABORERS - ZONE 2	6/1/2026	$50.80	$9.90	$9.25	$9.65	$0.00	$79.60
	12/7/2026	$52.30	$9.90	$9.25	$9.65	$0.00	$81.10
	6/7/2027	$53.90	$9.90	$9.25	$9.65	$0.00	$82.70
	12/6/2027	$55.50	$9.90	$9.25	$9.65	$0.00	$84.30
	6/5/2028	$57.18	$9.90	$9.25	$9.65	$0.00	$85.98
	12/4/2028	$58.85	$9.90	$9.25	$9.65	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"							
DIRECTIONAL DRILL MACHINE OPERATOR	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
DIVER	8/1/2024	$78.11	$10.08	$11.62	$10.04	$0.00	$109.85
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 1)							
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Diver wage 70/80/90 2A $69.83, 3A $91.79,4A $102.14 Total Rate							
DIVER TENDER	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 1)							
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Piledriver wage 70/80/90 2A $54.20, 3A $73.93,4A $82.05 Total Rate							
DIVER TENDER (EFFLUENT)	8/1/2024	$83.69	$10.08	$11.62	$12.67	$0.00	$118.06
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 1)							
For apprentice rates see "Apprentice- PILE DRIVER"							
DIVER/SLURRY (EFFLUENT)	8/1/2024	$117.16	$10.08	$11.62	$12.67	$0.00	$151.53
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 1)							
For apprentice rates see "Apprentice- PILE DRIVER"							
DRAWBRIDGE OPERATOR (Construction)	7/1/2020	$26.77	$6.67	$3.93	$0.00	$0.16	$37.53
DRAWBRIDGE - SEIU LOCAL 888							
DRAWBRIDGE - SEIU LOCAL 888							
ELECTRICIAN	3/1/2025	$64.26	$13.00	$14.31	$8.72	$0.00	$100.29
ELECTRICIANS LOCAL 103	9/1/2025	$66.17	$13.00	$14.37	$8.72	$0.00	$102.26

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
ELECTRICIANS LOCAL 103	3/1/2026	$67.37	$13.00	$14.40	$8.72	$0.00	$103.49
	9/1/2026	$69.28	$13.00	$14.46	$8.72	$0.00	$105.46
	3/1/2027	$70.47	$13.00	$14.49	$8.72	$0.00	$106.68
	9/1/2027	$72.39	$13.00	$14.55	$8.72	$0.00	$108.66
	3/1/2028	$73.59	$13.00	$14.59	$8.72	$0.00	$109.90

Apprentice: ELECTRICIAN

Effective Date: 3/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	$25.70	$13.00	$0.77	$0.00	$0.00	$39.47
2	40.00	$25.70	$13.00	$0.77	$0.00	$0.00	$39.47
3	45.00	$28.92	$13.00	$13.25	$3.92	$0.00	$59.09
4	45.00	$28.92	$13.00	$13.25	$3.92	$0.00	$59.09
5	50.00	$32.13	$13.00	$13.34	$4.36	$0.00	$62.83
6	55.00	$35.34	$13.00	$13.44	$4.80	$0.00	$66.58
7	60.00	$38.56	$13.00	$13.54	$5.23	$0.00	$70.33
8	65.00	$41.77	$13.00	$13.63	$5.67	$0.00	$74.07
9	70.00	$44.98	$13.00	$13.73	$6.10	$0.00	$77.81
10	75.00	$48.20	$13.00	$13.83	$6.54	$0.00	$81.57

Apprentice: ELECTRICIAN

Effective Date: 9/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	$26.47	$13.00	$0.79	$0.00	$0.00	$40.26
2	40.00	$26.47	$13.00	$0.79	$0.00	$0.00	$40.26
3	45.00	$29.78	$13.00	$13.27	$3.92	$0.00	$59.97
4	45.00	$29.78	$13.00	$13.27	$3.92	$0.00	$59.97
5	50.00	$33.09	$13.00	$13.37	$4.36	$0.00	$63.82
6	55.00	$36.39	$13.00	$13.47	$4.80	$0.00	$67.66
7	60.00	$39.70	$13.00	$13.57	$5.23	$0.00	$71.50
8	65.00	$43.01	$13.00	$13.67	$5.67	$0.00	$75.35
9	70.00	$46.32	$13.00	$13.77	$6.10	$0.00	$79.19
10	75.00	$49.63	$13.00	$13.87	$6.54	$0.00	$83.04

ELEVATOR CONSTRUCTOR ELEVATOR CONSTRUCTORS LOCAL 4 ELEVATOR CONSTRUCTORS LOCAL 4	1/1/2022	$65.62	$16.03	$10.71	$9.50	$0.00	$101.86

Apprentice: ELEVATOR CONSTRUCTOR

Effective Date: 1/1/2022

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$32.81	$16.03	$0.00	$0.00	$0.00	$48.84
2	55.00	$36.09	$16.03	$10.71	$9.50	$0.00	$72.33

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: ELEVATOR CONSTRUCTOR							
Effective Date: 1/1/2022							
Step / Percent		**Apprentice Base Wage**					
3 / 65.00		$42.65	$16.03	$10.71	$9.50	$0.00	$78.89
4 / 70.00		$45.93	$16.03	$10.71	$9.50	$0.00	$82.17
5 / 80.00		$52.50	$16.03	$10.71	$9.50	$0.00	$88.74
ELEVATOR CONSTRUCTOR HELPER ELEVATOR CONSTRUCTORS LOCAL 4 ELEVATOR CONSTRUCTORS LOCAL 4	1/1/2022	$45.93	$16.03	$10.71	$9.50	$0.00	$82.17
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"							
FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	5/1/2025	$53.22	$15.30	$13.15	$3.25	$0.00	$84.92
	11/1/2025	$54.51	$15.30	$13.15	$3.25	$0.00	$86.21
	5/1/2026	$55.95	$15.30	$13.15	$3.25	$0.00	$87.65
	11/1/2026	$57.24	$15.30	$13.15	$3.25	$0.00	$88.94
	5/1/2027	$58.67	$15.30	$13.15	$3.25	$0.00	$90.37
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	5/1/2025	$54.82	$15.30	$13.15	$3.25	$0.00	$86.52
	11/1/2025	$56.12	$15.30	$13.15	$3.25	$0.00	$87.82
	5/1/2026	$57.57	$15.30	$13.15	$3.25	$0.00	$89.27
	11/1/2026	$58.87	$15.30	$13.15	$3.25	$0.00	$90.57
	5/1/2027	$60.32	$15.30	$13.15	$3.25	$0.00	$92.02
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	5/1/2025	$26.22	$15.30	$13.15	$3.25	$0.00	$57.92
	11/1/2025	$26.98	$15.30	$13.15	$3.25	$0.00	$58.68
	5/1/2026	$27.83	$15.30	$13.15	$3.25	$0.00	$59.53
	11/1/2026	$28.59	$15.30	$13.15	$3.25	$0.00	$60.29
	5/1/2027	$29.44	$15.30	$13.15	$3.25	$0.00	$61.14
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIRE ALARM INSTALLER ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	3/1/2025	$64.26	$13.00	$14.31	$8.72	$0.00	$100.29
	9/1/2025	$66.17	$13.00	$14.37	$8.72	$0.00	$102.26
	3/1/2026	$67.37	$13.00	$14.40	$8.72	$0.00	$103.49
	9/1/2026	$69.28	$13.00	$14.46	$8.72	$0.00	$105.46
	3/1/2027	$70.47	$13.00	$14.49	$8.72	$0.00	$106.68
	9/1/2027	$72.39	$13.00	$14.55	$8.72	$0.00	$108.66
	3/1/2028	$73.59	$13.00	$14.59	$8.72	$0.00	$109.90
For apprentice rates see "Apprentice- ELECTRICIAN"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	3/1/2025	$51.41	$13.00	$13.92	$6.98	$0.00	$85.31
	9/1/2025	$52.94	$13.00	$13.97	$6.98	$0.00	$86.89
	3/1/2026	$53.90	$13.00	$14.00	$6.98	$0.00	$87.88
	9/1/2026	$55.42	$13.00	$14.04	$6.98	$0.00	$89.44
	3/1/2027	$56.38	$13.00	$14.07	$6.98	$0.00	$90.43
	9/1/2027	$57.91	$13.00	$14.12	$6.98	$0.00	$92.01
	3/1/2028	$58.87	$13.00	$14.15	$6.98	$0.00	$93.00
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"							
FIREMAN (ASST. ENGINEER) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$47.02	$15.55	$13.25	$3.25	$0.00	$79.07
	12/1/2025	$48.19	$15.55	$13.25	$3.25	$0.00	$80.24
	6/1/2026	$49.25	$15.55	$13.25	$3.25	$0.00	$81.30
	12/1/2026	$50.43	$15.55	$13.25	$3.25	$0.00	$82.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FLAGGER & SIGNALER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$28.09	$9.90	$9.25	$9.21	$0.00	$56.45
	12/1/2025	$28.09	$9.90	$9.25	$9.21	$0.00	$56.45
	6/1/2026	$29.21	$9.90	$9.25	$9.21	$0.00	$57.57
	12/1/2026	$29.21	$9.90	$9.25	$9.21	$0.00	$57.57
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
FLOORCOVERER FLOORCOVERERS LOCAL 2168 FLOORCOVERERS LOCAL 2168 ZONE I	3/1/2025	$57.73	$8.83	$11.47	$8.80	$0.00	$86.83
	9/1/2025	$59.23	$8.83	$11.47	$8.80	$0.00	$88.33
	3/1/2026	$60.73	$8.83	$11.47	$8.80	$0.00	$89.83
	9/1/2026	$62.23	$8.83	$11.47	$8.80	$0.00	$91.33
	3/1/2027	$63.73	$8.83	$11.47	$8.80	$0.00	$92.83

Apprentice: FLOORCOVERER

Effective Date: 3/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$25.98	$8.83	$0.00	$1.76	$0.00	$36.57
2	45.00	$25.98	$8.83	$0.00	$1.76	$0.00	$36.57
3	55.00	$31.75	$8.83	$0.00	$3.52	$0.00	$44.10
4	55.00	$31.75	$8.83	$0.00	$3.52	$0.00	$44.10
5	70.00	$40.41	$8.83	$11.47	$5.28	$0.00	$65.99
6	70.00	$40.41	$8.83	$11.47	$5.28	$0.00	$65.99
7	80.00	$46.18	$8.83	$11.47	$7.04	$0.00	$73.52
8	80.00	$46.18	$8.83	$11.47	$7.04	$0.00	$73.52

Apprentice: FLOORCOVERER

Effective Date: 9/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$26.65	$8.83	$0.00	$1.76	$0.00	$37.24
2	45.00	$26.65	$8.83	$0.00	$1.76	$0.00	$37.24
3	55.00	$32.58	$8.83	$0.00	$3.52	$0.00	$44.93

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: FLOORCOVERER							
Effective Date: 9/1/2025							
Step / Percent		**Apprentice Base Wage**					
4 / 55.00		$32.58	$8.83	$0.00	$3.52	$0.00	$44.93
5 / 70.00		$41.46	$8.83	$11.47	$5.28	$0.00	$67.04
6 / 70.00		$41.46	$8.83	$11.47	$5.28	$0.00	$67.04
7 / 80.00		$47.38	$8.83	$11.47	$7.04	$0.00	$74.72
8 / 80.00		$47.38	$8.83	$11.47	$7.04	$0.00	$74.72
FORK LIFT/CHERRY PICKER	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
GENERATOR/LIGHTING PLANT/HEATERS	6/1/2025	$37.52	$15.55	$13.25	$3.25	$0.00	$69.57
OPERATING ENGINEERS LOCAL 4	12/1/2025	$38.47	$15.55	$13.25	$3.25	$0.00	$70.52
OPERATING ENGINEERS LOCAL 4	6/1/2026	$39.33	$15.55	$13.25	$3.25	$0.00	$71.38
	12/1/2026	$40.28	$15.55	$13.25	$3.25	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)	1/1/2025	$47.96	$9.95	$11.85	$12.10	$0.00	$81.86
GLAZIERS LOCAL 35							
GLAZIERS LOCAL 35 (ZONE 2)							
Apprentice: GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)							
Effective Date: 1/1/2025							
Step / Percent		**Apprentice Base Wage**					
1 / 50.00		$23.98	$9.95	$0.00	$0.00	$0.00	$33.93
2 / 55.00		$26.38	$9.95	$0.00	$6.66	$0.00	$42.99
3 / 60.00		$28.78	$9.95	$0.00	$7.26	$0.00	$45.99
4 / 65.00		$31.17	$9.95	$0.00	$7.87	$0.00	$48.99
5 / 70.00		$33.57	$9.95	$11.85	$8.47	$0.00	$63.84
6 / 75.00		$35.97	$9.95	$11.85	$9.08	$0.00	$66.85
7 / 80.00		$38.37	$9.95	$11.85	$9.68	$0.00	$69.85
8 / 90.00		$43.16	$9.95	$11.85	$10.89	$0.00	$75.85
HOISTING ENGINEER/CRANES/GRADALLS	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: HOISTING ENGINEER/CRANES/GRADALLS

Effective Date: 6/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$32.08	$0.00	$0.00	$0.00	$0.00	$32.08
2	60.00	$35.00	$15.55	$13.25	$3.25	$0.00	$67.05
3	65.00	$37.91	$15.55	$13.25	$3.25	$0.00	$69.96
4	70.00	$40.83	$15.55	$13.25	$3.25	$0.00	$72.88
5	75.00	$43.75	$15.55	$13.25	$3.25	$0.00	$75.80
6	80.00	$46.66	$15.55	$13.25	$3.25	$0.00	$78.71
7	85.00	$49.58	$15.55	$13.25	$3.25	$0.00	$81.63
8	90.00	$52.50	$15.55	$13.25	$3.25	$0.00	$84.55

Apprentice: HOISTING ENGINEER/CRANES/GRADALLS

Effective Date: 12/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$32.88	$0.00	$0.00	$0.00	$0.00	$32.88
2	60.00	$35.87	$15.55	$13.25	$3.25	$0.00	$67.92
3	65.00	$38.86	$15.55	$13.25	$3.25	$0.00	$70.91
4	70.00	$41.85	$15.55	$13.25	$3.25	$0.00	$73.90
5	75.00	$44.84	$15.55	$13.25	$3.25	$0.00	$76.89
6	80.00	$47.82	$15.55	$13.25	$3.25	$0.00	$79.87
7	85.00	$50.81	$15.55	$13.25	$3.25	$0.00	$82.86
8	90.00	$53.80	$15.55	$13.25	$3.25	$0.00	$85.85

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
HVAC (DUCTWORK)	8/1/2025	$60.98	$14.91	$18.74	$9.53	$2.98	$107.14
SHEETMETAL WORKERS LOCAL 17	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
SHEETMETAL WORKERS LOCAL 17 - A							
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (ELECTRICAL CONTROLS)	3/1/2025	$64.26	$13.00	$14.31	$8.72	$0.00	$100.29
ELECTRICIANS LOCAL 103	9/1/2025	$66.17	$13.00	$14.37	$8.72	$0.00	$102.26
ELECTRICIANS LOCAL 103	3/1/2026	$67.37	$13.00	$14.40	$8.72	$0.00	$103.49
	9/1/2026	$69.28	$13.00	$14.46	$8.72	$0.00	$105.46
	3/1/2027	$70.47	$13.00	$14.49	$8.72	$0.00	$106.68
	9/1/2027	$72.39	$13.00	$14.55	$8.72	$0.00	$108.66
	3/1/2028	$73.59	$13.00	$14.59	$8.72	$0.00	$109.90
For apprentice rates see "Apprentice- ELECTRICIAN"							
HVAC (TESTING AND BALANCING - AIR)	8/1/2025	$60.98	$14.91	$18.74	$9.53	$2.98	$107.14
SHEETMETAL WORKERS LOCAL 17	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
SHEETMETAL WORKERS LOCAL 17 - A							
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (TESTING AND BALANCING -WATER)	3/1/2025	$68.88	$12.70	$13.05	$8.75	$0.00	$103.38
PIPEFITTERS LOCAL 537							
PIPEFITTERS LOCAL 537 (Local 138)							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HVAC MECHANIC PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537 (Local 138)	3/1/2025	$68.88	$12.70	$13.05	$8.75	$0.00	$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HYDRAULIC DRILLS LABORERS LABORERS - ZONE 2	6/1/2025	$41.09	$9.90	$9.25	$9.11	$0.00	$69.35
	12/1/2025	$42.47	$9.90	$9.25	$9.11	$0.00	$70.73
	6/1/2026	$43.91	$9.90	$9.25	$9.11	$0.00	$72.17
	12/1/2026	$45.35	$9.90	$9.25	$9.11	$0.00	$73.61
	6/1/2027	$46.80	$9.90	$9.25	$9.11	$0.00	$75.06
	12/1/2027	$48.25	$9.90	$9.25	$9.11	$0.00	$76.51
	6/1/2028	$49.75	$9.90	$9.25	$9.11	$0.00	$78.01
	12/1/2028	$51.25	$9.90	$9.25	$9.11	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"							
HYDRAULIC DRILLS (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$41.09	$9.90	$9.25	$9.21	$0.00	$69.45
	12/1/2025	$42.47	$9.90	$9.25	$9.21	$0.00	$70.83
	6/1/2026	$43.91	$9.90	$9.25	$9.21	$0.00	$72.27
	12/1/2026	$45.35	$9.90	$9.25	$9.21	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
INSULATOR (PIPES & TANKS) HEAT & FROST INSULATORS LOCAL 6 HEAT & FROST INSULATORS LOCAL 6 (BOSTON)	9/1/2024	$56.92	$14.75	$9.52	$10.09	$0.00	$91.28
	9/1/2025	$60.34	$14.75	$9.52	$10.09	$0.00	$94.70
	9/1/2026	$63.76	$14.75	$9.52	$10.09	$0.00	$98.12

Apprentice: INSULATOR (PIPES & TANKS)

Effective Date: 9/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$28.46	$14.75	$9.27	$5.05	$0.00	$57.53
2	60.00	$34.15	$14.75	$9.32	$6.05	$0.00	$64.27
3	70.00	$39.84	$14.75	$9.37	$7.06	$0.00	$71.02
4	80.00	$45.54	$14.75	$9.42	$8.07	$0.00	$77.78

Apprentice: INSULATOR (PIPES & TANKS)

Effective Date: 9/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$30.17	$14.75	$9.27	$5.05	$0.00	$59.24
2	60.00	$36.20	$14.75	$9.32	$6.05	$0.00	$66.32
3	70.00	$42.24	$14.75	$9.37	$7.06	$0.00	$73.42
4	80.00	$48.27	$14.75	$9.42	$8.07	$0.00	$80.51

IRONWORKER/WELDER IRONWORKERS LOCAL 7 IRONWORKERS LOCAL 7 (BOSTON AREA)	3/16/2025	$56.79	$9.00	$12.70	$14.45	$0.00	$92.94
	9/16/2025	$57.87	$9.05	$12.75	$14.50	$0.00	$94.17

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: IRONWORKER/WELDER

Effective Date: 3/16/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$34.07	$9.00	$12.70	$4.25	$0.00	$60.02
2	75.00	$42.59	$9.00	$12.70	$4.25	$0.00	$68.54
3	85.00	$48.27	$9.00	$12.70	$4.45	$0.00	$74.42
4	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
5	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Apprentice: IRONWORKER/WELDER

Effective Date: 9/16/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$34.72	$9.05	$12.75	$4.50	$0.00	$61.02
2	75.00	$43.40	$9.05	$12.75	$4.50	$0.00	$69.70
3	85.00	$49.19	$9.05	$12.75	$4.50	$0.00	$75.49
4	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
5	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
JACKHAMMER & PAVING BREAKER OPERATOR LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
LABORER LABORERS LABORERS - ZONE 2	6/1/2025	$40.34	$9.90	$9.25	$9.11	$0.00	$68.60
	12/1/2025	$41.72	$9.90	$9.25	$9.11	$0.00	$69.98
	6/1/2026	$43.16	$9.90	$9.25	$9.11	$0.00	$71.42
	12/1/2026	$44.60	$9.90	$9.25	$9.11	$0.00	$72.86
	6/1/2027	$46.05	$9.90	$9.25	$9.11	$0.00	$74.31
	12/1/2027	$47.50	$9.90	$9.25	$9.11	$0.00	$75.76
	6/1/2028	$49.00	$9.90	$9.25	$9.11	$0.00	$77.26
	12/1/2028	$50.50	$9.90	$9.25	$9.11	$0.00	$78.76

Apprentice: LABORER

Effective Date: 6/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$40.34	$9.90	$9.25	$9.21	$0.00	$68.70
	12/1/2025	$41.72	$9.90	$9.25	$9.21	$0.00	$70.08
	6/1/2026	$43.16	$9.90	$9.25	$9.21	$0.00	$71.52
	12/1/2026	$44.60	$9.90	$9.25	$9.21	$0.00	$72.96

Apprentice: LABORER

Effective Date: 6/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$24.20	$9.90	$9.25	$9.11	$0.00	$52.46
2	70.00	$28.24	$9.90	$9.25	$9.11	$0.00	$56.50
3	80.00	$32.27	$9.90	$9.25	$9.11	$0.00	$60.53
4	90.00	$36.31	$9.90	$9.25	$9.11	$0.00	$64.57

Apprentice: LABORER

Effective Date: 12/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$25.03	$9.90	$9.25	$9.11	$0.00	$53.29
2	70.00	$29.20	$9.90	$9.25	$9.11	$0.00	$57.46
3	80.00	$33.38	$9.90	$9.25	$9.11	$0.00	$61.64
4	90.00	$37.55	$9.90	$9.25	$9.11	$0.00	$65.81

Apprentice: LABORER (HEAVY & HIGHWAY)

Effective Date: 6/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$24.20	$9.90	$9.25	$9.21	$0.00	$52.56
2	70.00	$28.24	$9.90	$9.25	$9.21	$0.00	$56.60
3	80.00	$32.27	$9.90	$9.25	$9.21	$0.00	$60.63
4	90.00	$36.31	$9.90	$9.25	$9.21	$0.00	$64.67

Apprentice: LABORER (HEAVY & HIGHWAY)

Effective Date: 12/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$25.03	$9.90	$9.25	$9.21	$0.00	$53.39
2	70.00	$29.20	$9.90	$9.25	$9.21	$0.00	$57.56
3	80.00	$33.38	$9.90	$9.25	$9.21	$0.00	$61.74
4	90.00	$37.55	$9.90	$9.25	$9.21	$0.00	$65.91

LABORER: CARPENTER TENDER LABORERS LABORERS - ZONE 2	6/1/2025	$40.34	$9.90	$9.25	$9.11	$0.00	$68.60
	12/1/2025	$41.72	$9.90	$9.25	$9.11	$0.00	$69.98
	6/1/2026	$43.16	$9.90	$9.25	$9.11	$0.00	$71.42

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	12/1/2026	$44.60	$9.90	$9.25	$9.11	$0.00	$72.86
	6/1/2027	$46.05	$9.90	$9.25	$9.11	$0.00	$74.31
	12/1/2027	$47.50	$9.90	$9.25	$9.11	$0.00	$75.76
	6/1/2028	$49.00	$9.90	$9.25	$9.11	$0.00	$77.26
	12/1/2028	$50.50	$9.90	$9.25	$9.11	$0.00	$78.76
For apprentice rates see "Apprentice- LABORER"							
LABORER: CEMENT FINISHER TENDER	6/1/2025	$40.34	$9.90	$9.25	$9.11	$0.00	$68.60
LABORERS	12/1/2025	$41.72	$9.90	$9.25	$9.11	$0.00	$69.98
LABORERS - ZONE 2	6/1/2026	$43.16	$9.90	$9.25	$9.11	$0.00	$71.42
	12/1/2026	$44.60	$9.90	$9.25	$9.11	$0.00	$72.86
	6/1/2027	$46.05	$9.90	$9.25	$9.11	$0.00	$74.31
	12/1/2027	$47.50	$9.90	$9.25	$9.11	$0.00	$75.76
	6/1/2028	$49.00	$9.90	$9.25	$9.11	$0.00	$77.26
	12/1/2028	$50.50	$9.90	$9.25	$9.11	$0.00	$78.76
For apprentice rates see "Apprentice- LABORER"							
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER	6/2/2025	$40.43	$9.90	$9.25	$9.17	$0.00	$68.75
LABORERS	12/1/2025	$41.81	$9.90	$9.25	$9.17	$0.00	$70.13
LABORERS - ZONE 2	6/1/2026	$43.25	$9.90	$9.25	$9.17	$0.00	$71.57
	12/7/2026	$44.69	$9.90	$9.25	$9.17	$0.00	$73.01
	6/7/2027	$46.14	$9.90	$9.25	$9.17	$0.00	$74.46
	12/6/2027	$47.59	$9.90	$9.25	$9.17	$0.00	$75.91
	6/5/2028	$49.09	$9.90	$9.25	$9.17	$0.00	$77.41
	12/4/2028	$50.59	$9.90	$9.25	$9.17	$0.00	$78.91
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
LABORERS	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
LABORERS - ZONE 2	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
LABORERS	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
LABORER: MULTI-TRADE TENDER	6/1/2025	$40.34	$9.90	$9.25	$9.11	$0.00	$68.60
LABORERS	12/1/2025	$41.72	$9.90	$9.25	$9.11	$0.00	$69.98
LABORERS - ZONE 2	6/1/2026	$43.16	$9.90	$9.25	$9.11	$0.00	$71.42
	12/1/2026	$44.60	$9.90	$9.25	$9.11	$0.00	$72.86
	6/1/2027	$46.05	$9.90	$9.25	$9.11	$0.00	$74.31
	12/1/2027	$47.50	$9.90	$9.25	$9.11	$0.00	$75.76
	6/1/2028	$49.00	$9.90	$9.25	$9.11	$0.00	$77.26
	12/1/2028	$50.50	$9.90	$9.25	$9.11	$0.00	$78.76

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"							
LABORER: TREE REMOVER LABORERS LABORERS - ZONE 2	6/1/2025	$40.34	$9.90	$9.25	$9.11	$0.00	$68.60
	12/1/2025	$41.72	$9.90	$9.25	$9.11	$0.00	$69.98
	6/1/2026	$43.16	$9.90	$9.25	$9.11	$0.00	$71.42
	12/1/2026	$44.60	$9.90	$9.25	$9.11	$0.00	$72.86
	6/1/2027	$46.05	$9.90	$9.25	$9.11	$0.00	$74.31
	12/1/2027	$47.50	$9.90	$9.25	$9.11	$0.00	$75.76
	6/1/2028	$49.00	$9.90	$9.25	$9.11	$0.00	$77.26
	12/1/2028	$50.50	$9.90	$9.25	$9.11	$0.00	$78.76
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"							
LASER BEAM OPERATOR LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
LASER BEAM OPERATOR (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
MARBLE & TILE FINISHERS BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 - MARBLE & TILE	8/1/2025	$52.08	$11.49	$15.57	$6.05	$0.00	$85.19
	2/1/2026	$53.16	$11.49	$15.57	$6.05	$0.00	$86.27
	8/1/2026	$54.92	$11.49	$15.57	$6.05	$0.00	$88.03
	2/1/2027	$56.04	$11.49	$15.57	$6.05	$0.00	$89.15

Apprentice: MARBLE & TILE FINISHERS

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$26.04	$11.49	$15.57	$6.05	$0.00	$59.15
2	60.00	$31.25	$11.49	$15.57	$6.05	$0.00	$64.36
3	70.00	$36.46	$11.49	$15.57	$6.05	$0.00	$69.57
4	80.00	$41.66	$11.49	$15.57	$6.05	$0.00	$74.77
5	90.00	$46.87	$11.49	$15.57	$6.05	$0.00	$79.98

Apprentice: MARBLE & TILE FINISHERS

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
MARBLE MASONS,TILELAYERS & TERRAZZO MECH BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 - MARBLE & TILE	8/1/2025	$67.97	$11.49	$15.57	$7.99	$0.00	$103.02
	2/1/2026	$69.32	$11.49	$15.57	$7.99	$0.00	$104.37
	8/1/2026	$71.52	$11.49	$15.57	$7.99	$0.00	$106.57
	2/1/2027	$72.92	$11.49	$15.57	$7.99	$0.00	$107.97

Apprentice: MARBLE & TILE FINISHERS

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$26.58	$11.49	$15.57	$6.05	$0.00	$59.69
2	60.00	$31.90	$11.49	$15.57	$6.05	$0.00	$65.01
3	70.00	$37.21	$11.49	$15.57	$6.05	$0.00	$70.32
4	80.00	$42.53	$11.49	$15.57	$6.05	$0.00	$75.64
5	90.00	$47.84	$11.49	$15.57	$6.05	$0.00	$80.95

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$33.99	$11.49	$15.57	$7.99	$0.00	$69.04
2	60.00	$40.78	$11.49	$15.57	$7.99	$0.00	$75.83
3	70.00	$47.58	$11.49	$15.57	$7.99	$0.00	$82.63
4	80.00	$54.38	$11.49	$15.57	$7.99	$0.00	$89.43
5	90.00	$61.17	$11.49	$15.57	$7.99	$0.00	$96.22

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$34.66	$11.49	$15.57	$7.99	$0.00	$69.71
2	60.00	$41.59	$11.49	$15.57	$7.99	$0.00	$76.64
3	70.00	$48.52	$11.49	$15.57	$7.99	$0.00	$83.57
4	80.00	$55.46	$11.49	$15.57	$7.99	$0.00	$90.51
5	90.00	$62.39	$11.49	$15.57	$7.99	$0.00	$97.44

MECH. SWEEPER OPERATOR (ON CONST. SITES) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
MILLWRIGHT (Zone 1)	1/6/2025	$50.53	$10.08	$11.47	$10.25	$0.00	$82.33
MILLWRIGHTS LOCAL 1121	1/5/2026	$53.03	$10.08	$11.47	$10.25	$0.00	$84.83
MILLWRIGHTS LOCAL 1121 - Zone 1							

Apprentice: MILLWRIGHT (Zone 1)

Effective Date: 1/6/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$27.79	$10.08	$0.00	$5.64	$0.00	$43.51
2	65.00	$32.84	$10.08	$0.00	$6.66	$0.00	$49.58
3	75.00	$37.90	$10.08	$11.47	$7.69	$0.00	$67.14
4	85.00	$42.95	$10.08	$11.47	$8.71	$0.00	$73.21

Apprentice: MILLWRIGHT (Zone 1)

Effective Date: 1/5/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$29.17	$10.08	$0.00	$5.64	$0.00	$44.89
2	65.00	$34.47	$10.08	$0.00	$6.66	$0.00	$51.21
3	75.00	$39.77	$10.08	$11.47	$7.69	$0.00	$69.01
4	85.00	$45.08	$10.08	$11.47	$8.71	$0.00	$75.34

MORTAR MIXER	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
LABORERS	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
LABORERS - ZONE 2	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01

For apprentice rates see "Apprentice- LABORER"

OILER (OTHER THAN TRUCK CRANES,GRADALLS)	6/1/2025	$25.97	$15.30	$13.15	$3.25	$0.00	$57.67
OPERATING ENGINEERS LOCAL 4	12/1/2025	$26.63	$15.30	$13.15	$3.25	$0.00	$58.33
OPERATING ENGINEERS LOCAL 4	6/1/2026	$27.22	$15.30	$13.15	$3.25	$0.00	$58.92
	12/1/2026	$27.89	$15.30	$13.15	$3.25	$0.00	$59.59

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OILER (TRUCK CRANES, GRADALLS)	6/1/2025	$31.80	$15.30	$13.15	$3.25	$0.00	$63.50
OPERATING ENGINEERS LOCAL 4	12/1/2025	$32.60	$15.30	$13.15	$3.25	$0.00	$64.30
OPERATING ENGINEERS LOCAL 4	6/1/2026	$33.32	$15.30	$13.15	$3.25	$0.00	$65.02
	12/1/2026	$34.12	$15.30	$13.15	$3.25	$0.00	$65.82

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OTHER POWER DRIVEN EQUIPMENT - CLASS II	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PAINTER (BRIDGES/TANKS) PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 2	1/1/2025	$58.46	$9.95	$11.85	$12.10	$0.00	$92.36

Apprentice: PAINTER (BRIDGES/TANKS)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$29.23	$9.95	$0.00	$0.00	$0.00	$39.18
2	55.00	$32.15	$9.95	$0.00	$6.66	$0.00	$48.76
3	60.00	$35.08	$9.95	$0.00	$7.26	$0.00	$52.29
4	65.00	$38.00	$9.95	$0.00	$7.87	$0.00	$55.82
5	70.00	$40.92	$9.95	$11.85	$8.47	$0.00	$71.19
6	75.00	$43.85	$9.95	$11.85	$9.08	$0.00	$74.73
7	80.00	$46.77	$9.95	$11.85	$9.68	$0.00	$78.25
8	90.00	$52.61	$9.95	$11.85	$10.89	$0.00	$85.30

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 2	1/1/2025	$49.36	$9.95	$11.85	$12.10	$0.00	$83.26

Apprentice: PAINTER (SPRAY OR SANDBLAST, NEW) *

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$24.68	$9.95	$0.00	$0.00	$0.00	$34.63
2	55.00	$27.15	$9.95	$0.00	$6.66	$0.00	$43.76
3	60.00	$29.62	$9.95	$0.00	$7.26	$0.00	$46.83
4	65.00	$32.08	$9.95	$0.00	$7.87	$0.00	$49.90
5	70.00	$34.55	$9.95	$11.85	$8.47	$0.00	$64.82
6	75.00	$37.02	$9.95	$11.85	$9.08	$0.00	$67.90
7	80.00	$39.49	$9.95	$11.85	$9.68	$0.00	$70.97
8	90.00	$44.42	$9.95	$11.85	$10.89	$0.00	$77.11

PAINTER (SPRAY OR SANDBLAST, REPAINT) PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 2	1/1/2025	$47.42	$9.95	$11.85	$12.10	$0.00	$81.32

Apprentice: PAINTER (SPRAY OR SANDBLAST, REPAINT)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$23.71	$9.95	$0.00	$0.00	$0.00	$33.66

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: PAINTER (SPRAY OR SANDBLAST, REPAINT)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
2	55.00	$26.08	$9.95	$0.00	$6.66	$0.00	$42.69
3	60.00	$28.45	$9.95	$0.00	$7.26	$0.00	$45.66
4	65.00	$30.82	$9.95	$0.00	$7.87	$0.00	$48.64
5	70.00	$33.19	$9.95	$11.85	$8.47	$0.00	$63.46
6	75.00	$35.57	$9.95	$11.85	$9.08	$0.00	$66.45
7	80.00	$37.94	$9.95	$11.85	$9.68	$0.00	$69.42
8	90.00	$42.68	$9.95	$11.85	$10.89	$0.00	$75.37

PAINTER / TAPER (BRUSH, NEW) *	1/1/2025	$47.96	$9.95	$11.85	$12.10	$0.00	$81.86

* If 30% or more of surfaces to be painted are new construction,
NEW paint rate shall be used.
PAINTERS LOCAL 35
PAINTERS LOCAL 35 - ZONE 2

Apprentice: PAINTER / TAPER (BRUSH, NEW) *

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$23.98	$9.95	$0.00	$0.00	$0.00	$33.93
2	55.00	$26.38	$9.95	$0.00	$6.66	$0.00	$42.99
3	60.00	$28.78	$9.95	$0.00	$7.26	$0.00	$45.99
4	65.00	$31.17	$9.95	$0.00	$7.87	$0.00	$48.99
5	70.00	$33.57	$9.95	$11.85	$8.47	$0.00	$63.84
6	75.00	$35.97	$9.95	$11.85	$9.08	$0.00	$66.85
7	80.00	$38.37	$9.95	$11.85	$9.68	$0.00	$69.85
8	90.00	$43.16	$9.95	$11.85	$10.89	$0.00	$75.85

PAINTER / TAPER (BRUSH, REPAINT)	1/1/2025	$46.02	$9.95	$11.85	$12.10	$0.00	$79.92

PAINTERS LOCAL 35
PAINTERS LOCAL 35 - ZONE 2

Apprentice: PAINTER / TAPER (BRUSH, REPAINT)

Effective Date: 1/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$23.01	$9.95	$0.00	$0.00	$0.00	$32.96
2	55.00	$25.31	$9.95	$0.00	$6.66	$0.00	$41.92
3	60.00	$27.61	$9.95	$0.00	$7.26	$0.00	$44.82
4	65.00	$29.91	$9.95	$0.00	$7.87	$0.00	$47.73
5	70.00	$32.21	$9.95	$11.85	$8.47	$0.00	$62.48
6	75.00	$34.52	$9.95	$11.85	$9.08	$0.00	$65.40
7	80.00	$36.82	$9.95	$11.85	$9.68	$0.00	$68.30
8	90.00	$41.42	$9.95	$11.85	$10.89	$0.00	$74.11

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$40.34	$9.90	$9.25	$9.21	$0.00	$68.70
	12/1/2025	$41.72	$9.90	$9.25	$9.21	$0.00	$70.08
	6/1/2026	$43.16	$9.90	$9.25	$9.21	$0.00	$71.52
	12/1/2026	$44.60	$9.90	$9.25	$9.21	$0.00	$72.96
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
PANEL & PICKUP TRUCKS DRIVER TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$40.78	$15.57	$20.17	$0.00	$0.00	$76.52
	12/1/2025	$40.78	$15.57	$21.78	$0.00	$0.00	$78.13
	1/1/2026	$40.78	$16.17	$21.78	$0.00	$0.00	$78.73
	6/1/2026	$41.78	$16.17	$21.78	$0.00	$0.00	$79.73
	12/1/2026	$41.78	$16.17	$23.52	$0.00	$0.00	$81.47
	1/1/2027	$41.78	$16.77	$23.52	$0.00	$0.00	$82.07
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16
For apprentice rates see "Apprentice- PILE DRIVER"							
PILE DRIVER PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16

Apprentice: PILE DRIVER

Effective Date: 8/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$25.11	$10.08	$0.00	$2.53	$0.00	$37.72
2	55.00	$30.68	$10.08	$0.00	$5.07	$0.00	$45.83
3	70.00	$39.05	$10.08	$11.62	$7.60	$0.00	$68.35
4	80.00	$44.63	$10.08	$11.62	$10.14	$0.00	$76.47

PIPEFITTER & STEAMFITTER PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537 (Local 138)	3/1/2025	$68.88	$12.70	$13.05	$8.75	$0.00	$103.38

Apprentice: PIPEFITTER & STEAMFITTER

Effective Date: 3/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	$27.55	$12.70	$0.30	$8.75	$0.00	$49.30
2	45.00	$31.00	$12.70	$13.05	$8.75	$0.00	$65.50
3	60.00	$41.33	$12.70	$13.05	$8.75	$0.00	$75.83
4	70.00	$48.22	$12.70	$13.05	$8.75	$0.00	$82.72
5	80.00	$55.10	$12.70	$13.05	$8.75	$0.00	$89.60

PIPELAYER LABORERS	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS - ZONE 2	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"							
PIPELAYER (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
PLUMBER PLUMBERS & GASFITTERS LOCAL 12 PLUMBERS & GASFITTERS LOCAL 12 (Local 138)	3/2/2025	$69.84	$14.32	$12.31	$8.00	$0.00	$104.47

Apprentice: PLUMBER

Effective Date: 3/2/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	35.00	$24.44	$14.32	$4.61	$2.80	$0.00	$46.17
2	40.00	$27.94	$14.32	$5.22	$3.20	$0.00	$50.68
3	55.00	$38.41	$14.32	$7.03	$4.40	$0.00	$64.16
4	65.00	$45.40	$14.32	$8.30	$5.20	$0.00	$73.22
5	75.00	$52.38	$14.32	$9.53	$6.00	$0.00	$82.23

PNEUMATIC CONTROLS (TEMP.) PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537 (Local 138)	3/1/2025	$68.88	$12.70	$13.05	$8.75	$0.00	$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
PNEUMATIC DRILL/TOOL OPERATOR	6/1/2025	$41.09	$9.90	$9.25	$8.29	$0.00	$68.53
LABORERS LABORERS - ZONE 2	12/1/2025	$42.47	$9.90	$9.25	$8.29	$0.00	$69.91
	6/1/2026	$43.91	$9.90	$9.25	$8.29	$0.00	$71.35
	12/1/2026	$45.35	$9.90	$9.25	$8.29	$0.00	$72.79
	6/1/2027	$46.80	$9.90	$9.25	$8.29	$0.00	$74.24
	12/1/2027	$48.25	$9.90	$9.25	$8.29	$0.00	$75.69
	6/1/2028	$49.75	$9.90	$9.25	$8.29	$0.00	$77.19
	12/1/2028	$51.25	$9.90	$9.25	$8.29	$0.00	$78.69
For apprentice rates see "Apprentice- LABORER"							
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWDERMAN & BLASTER	6/1/2025	$41.34	$9.90	$9.25	$9.11	$0.00	$69.60

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS LABORERS - ZONE 2	12/1/2025	$42.72	$9.90	$9.25	$9.11	$0.00	$70.98
	6/1/2026	$44.16	$9.90	$9.25	$9.11	$0.00	$72.42
	12/1/2026	$45.60	$9.90	$9.25	$9.11	$0.00	$73.86
	6/1/2027	$47.05	$9.90	$9.25	$9.11	$0.00	$75.31
	12/1/2027	$48.50	$9.90	$9.25	$9.11	$0.00	$76.76
	6/1/2028	$50.00	$9.90	$9.25	$9.11	$0.00	$78.26
	12/1/2028	$51.50	$9.90	$9.25	$9.11	$0.00	$79.76
For apprentice rates see "Apprentice- LABORER"							
POWDERMAN & BLASTER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2025	$41.34	$9.65	$9.25	$9.21	$0.00	$69.45
	12/1/2025	$42.72	$9.65	$9.25	$9.21	$0.00	$70.83
	6/1/2026	$44.16	$9.65	$9.25	$9.21	$0.00	$72.27
	12/1/2026	$45.60	$9.65	$9.25	$9.21	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWER SHOVEL/DERRICK/TRENCHING MACHINE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (CONCRETE) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (DEWATERING, OTHER) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$37.52	$15.55	$13.25	$3.25	$0.00	$69.57
	12/1/2025	$38.47	$15.55	$13.25	$3.25	$0.00	$70.52
	6/1/2026	$39.33	$15.55	$13.25	$3.25	$0.00	$71.38
	12/1/2026	$40.28	$15.55	$13.25	$3.25	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
READY-MIX CONCRETE DRIVER TEAMSTERS 42 - J.G. MacLeallan (Wakefield) TEAMSTERS 42 - J.G. MacLeallan (Wakefield)	5/1/2025	$30.00	$12.00	$7.00	$0.00	$0.00	$49.00
	5/1/2026	$30.50	$12.00	$7.00	$0.00	$0.00	$49.50
RECLAIMERS OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
RIDE-ON MOTORIZED BUGGY OPERATOR LABORERS LABORERS - ZONE 2	6/1/2025	$40.59	$9.90	$9.25	$9.11	$0.00	$68.85
	12/1/2025	$41.97	$9.90	$9.25	$9.11	$0.00	$70.23
	6/1/2026	$43.41	$9.90	$9.25	$9.11	$0.00	$71.67
	12/1/2026	$44.85	$9.90	$9.25	$9.11	$0.00	$73.11
	6/1/2027	$46.30	$9.90	$9.25	$9.11	$0.00	$74.56
	12/1/2027	$47.75	$9.90	$9.25	$9.11	$0.00	$76.01
	6/1/2028	$49.25	$9.90	$9.25	$9.11	$0.00	$77.51
	12/1/2028	$50.75	$9.90	$9.25	$9.11	$0.00	$79.01

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"							
ROLLER/SPREADER/MULCHING MACHINE	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)	8/1/2025	$53.53	$13.28	$12.67	$9.03	$0.00	$88.51
ROOFERS LOCAL 33	2/1/2026	$54.78	$13.28	$12.67	$9.03	$0.00	$89.76
ROOFERS LOCAL 33							

Apprentice: ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$26.77	$13.28	$6.52	$9.03	$0.00	$55.60
2	60.00	$32.12	$13.28	$12.67	$9.03	$0.00	$67.10
3	65.00	$34.79	$13.28	$12.67	$9.03	$0.00	$69.77
4	75.00	$40.15	$13.28	$12.67	$9.03	$0.00	$75.13
5	85.00	$45.50	$13.28	$12.67	$9.03	$0.00	$80.48

Apprentice: ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.39	$13.28	$6.52	$9.03	$0.00	$56.22
2	60.00	$32.87	$13.28	$12.67	$9.03	$0.00	$67.85
3	65.00	$35.61	$13.28	$12.67	$9.03	$0.00	$70.59
4	75.00	$41.09	$13.28	$12.67	$9.03	$0.00	$76.07
5	85.00	$46.56	$13.28	$12.67	$9.03	$0.00	$81.54

ROOFER SLATE / TILE / PRECAST CONCRETE	8/1/2025	$53.78	$13.28	$12.67	$9.03	$0.00	$88.76
ROOFERS LOCAL 33	2/1/2026	$55.03	$13.28	$12.67	$9.03	$0.00	$90.01
ROOFERS LOCAL 33							
For apprentice rates see "Apprentice- ROOFER"							
SHEETMETAL WORKER	8/1/2025	$60.98	$14.91	$18.74	$9.53	$2.98	$107.14
SHEETMETAL WORKERS LOCAL 17	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
SHEETMETAL WORKERS LOCAL 17 - A							

Apprentice: SHEETMETAL WORKER

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	42.00	$25.61	$14.91	$6.13	$0.00	$0.00	$46.65
2	42.00	$25.61	$14.91	$6.13	$0.00	$0.00	$46.65

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: SHEETMETAL WORKER

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
3	47.00	$28.66	$14.91	$11.01	$1.25	$1.62	$57.45
4	47.00	$28.66	$14.91	$11.01	$1.25	$1.62	$57.45
5	52.00	$31.71	$14.91	$11.74	$1.50	$1.74	$61.60
6	52.00	$31.71	$14.91	$11.74	$1.75	$1.75	$61.86
7	60.00	$36.59	$14.91	$12.90	$2.00	$1.93	$68.33
8	65.00	$39.64	$14.91	$13.63	$2.25	$2.04	$72.47
9	75.00	$45.74	$14.91	$15.09	$2.75	$2.28	$80.77
10	85.00	$51.83	$14.91	$16.55	$2.75	$2.49	$88.53

Apprentice: SHEETMETAL WORKER

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	42.00	$26.43	$14.91	$6.19	$0.00	$0.00	$47.53
2	42.00	$26.43	$14.91	$6.19	$0.00	$0.00	$47.53
3	47.00	$29.58	$14.91	$10.93	$1.25	$1.62	$58.29
4	47.00	$29.58	$14.91	$10.93	$1.25	$1.62	$58.29
5	52.00	$32.72	$14.91	$11.66	$1.50	$1.74	$62.53
6	52.00	$32.72	$14.91	$11.66	$1.75	$1.75	$62.79
7	60.00	$37.76	$14.91	$12.84	$2.00	$1.93	$69.44
8	65.00	$40.90	$14.91	$13.58	$2.25	$2.04	$73.68
9	75.00	$47.20	$14.91	$15.06	$2.75	$2.28	$82.20
10	85.00	$53.49	$14.91	$16.53	$2.75	$2.49	$90.17

SPECIALIZED EARTH MOVING EQUIP < 35 TONS TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$41.24	$15.57	$20.17	$0.00	$0.00	$76.98
	12/1/2025	$41.24	$15.57	$21.78	$0.00	$0.00	$78.59
	1/1/2026	$41.24	$16.17	$21.78	$0.00	$0.00	$79.19
	6/1/2026	$42.24	$16.17	$21.78	$0.00	$0.00	$80.19
	12/1/2026	$42.24	$16.17	$23.52	$0.00	$0.00	$81.93
	1/1/2027	$42.24	$16.77	$23.52	$0.00	$0.00	$82.53
SPECIALIZED EARTH MOVING EQUIP > 35 TONS TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2025	$41.53	$15.57	$20.17	$0.00	$0.00	$77.27
	12/1/2025	$41.53	$15.57	$21.78	$0.00	$0.00	$78.88
	1/1/2026	$41.53	$16.17	$21.78	$0.00	$0.00	$79.48
	6/1/2026	$42.53	$16.17	$21.78	$0.00	$0.00	$80.48
	12/1/2026	$42.53	$16.17	$23.52	$0.00	$0.00	$82.22
	1/1/2027	$42.53	$16.77	$23.52	$0.00	$0.00	$82.82
SPRINKLER FITTER SPRINKLER FITTERS LOCAL 550 SPRINKLER FITTERS LOCAL 550 - (Section B) Zone 2	3/1/2025	$64.93	$11.51	$7.30	$16.50	$0.00	$100.24

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: SPRINKLER FITTER							
Effective Date: 3/1/2025							
Step / Percent		**Apprentice Base Wage**					
1 / 35.00		$22.73	$11.51	$13.07	$0.00	$0.00	$47.31
2 / 40.00		$25.97	$11.51	$13.90	$0.00	$0.00	$51.38
3 / 45.00		$29.22	$11.51	$14.72	$0.00	$0.00	$55.45
4 / 50.00		$32.47	$11.51	$15.55	$0.00	$0.00	$59.53
5 / 55.00		$35.71	$11.51	$16.38	$0.00	$0.00	$63.60
6 / 60.00		$38.96	$11.51	$17.20	$0.00	$0.00	$67.67
7 / 65.00		$42.20	$11.51	$18.03	$0.00	$0.00	$71.74
8 / 70.00		$45.45	$11.51	$18.85	$0.00	$0.00	$75.81
9 / 75.00		$48.70	$11.51	$19.68	$0.00	$0.00	$79.89
10 / 80.00		$51.94	$11.51	$20.50	$0.00	$0.00	$83.95
STEAM BOILER OPERATOR	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TELECOMMUNICATION TECHNICIAN	3/1/2025	$51.41	$13.00	$13.92	$6.98	$0.00	$85.31
ELECTRICIANS LOCAL 103	9/1/2025	$52.94	$13.00	$13.97	$6.98	$0.00	$86.89
ELECTRICIANS LOCAL 103	3/1/2026	$53.90	$13.00	$14.00	$6.98	$0.00	$87.88
	9/1/2026	$55.42	$13.00	$14.04	$6.98	$0.00	$89.44
	3/1/2027	$56.38	$13.00	$14.07	$6.98	$0.00	$90.43
	9/1/2027	$57.91	$13.00	$14.12	$6.98	$0.00	$92.01
	3/1/2028	$58.87	$13.00	$14.15	$6.98	$0.00	$93.00
Apprentice: TELECOMMUNICATION TECHNICIAN							
Effective Date: 3/1/2025							
Step / Percent		**Apprentice Base Wage**					
1 / 45.00		$23.13	$13.00	$0.69	$0.00	$0.00	$36.82
2 / 45.00		$23.13	$13.00	$0.69	$0.00	$0.00	$36.82
3 / 50.00		$25.71	$13.00	$13.15	$3.49	$0.00	$55.35
4 / 50.00		$25.71	$13.00	$13.15	$3.49	$0.00	$55.35
5 / 55.00		$28.28	$13.00	$13.23	$3.84	$0.00	$58.35
6 / 60.00		$30.85	$13.00	$13.31	$4.19	$0.00	$61.35
7 / 65.00		$33.42	$13.00	$13.38	$4.54	$0.00	$64.34

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: TELECOMMUNICATION TECHNICIAN

Effective Date: 3/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
8	70.00	$35.99	$13.00	$13.46	$4.89	$0.00	$67.34
9	75.00	$38.56	$13.00	$13.54	$5.24	$0.00	$70.34
10	80.00	$41.13	$13.00	$13.61	$5.58	$0.00	$73.32

Apprentice: TELECOMMUNICATION TECHNICIAN

Effective Date: 9/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$23.82	$13.00	$0.71	$0.00	$0.00	$37.53
2	45.00	$23.82	$13.00	$0.71	$0.00	$0.00	$37.53
3	50.00	$26.47	$13.00	$13.17	$3.49	$0.00	$56.13
4	50.00	$26.47	$13.00	$13.17	$3.49	$0.00	$56.13
5	55.00	$29.12	$13.00	$13.25	$3.84	$0.00	$59.21
6	60.00	$31.76	$13.00	$13.33	$4.19	$0.00	$62.28
7	65.00	$34.41	$13.00	$13.41	$4.54	$0.00	$65.36
8	70.00	$37.06	$13.00	$13.49	$4.89	$0.00	$68.44
9	75.00	$39.71	$13.00	$13.57	$5.24	$0.00	$71.52
10	80.00	$42.35	$13.00	$13.65	$5.58	$0.00	$74.58

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
TERRAZZO FINISHERS	8/1/2025	$66.89	$11.49	$15.57	$8.02	$0.00	$101.97
BRICKLAYERS LOCAL 3	2/1/2026	$68.24	$11.49	$15.57	$8.02	$0.00	$103.32
BRICKLAYERS LOCAL 3 - MARBLE & TILE	8/1/2026	$70.44	$11.49	$15.57	$8.02	$0.00	$105.52
	2/1/2027	$71.84	$11.49	$15.57	$8.02	$0.00	$106.92

Apprentice: TERRAZZO FINISHERS

Effective Date: 8/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$33.45	$11.49	$15.57	$8.02	$0.00	$68.53
2	60.00	$40.13	$11.49	$15.57	$8.02	$0.00	$75.21
3	70.00	$46.82	$11.49	$15.57	$8.02	$0.00	$81.90
4	80.00	$53.51	$11.49	$15.57	$8.02	$0.00	$88.59
5	90.00	$60.20	$11.49	$15.57	$8.02	$0.00	$95.28

Apprentice: TERRAZZO FINISHERS

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$34.12	$11.49	$15.57	$8.02	$0.00	$69.20
2	60.00	$40.94	$11.49	$15.57	$8.02	$0.00	$76.02

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: TERRAZZO FINISHERS							
Effective Date: 2/1/2026							
Step / Percent		**Apprentice Base Wage**					
3 / 70.00		$47.77	$11.49	$15.57	$8.02	$0.00	$82.85
4 / 80.00		$54.59	$11.49	$15.57	$8.02	$0.00	$89.67
5 / 90.00		$61.42	$11.49	$15.57	$8.02	$0.00	$96.50
TEST BORING DRILLER	6/1/2025	$51.70	$9.90	$9.25	$9.80	$0.00	$80.65
LABORERS	12/1/2025	$53.20	$9.90	$9.25	$9.80	$0.00	$82.15
LABORERS - FOUNDATION AND MARINE	6/1/2026	$54.75	$9.90	$9.25	$9.80	$0.00	$83.70
	12/1/2026	$56.25	$9.90	$9.25	$9.80	$0.00	$85.20
For apprentice rates see "Apprentice- LABORER"							
TEST BORING DRILLER HELPER	6/1/2025	$47.82	$9.90	$9.25	$9.80	$0.00	$76.77
LABORERS	12/1/2025	$49.32	$9.90	$9.25	$9.80	$0.00	$78.27
LABORERS - FOUNDATION AND MARINE	6/1/2026	$50.87	$9.90	$9.25	$9.80	$0.00	$79.82
	12/1/2026	$52.37	$9.90	$9.25	$9.80	$0.00	$81.32
For apprentice rates see "Apprentice- LABORER"							
TEST BORING LABORER	6/1/2025	$47.70	$9.90	$9.25	$9.80	$0.00	$76.65
LABORERS	12/1/2025	$49.20	$9.90	$9.25	$9.80	$0.00	$78.15
LABORERS - FOUNDATION AND MARINE	6/1/2026	$50.75	$9.90	$9.25	$9.80	$0.00	$79.70
	12/1/2026	$52.25	$9.90	$9.25	$9.80	$0.00	$81.20
For apprentice rates see "Apprentice- LABORER"							
TRACTORS/PORTABLE STEAM GENERATORS	6/1/2025	$57.68	$15.55	$13.25	$3.25	$0.00	$89.73
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.12	$15.55	$13.25	$3.25	$0.00	$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	$60.40	$15.55	$13.25	$3.25	$0.00	$92.45
	12/1/2026	$61.84	$15.55	$13.25	$3.25	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TRAILERS FOR EARTH MOVING EQUIPMENT	6/1/2025	$41.82	$15.57	$20.17	$0.00	$0.00	$77.56
TEAMSTERS JOINT COUNCIL NO. 10	12/1/2025	$41.82	$15.57	$21.78	$0.00	$0.00	$79.17
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	1/1/2026	$41.82	$16.17	$21.78	$0.00	$0.00	$79.77
	6/1/2026	$42.82	$16.17	$21.78	$0.00	$0.00	$80.77
	12/1/2026	$42.82	$16.17	$23.52	$0.00	$0.00	$82.51
	1/1/2027	$42.82	$16.77	$23.52	$0.00	$0.00	$83.11
TUNNEL WORK - COMPRESSED AIR	6/1/2025	$59.93	$9.90	$9.25	$10.25	$0.00	$89.33
LABORERS	12/1/2025	$61.43	$9.90	$9.25	$10.25	$0.00	$90.83
LABORERS (COMPRESSED AIR)	6/1/2026	$62.98	$9.90	$9.25	$10.25	$0.00	$92.38
	12/1/2026	$64.48	$9.90	$9.25	$10.25	$0.00	$93.88
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE)	6/1/2025	$61.93	$9.90	$9.25	$10.25	$0.00	$91.33
LABORERS	12/1/2025	$63.43	$9.90	$9.25	$10.25	$0.00	$92.83
LABORERS (COMPRESSED AIR)	6/1/2026	$64.98	$9.90	$9.25	$10.25	$0.00	$94.38
	12/1/2026	$66.48	$9.90	$9.25	$10.25	$0.00	$95.88

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR	6/1/2025	$52.00	$9.90	$9.25	$10.25	$0.00	$81.40
LABORERS	12/1/2025	$53.50	$9.90	$9.25	$10.25	$0.00	$82.90
LABORERS (FREE AIR TUNNEL)	6/1/2026	$55.05	$9.90	$9.25	$10.25	$0.00	$84.45
	12/1/2026	$56.55	$9.90	$9.25	$10.25	$0.00	$85.95
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR (HAZ. WASTE)	6/1/2025	$54.00	$9.90	$9.25	$10.25	$0.00	$83.40
LABORERS	12/1/2025	$55.50	$9.90	$9.25	$10.25	$0.00	$84.90
LABORERS (FREE AIR TUNNEL)	6/1/2026	$57.05	$9.90	$9.25	$10.25	$0.00	$86.45
	12/1/2026	$58.55	$9.90	$9.25	$10.25	$0.00	$87.95
For apprentice rates see "Apprentice- LABORER"							
VAC-HAUL	6/1/2025	$41.24	$15.57	$20.17	$0.00	$0.00	$76.98
TEAMSTERS JOINT COUNCIL NO. 10	12/1/2025	$41.24	$15.57	$21.78	$0.00	$0.00	$78.59
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	1/1/2026	$41.24	$16.17	$21.78	$0.00	$0.00	$79.19
	6/1/2026	$42.24	$16.17	$21.78	$0.00	$0.00	$80.19
	12/1/2026	$42.24	$16.17	$23.52	$0.00	$0.00	$81.93
	1/1/2027	$42.24	$16.77	$23.52	$0.00	$0.00	$82.53
WAGON DRILL OPERATOR	6/1/2025	$42.00	$9.65	$9.00	$8.70	$0.00	$69.35
LABORERS	12/1/2025	$43.38	$9.65	$9.00	$8.70	$0.00	$70.73
LABORERS - ZONE 2	6/1/2026	$44.82	$9.65	$9.00	$8.70	$0.00	$72.17
	12/1/2026	$46.26	$9.65	$9.00	$8.70	$0.00	$73.61
	6/1/2027	$47.71	$9.65	$9.00	$8.70	$0.00	$75.06
	12/1/2027	$49.16	$9.65	$9.00	$8.70	$0.00	$76.51
	6/1/2028	$50.66	$9.65	$9.00	$8.70	$0.00	$78.01
	12/1/2028	$52.16	$9.65	$9.00	$8.70	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"							
WAGON DRILL OPERATOR (HEAVY & HIGHWAY)	6/1/2025	$40.59	$9.90	$9.25	$9.21	$0.00	$68.95
LABORERS	12/1/2025	$41.97	$9.90	$9.25	$9.21	$0.00	$70.33
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2026	$43.41	$9.90	$9.25	$9.21	$0.00	$71.77
	12/1/2026	$44.85	$9.90	$9.25	$9.21	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
WASTE WATER PUMP OPERATOR	6/1/2025	$58.33	$15.55	$13.25	$3.25	$0.00	$90.38
OPERATING ENGINEERS LOCAL 4	12/1/2025	$59.78	$15.55	$13.25	$3.25	$0.00	$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	$61.08	$15.55	$13.25	$3.25	$0.00	$93.13
	12/1/2026	$62.53	$15.55	$13.25	$3.25	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
WATER METER INSTALLER	3/2/2025	$69.84	$14.32	$12.31	$8.00	$0.00	$104.47
PLUMBERS & GASFITTERS LOCAL 12							
PLUMBERS & GASFITTERS LOCAL 12 (Local 138)							
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"							

Outside Electrical

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
CABLE TECHNICIAN (Power Zone) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$29.67	$9.25	$0.89	$1.00	$0.00	$40.81
CABLEMAN (Underground Ducts & Cables) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$42.03	$9.25	$1.26	$9.01	$0.00	$61.55
DRIVER / GROUNDMAN CDL OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$34.62	$9.25	$1.04	$9.03	$0.00	$53.94
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$27.20	$9.25	$0.82	$1.00	$0.00	$38.27
EQUIPMENT OPERATOR (Class A CDL) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$42.03	$9.25	$1.26	$13.09	$0.00	$65.63
EQUIPMENT OPERATOR (Class B CDL) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$37.09	$9.25	$1.11	$9.76	$0.00	$57.21
GROUNDMAN OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$27.20	$9.25	$0.82	$1.00	$0.00	$38.27
GROUNDMAN -Inexperienced (<2000 Hrs.) OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 For apprentice rates see "Apprentice- LINEMAN"	8/30/2020	$22.25	$9.25	$0.82	$1.00	$0.00	$33.32
JOURNEYMAN LINEMAN OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/30/2020	$49.45	$9.25	$1.48	$16.00	$0.00	$76.18

Apprentice: JOURNEYMAN LINEMAN

Effective Date: 8/30/2020

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$29.67	$9.25	$0.89	$2.50	$0.00	$42.31
2	65.00	$32.14	$9.25	$0.96	$2.50	$0.00	$44.85
3	70.00	$34.62	$9.25	$1.04	$2.50	$0.00	$47.41
4	75.00	$37.09	$9.25	$1.11	$4.00	$0.00	$51.45

Outside Electrical

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: JOURNEYMAN LINEMAN							
Effective Date: 8/30/2020							
Step / Percent		**Apprentice Base Wage**					
5 / 80.00		$39.56	$9.25	$1.19	$4.00	$0.00	$54.00
6 / 85.00		$42.03	$9.25	$1.26	$4.00	$0.00	$56.54
7 / 90.00		$44.51	$9.25	$1.34	$6.00	$0.00	$61.10
TELEDATA CABLE SPLICER OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$30.73	$4.70	$0.92	$2.25	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$28.93	$4.70	$0.89	$2.25	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$28.93	$4.70	$0.89	$2.25	$0.00	$36.77

Additional Apprentice Information

All apprentices must be registered with the Division of Apprenticeship Training(DAS) in accordance with M.G.L.c. 23, §§ 11E-11L. Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the hourly prevailing wage rate established by the Commissioner under the provisions of M.G.L.c. 149, §§ 26-27D.

Apprentice ratios are established by DAS pursuant to M.G.L.c. 23, §§ 11E-11L. Ratios are expressed as the allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified. The ratios listed herein have been taken from relevant private collective bargaining agreements(CBAs) and are provided for illustrative purposes only. They have not been independently verified as being accurate or continuing to be accurate.

Parties having questions regarding what ratio to use should contact DAS.

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT 00870

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)
Revised April 9, 2019

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted:

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority.

   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   d. "Minority" includes:

      (i) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $ 10,000 the provisions of the specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

   b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

   c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

   d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

   e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

   f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

   g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

   h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables of affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11 The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as many be required by the Government and keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

APPENDIX A

The following goals and timetables for female utilization shall be included in all Federal and federally assisted construction contracts and subcontracts in excess of $ 10,000. The goals are applicable to the Contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a Federal or federally-assisted construction contract or subcontract.

Area covered: Goal for Women apply nationwide

Goals and Timetables

Timetable	Goals (percent)
From Apr. 1, 1980 until further notice	6.9

APPENDIX B-80

Until further notice, the following goals for minority utilization in each construction craft and trade shall included in all Federal or federally assisted construction contracts and subcontracts in excess of $ 10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total on- site construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or nonfederally related project, contract or subcontract.

Construction contractors participating in an approved Hometown Plan (see 41 CFR 6-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix B-80.

Economic Areas

STATE:	Goals (percent)
MASSACHUSETTS	
004 Boston MA: SMSA Counties: 1123 Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH	4.0
MA Essex, MA Middlesex, MA Norfolk, MA Plymouth, MA Suffolk, NH Rockingham.	
5403 Fall River- New Bedford MA, Bristol	1.6
9243 Worcester-Fitchburg-Leominster, MA	1.6
6323 Springfield-Chicopee-Holyoke MA-CT MA Hampden, MA Hampshire	4.8
Non-SMSA Counties: MA Barnstable, MA Dukes, MA Nantucket	3.6
Non-SMSA Counties: MA Franklin	5.9

APPENDIX C

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. **Solicitations for Subcontractors, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to nondiscrimination on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto, and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Massachusetts Department of Transportation (MassDOT) or FHWA to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor will so certify to MassDOT or FHWA, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Nondiscrimination provisions of this contract, MassDOT will impose such contract sanctions as it or FHWA may determine to be appropriate, including, but not limited to:

    a. withholding payments to the contractor under the contract until the contractor complies; and/or
    b. cancelling, terminating, or suspending a control, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as MassDOT or FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request MassDOT to enter into any litigation to protect the interests of MassDOT. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

APPENDIX D

During the performance of this contact, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor," which includes consultants) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

PERTINENT NON-DISCRIMINATION AUTHORITIES:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21

- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-Aid programs and projects)

- Federal-Aid Highway Act of 1973 (23 U.S.C. § 324 *et seq.*) (prohibits discrimination on the basis of sex)

- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability) and 49 CFR Part 27

- The Age Discrimination Act of 1975, as amended (42 U.S.C. § 6101 *et seq.*) (prohibits discrimination on the basis of age)

- Airport and Airway Improvement Act of 1982 (49 U.S.C. § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex)

- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage, and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975, and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of Federal-Aid recipients, sub-recipients, and contractors, whether such programs or activities are Federally funded or not)

- Titles II and III of the Americans with Disabilities Act (42 U.S.C. §§ 12131-12189), as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38 (prohibits discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities)

- The Federal Aviation Administration's Non-Discrimination Statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex)

- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations)

- Executive Order 13166, Improving Access to Services for People with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100)

- Title IX of the Education Amendments Act of 1972, as amended (20 U.S.C. 1681 *et seq.*) (prohibits discrimination on the basis of sex in education programs or activities)

*** END OF DOCUMENT ***

DOCUMENT 00880

Revised January 12, 2022

DEPARTMENT OF LABOR

Employment Standards Administration

MINIMUM WAGES FOR FEDERAL AND FEDERALLY ASSISTED CONTRACTS

THIS PAGE INTENTIONALLY LEFT BLANK

"General Decision Number: MA20250018 07/18/2025

Superseded General Decision Number: MA20240018

State: Massachusetts

Construction Type: Highway

County: Essex County in Massachusetts.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally
required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658.
Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours

	spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	03/14/2025
2	03/21/2025
3	07/11/2025
4	07/18/2025

CARP0339-004 03/01/2025

	Rates	Fringes
CARPENTER (Includes Form Work)	$ 49.10	31.20

ELEC0103-007 03/01/2025

	Rates	Fringes
ELECTRICIAN	$ 64.26	36.99

ENGI0004-025 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
Group 1	$ 57.83	33.70
Group 2	$ 57.18	33.70

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Labor Day, Memorial Day, Independence Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

POWER EQUIPMENT OPERATORS CLASSIFICATIONS
Group 1: Backhoe/Excavator/Trackhoe; Bobcat/Skid Steer/Skid Loader; Broom/Sweeper; Gradall; Loader; Paver (Asphalt, Aggregate, and Concrete); Post Driver (Guardrail/Fences)
Group 2: Bulldozer; Grader/Blade; Milling Machine; Roller

---

* IRON0007-026 03/16/2025

	Rates	Fringes
IRONWORKER (ORNAMENTAL AND STRUCTURAL)	$ 56.79	37.10

LABO0022-016 12/01/2024

	Rates	Fringes
LABORER		
Asphalt, Includes Raker, Shoveler, Spreader, and Distributor	$ 38.95	29.70
Common or General	$ 38.95	29.70
Landscape	$ 38.95	29.70

LABO0039-001 06/01/2021

	Rates	Fringes
LABORER (Guardrail Installation)	$ 35.00	25.94

PAIN0035-023 07/01/2024

	Rates	Fringes
PAINTER (Steel)	$ 56.76	36.00

SUMA2014-008 01/11/2017

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 56.70	21.08
IRONWORKER, REINFORCING	$ 49.94	22.45
LABORER: Concrete Saw (Hand Held/Walk Behind)	$ 41.78	18.37
OPERATOR: Crane	$ 52.14	21.08

OPERATOR: Forklift	$ 64.67	0.00
OPERATOR: Mechanic	$ 48.14	17.02
OPERATOR: Piledriver	$ 44.46	16.94
PAINTER: Spray (Linestriping)	$ 41.14	15.50
PILEDRIVERMAN	$ 45.65	23.33
TRAFFIC CONTROL: Flagger	$ 23.00	20.44
TRAFFIC CONTROL: Laborer-Cones/ Barricades/Barrels - Setter/Mover/Sweeper	$ 44.49	12.41
TRUCK DRIVER: Concrete Truck	$ 33.69	15.79
TRUCK DRIVER: Dump Truck	$ 38.92	9.73
TRUCK DRIVER: Flatbed Truck	$ 48.53	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including

preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers.
0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio.
The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the

collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME

refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be

directed to the WHD Branch of Construction Wage Determinations.
Requests can be submitted via email to BCWD-Office@dol.gov or
by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested
party (those affected by the action) that disagrees with the
decision can request review and reconsideration from the Wage
and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).
Requests for review and reconsideration can be submitted via
email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the
interested party's position and any information (wage payment
data, project description, area practice material, etc.) that
the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an
interested party may appeal directly to the Administrative
Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

==========
=====

END OF GENERAL DECISION"

"General Decision Number: MA20250008 08/01/2025

Superseded General Decision Number: MA20240008

State: Massachusetts

Construction Types: Heavy (Heavy and Marine)

Counties: Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth and Suffolk Counties in Massachusetts.

HEAVY AND MARINE CONTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally
required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658.
Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is

		higher) for all hours
		spent performing on the
		contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.	

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	03/07/2025
2	03/14/2025
3	03/21/2025
4	07/11/2025
5	07/18/2025
6	08/01/2025

BOIL0029-001 01/01/2025

	Rates	Fringes
BOILERMAKER	$ 50.62	28.82

BRMA0001-011 02/01/2023

FOXBORO CHAPTER

BRISTOL (Attleboro, Berkley, Dighton, Mansfield, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Taunton); NORFOLK, (Bellingham, Canton, Dedham, Foxboro, Franklin, Norfolk, Norwood, Plainville, Sharon, Walpole, Westrwood, Wrentham); and PLYMOUTH (Lakeville)

	Rates	Fringes
Bricklayer/Cement Mason	$ 60.35	34.40

BRMA0001-012 02/01/2023

LOWELL CHAPTER

MIDDLESEX (Acton, Ashby, Ayer, Bedford, Billerica, Boxboro, Carlisle, Chemsford, Dracut, Dunstabale, Ft Devens, Groton, Littleton, Lowell, North Acton, Pepperell, Shirley, South Acton, Tewksbury, Townsend, Tyngsboro, West Acton, Westford,
Wilmington)

	Rates	Fringes
BRICKLAYER	$ 58.21	33.71

BRMA0001-013 08/01/2023

LOWELL CHAPTER
MIDDLESEX (Ashland, Framingham, Holliston, Hopkinton, Hudson,
Maynard, Natick, Sherbvorn, Stow); and NORFOLK (Medfield, Medway, Millis)

	Rates	Fringes
BRICKLAYER	$ 62.40	34.40

BRMA0003-001 08/01/2024

	Rates	Fringes
Marble & Tile Finisher	$ 49.32	35.26
Marble, Tile & Terrazzo Workers	$ 64.52	37.51
TERRAZZO FINISHER	$ 63.44	37.33

BRMA0003-003 08/01/2024

BOSTON CHAPTER
MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Somerville); NORFOLK (Brookline, Milton); and SUFFOLK

	Rates	Fringes
BRICKLAYER	$ 64.50	37.54

BRMA0003-011 08/01/2024

LYNN CHAPTER

ESSEX (Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salisbury, Salem, Saugus, Swampscott, Topsfield, Wakefield, Wenham, West Newbury); and MIDDLESEX (North Reading, Reading, Wakefield)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 64.50	37.54

BRMA0003-012 08/01/2024

	Rates	Fringes
BRICKLAYER WALTHAM CHAPTER - MIDDLESEX (Belmont, Burlington, Concord, Lexington, Lincoln, Stoneham, Sudbury, Waltham, Watertown, Wayland, Weston, Winchester, Woburn).....	$ 64.50	37.54

BRMA0003-014 08/01/2024

QUINCY CHAPTER

PLYMOUTH COUNTY (Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham,
Hull, Kingston, Marshfield, Middleboro, Norwell, Pembroke, Plymouth, Rockland, Scituate, West Bridgewater, Whitman)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 64.50	37.54

BRMA0003-025 08/01/2024

NEW BEDFORD CHAPTER

BARNSTABLE; BRISTOL (Acushnet, Darmouth, Fairhaven, Fall River,
Freetown, New Bedford, Somerset, Swansea, Westport); DUKES;
NANTUCKET; PLYMOUTH (Marion, Mattapoisett, Rochester,
Wareham)

	Rates	Fringes
Bricklayer/Cement Mason.....	$ 64.50	37.54

BRMA0003-033 08/01/2024

NEWTON CHAPTER
MIDDLESEX (Newton); NORFOLK (Dover, Needham, Wellesley)

	Rates	Fringes
Bricklayer, Plasterer.....	$ 64.50	37.54

CARP0056-001 08/01/2024

All of SUFFOLK COUNTY; and those areas of BARNSTABLE, BRISTOL,
ESSEX, MIDDLESEX, NORFOLK, and PLYMOUTH COUNTIES situated
INSIDE Boston Beltway (I-495) and North of Cape Cod Canal. ALL
of DUKES and NANTUCKET COUNTIES

	Rates	Fringes
PILEDRIVERMAN.....	$ 55.79	35.47

CARP0056-002 08/01/2024

The areas of BARNSTABLE, BRISTOL, PLYMOUTH, and NORFOLK
COUNTIES situated OUTSIDE Boston Beltway (I-495) and South of

Cape Cod Canal

	Rates	Fringes
PILEDRIVERMAN	$ 51.97	35.47

CARP0056-003 08/01/2024

Those areas of ESSEX and MIDDLESEX COUNTIES situated OUTSIDE
Boston Beltway (I-495)

	Rates	Fringes
PILEDRIVERMAN	$ 49.19	35.47

CARP0056-004 08/01/2024

	Rates	Fringes
DIVER TENDER	$ 61.70	35.47
DIVER	$ 78.11	35.47

CARP0327-002 03/01/2025

MIDDLESEX (Belmont, Cambridge, Everett, Malden, Medford, Somerville); NORFOLK (Brookline, Dedham, Milton); AND SUFFOLK
COUNTIES

	Rates	Fringes
CARPENTER	$ 59.94	31.30

CARP0339-002 03/01/2025

BRISTOL (Attleborough, North Attleborough); ESSEX; MIDDLESEX
(Except Belmont, Cambridge, Everett, Malden, Medford,

Somerville); AND NORFOLK (Bellingham, Braintree, Canton, Cohassett, Foxboro, Franklin, Medfield, Medway, Millis, Needham, Norfolk, Norwood, Plainville, Quincy, Sharon, Walpole,
Wellesley, Westwood, Weymouth, Wrentham) COUNTIES

	Rates	Fringes
CARPENTER	$ 49.10	31.20

CARP0346-001 03/01/2025

NORFOLK (Braintree, Quincy, Cohasset, Weymouth, etc.) PLYMOUTH
(Duxbury, Hanover, Hull, Hingham, Marshfield, Norwell, Pembroke
Rockland, Scituate)

	Rates	Fringes
CARPENTER	$ 49.10	31.20

CARP0624-002 09/01/2017

DUKES; NANTUCKET

	Rates	Fringes
CARPENTER	$ 46.43	28.35

CARP0624-006 09/01/2017

BARNSTABLE; BRISTOL (Except Attleboro & North Attleboro); NORFOLK (Avon, Holbrook, Randolph, Stoughton); PLYMOUTH (Bridgewater, Kingston, Lakeville, Middleboro, Plymouth, S. Hanover, Whitman)

	Rates	Fringes
CARPENTER	$ 39.28	27.90

CARP1121-001 01/06/2025

SUFFOLK COUNTY

	Rates	Fringes
MILLWRIGHT	$ 50.47	33.50

CARP1121-005 01/06/2025

BARNSTABLE, BRISTOL, DUKES, ESSEX, MIDDLESEX, NANTUCKET, NORFOLK and PLYMOUTH COUNTIES

	Rates	Fringes
MILLWRIGHT	$ 45.03	33.25

ELEC0096-001 09/01/2024

MIDDLESEX (Ashby, Ashland, Ayer, Ft. Devens, Groton, Hopkinton,
Hudson, Marlboro, Pepperell, Shirley, Stow, Townsend)

	Rates	Fringes
ELECTRICIAN	$ 45.99	33.06
Teledata System Installer	$ 35.29	32.98

---

* ELEC0099-001 06/01/2025

BRISTOL (Attleboro, North Attleboro, Seekonk)

	Rates	Fringes
ELECTRICIAN	$ 56.11	44.10%
Teledata System Installer	$ 42.09	10.45%+15.31

ELEC0103-002 03/01/2025

ESSEX (Amesbury, Andover, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport,
North Andover, Rowley, Salisbury, West Newbury); MIDDLESEX (Bedford, Billerica, Boxboro, Burlington, Carlisle, Chelmsford,
Dracut, Dunstable littleton, Lowell, North Reading, Tewksbury,
Tyngsboro, Westford, Wilmington)

	Rates	Fringes
ELECTRICIAN.....	$ 64.26	36.99

ELEC0103-004 03/01/2025

ESSEX (Beverly, Danvers, Essex, Gloucester, Hamilton, Ipswich,
Manchester, Marblehead, Middleton, Peabody, Rockport, Salem,
Topsfield, Wenham)

	Rates	Fringes
ELECTRICIAN.....	$ 64.26	36.99

ELEC0103-005 03/01/2025

ESSEX (Lynn, Lynnfield, Nahant, Saugus, Swampscott); MIDDLESEX
(Acton, Arlington, Belmont, Cambridge, Concord, Everett, Framingham, Holliston, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown,
Wayland, Weston, Winchester, Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro,
Frankloin, Medfield, Medway, Millis, Milton, Needham, Norfolk,
Norwood, Quincy, Sharon, Walpole, Wellesley, Westwood,

Weymouth, Wrentham); PLYMOUTH (Hingham and Hull);SUFFOLK

	Rates	Fringes
ELECTRICIAN	$ 64.26	36.99

ELEC0104-001 09/01/2024

	Rates	Fringes
Line Construction:		
Cableman	$ 58.41	30.19+A
Equipment Operator	$ 49.65	26.72+A
Groundman	$ 32.13	12.70+A
Lineman	$ 58.41	30.19+A

A. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Christmas Day and Columbus Day, provided the employee has been employed 5 working days prior to any one of the listed holidays.

ELEC0223-002 09/01/2024

BARNSTABLE, BRISTOL (Except Attleboro, North Attleboro, Seekonk); DUKES; NANTUCKET; PLYMOUTH (Except Hingham and Hull
Twps); NORFOLK (Avon, Halbrook, Randolph, Sloughton)

	Rates	Fringes
ELECTRICIAN	$ 50.02	31.09%+15.50

ENGI0004-009 06/01/2025

	Rates	Fringes
Power equipment operators:		
Group 1	$ 57.83	33.70
Group 2	$ 57.18	33.70

Group 3	$ 37.02	33.70
Group 4	$ 46.52	33.70
Group 5	$ 25.02	33.70
Group 6	$ 30.85	33.70

HOURLY PREMIUM FOR BOOM LENGTHS (Including Jib):
Over 150 ft. +2.18
Over 185 ft. +3.84
Over 210 ft. +5.39
Over 250 ft. +8.16
Over 295 ft. +11.29
Over 350 ft. +13.14

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. PAID HOLIDAYS: New Year's Day, Washington,s Birthday,
Labor Day, Memorial Day, Independence Day, Patriot's Day,
Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

POWER EQUIPMENT OPERATORS CLASSIFICATIONS [HEAVY CONSTRUCTION]
GROUP 1: Power shovel; crane; truck crane; derrick; pile driver; trenching machine; mechanical hoist pavement breaker; cement concrete paver; dragline; hoisting engine;
three drum machine; pumpcrete machine; loaders; shovel dozer; front end loader; mucking machine; shaft hoist; steam engine; backhoe; gradall; cable way; fork lift; cherry picker; boring machine; rotary drill; post hole hammer; post hole digger; asphalt plant on job site; concrete batching and/or mixing plant on job site; crusher
plant on job site; paving concrete mixer; timber jack
GROUP 2: Sonic or vibratory hammer; grader; scraper; tandem
scraper; bulldozer; tractor; mechanic - maintenance; York rake; mulching machine; paving screed machine;stationary steam boiler; paving concrete finishing machine; grout pump; portable steam boiler; portable steam generator; roller; spreader; asphalt paver; locomotives or machines used in place thereof; tamper (self propelled or tractor-draw); cal tracks; ballast regulator;rail anchor machine; switch tamper; tire truck
GROUP 3: Pumps (1-3 grouped); compressor; welding machines

(1-3 grouped); generator; sighting plant; heaters (power driven, 1- 5); syphon-pulsometer; concrete mixer; valves controlling permanent plant air steam, conveyor, wellpoint system (operating)
GROUP 4: Assitant engineer (fireman)
GROUP 5: Oiler (other than truck cranes and gradalls)
GROUP 6: Oiler (on truck cranes and gradalls)

IRON0007-001 03/16/2025

AREA 1: BRISTOL (Easton); ESSEX (Beverly,Gloucester,Lynn, Lynnfield, Manchester,Marblehead, Nahant, Rockport, Salem, Saugus, Swampscott); MIDDLESEX (Arlington, Bedford, Belmont, Burlington, Cambridge, Carlisle, Concord, Dunstable, Everett, Framingham, Lexington, Lincoln, Malden, Maynard, Medford, Melrose, Natick, Newton, Reading, Sherborn, Somerville, Stoneham, Sudbury, Wakefield, Waltham, Watertown, Wayland, Weston, Winchester, Woburn); NORFOLK (Except Medway); PLYMOUTH (Abington, Bridgewater, Brocton, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Norwell, Pembroke, Plymouth, Plympton, Rockland, Scituate, West Bridgewater, Whitman); SUFFOLK

AREA 2: ESSEX (Amesbury, Andover, Boxford, Danvers, Essex, Georgetown, Hamilton, Haverhill, Ipswich, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, Topsfield, Wenham, West Newbury); MIDDLESEX (Action,Billerica, Chelmsford, Dracut, Groton, Groveland, Littleton, Lowell, Middleton, North Reading, Pepperell, Tewksbury, Tyngsboro, Westford, Wilminton)

	Rates	Fringes
IRONWORKER		
AREA 1.....	$ 56.79	37.10

AREA 2.....$ 52.38 37.10

IRON0007-010 03/16/2025

MIDDLESEX (Ashby, Ashland, Ayer, Boxboro, Holliston, Hopkinton,
Hudson, Marlboro, Shirley, Stow, Townsend); NORFOLK (Medway)

	Rates	Fringes
IRONWORKER	$ 56.79	37.10

IRON0037-002 03/16/2025

BARNSTABLE; BRISTOL (Acushnet, Attleboro, Berkley, Dartmouth,
Dighton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk,
Somerset, Swansea, Taunton, Westport); DUKES; NANTUCKET; NORFOLK (Billingham, Franklin, Plainville, Wrentham); PLYMOUTH
(Lakeville, Marion, Mattapoisett, Middleboro, Rochester, Wareham)

	Rates	Fringes
IRONWORKER	$ 42.58	32.98

LABO0022-006 12/01/2024

SUFFOLK COUNTY (Boston, Chelsea, Revere, Winthrop, Deer & Nut
Islands); MIDDLESEX COUNTY (Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn only); NORFOLK COUNTY (Brookline, Dedham, and Milton only)

	Rates	Fringes
Laborers:		
GROUP 1	$ 46.20	29.70
GROUP 2	$ 46.20	29.70
GROUP 3	$ 46.20	29.70
GROUP 4	$ 46.20	29.70
GROUP 5	$ 27.01	29.70
GROUP 6	$ 46.20	29.70

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drill operator

GROUP 3: Air track operator; block paver; rammer; curb setter

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

---

LABO0022-012 12/01/2024

Counties of BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH; MIDDLESEX (With the exception of Arlington, Belmont, Burlington, Cambridge, Everett, Malden, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Winthrop and Woburn); NORFOLK (With the exception of Brookline, Dedham, and Milton)

	Rates	Fringes

Laborers:

GROUP 1	$ 38.95	29.70
GROUP 2	$ 38.95	29.70
GROUP 3	$ 38.95	29.70
GROUP 4	$ 38.95	29.70
GROUP 5	$ 27.01	29.70
GROUP 6	$ 46.10	29.70

LABORERS CLASSIFICATIONS

GROUP 1: Laborers; carpenter tenders; cement finisher tenders

GROUP 2: Asphalt raker; fence and guard rail erector; laser beam operator; mason tender; pipelayer; pneumatic drill operator; pneumatic tool operator; wagon drillperator

GROUP 3: Air track operator; block paver; rammer; curb setter; hydraulic & similar self powere drills

GROUP 4: Blaster; powderman

GROUP 5: Flagger

GROUP 6: Asbestos Abatement; Toxic and Hazardous Waste Laborers

---

LABO0022-013 12/01/2024

	Rates	Fringes
Laborers:		
(FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR)		
GROUP 1	$ 50.50	29.70
GROUP 2	$ 50.50	29.70
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
TEST BORING & WELL DRILLING		
Driller	$ 50.20	29.70

Laborer	$ 46.20	29.70
(OPEN AIR CASSONS, UNDERPINNING AND TEST BORING INDUSTRIES):		
OPEN AIR CASSON, UNDERPINNING WORK & BORING CREW		
Bottom man	$ 47.35	29.70
Laborers; Top man	$ 46.20	29.70
(TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR)		
GROUP 1	$ 47.95	29.70
GROUP 2	$ 58.43	29.70
GROUP 3	$ 58.43	29.70
GROUP 4	$ 58.43	29.70
GROUP 5	$ 58.43	29.70
GROUP 6	$ 58.43	29.70
CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)		
GROUP 1	$ 50.50	29.70
GROUP 2	$ 50.50	29.70
ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNEL IN FREE AIR		
GROUP 1	$ 47.95	29.70
GROUP 2	$ 50.50	29.70
GROUP 3	$ 50.50	29.70
GROUP 4	$ 50.50	29.70
GROUP 5	$ 52.50	29.70

LABORERS CLASSIFICATIONS for TUNNELS, CAISSON & CYLINDER WORK IN COMPRESSED AIR

GROUP 1: Powder watchman; Top man on iron bolt; change house attendant

GROUP 2: Brakeman; trackman; groutman; tunnel laborer; outside lock tender; lock tender; guage tender

GROUP 3: Motorman, miner

GROUP 4: Blaster

GROUP 5: Mucking machine operator

GROUP 6: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars $2.00 per hour over the basic wage rate.

LABORERS CLASSIFICATIONS for (FREE AIR OPERATION): SHIELD DRIVEN AND LINER PLATE IN FREE AIR

GROUP 1: Miner; miner welder; conveyor operator; motorman; mucking machine operator; nozzle man; grout man-; pumps, shaft and tunnel steel and rodman; shield and erector arm operators, mole nipper, outside motorman, burner, TBM operator, safety miner; laborer topside; heading motormen; erecting operators; top signal men

GROUP 2: Brakeman; trackman

LABORERS CLASSIFICATIONS FOR CLEANING CONCRETE AND CAULKING TUNNEL (Both New & Existing)

GROUP 1: Concrete workers; strippers and form movers (wood & steel), cement finisher

GROUP 2: Form erector (wood & steel and all accessories)

LABORERS CLASSIFICATIONS for ROCK SHAFT, CONCRETE LINING OF SAME AND TUNNE IN FREE AIR

GROUP 1: Change house attendants

GROUP 2: Laborers, topside, bottom men (when heading is 50 ft. from shaft) and all other laborers

GROUP 3: Brakeman; trackman; tunnel laborers; shaft laborers

GROUP 4: Miner; cage tender; bellman

GROUP 5: Hazardous Waste work within the ""HOT"" zone. (A premium of two dollars $2.00 per hour over the basic wage rate)

FOOTNOTE FOR LABORERS:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day

---

LABO1421-001 12/02/2024

WRECKING LABORERS:

	Rates	Fringes
Laborers: (Wrecking)		
Group 1	$ 46.25	29.70
Group 2	$ 47.00	29.70
Group 3	$ 47.25	29.70
Group 4	$ 42.25	29.70
Group 5	$ 45.35	29.70
Group 6	$ 46.25	29.70

Group 1: Adzeman, Wrecking Laborer.
Group 2: Burners, Jackhammers.
Group 3: Small Backhoes, Loaders on tracks, Bobcat Type Loaders, Hydraulic ""Brock"" Type Hammer Operators, Concrete Cutting Saws.
Group 4: Yardman (Salvage Yard Only).
Group 5: Yardman, Burners, Sawyers.
Group 6: Asbestos, Lead Paint, Toxic and Hazardous Waste.

PAIN0035-001 07/01/2024

BARNSTABLE BRISTOL; DUKES; ESSEX; NANTUCKET; PLYMOUTH
(Remainder of NORFOLK; MIDDLESEX AND SUFFOLK COUNTIES)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Bridge	$ 50.36	30.25
Brush, Taper	$ 39.86	30.25
Spray, Sandblast	$ 41.26	30.25
REPAINT:		
Bridge	$ 56.76	36.00
Brush, Taper	$ 37.92	30.25
Spray, Sandblast	$ 39.32	30.25

PAIN0035-015 07/01/2024

MIDDLESEX (Cambridge, Everett, Malden, Medford,
Sommerville)
SUFFOLK COUNTY (Boston, Chelsea) NORFOLK COUNTY (Brookline)

	Rates	Fringes
PAINTER		
NEW CONSTRUCTION:		
Brush, Taper	$ 46.26	36.00
Spay, Sandblast	$ 47.66	36.00
Spray, Sandblast	$ 47.05	30.25
REPAINT:		
Bridge	$ 56.76	36.00
Brush, Taper	$ 44.32	36.00
Spray, Sandblast	$ 45.72	36.00

PLAS0534-001 07/01/2024

ESSEX; MIDDLESEX; NORFOLK AND SUFFOLK COUNTY

	Rates	Fringes

CEMENT MASON/CONCRETE FINISHER...$ 49.19 40.86

PLUM0004-001 03/01/2025

MIDDLESEX (Ashby, Ayer-West of Greenville branch of Boston and
Maine Railroad, Ft. Devens, Groton, Shirley, Townsend)

	Rates	Fringes
Plumbers and Pipefitters.....$	55.00	30.17

PLUM0012-001 03/02/2025

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill,
Ipswich, Lawrence,Manchester, Marblehead, Merrimac, Methuem,
Middleton, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Topsfieild, Wenham, West
Newbury)

	Rates	Fringes
PLUMBER.....$	69.84	36.43

PLUM0012-003 03/02/2025

ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill,
Ipswich, Lawrence, Manchester, Marblehead, Merrimac, Methuen,
Middleton, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Topsfield, Wenham, West Newbury)

	Rates	Fringes
Plumber, Pipefitter, Steamfitter	$ 69.84	36.43

PLUM0012-006 03/02/2025

ESSEX (Lynn, Lynnfield, Nahant, Saugus, and Swampscott); MIDDLESEX (Acton, Arlington, Ashland, Ayer - except W. of Greenville Branch of Boston & Maine RR, Bedford, Belmont, Billerica, Boxboro, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Hudson, Holliston, Hopkinton, Lexington, Lincoln, Littleton, Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick, Newton, North Reading, Pepperell, Reading, Sherborn, Somerville, Stoneham, Stow, Sudbury, Tewksbury, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Westford, Wilmington, Winchester, Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover,Foxboro, Franklin, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Plainville, Quincy, Sharon, Walpole, Wellesley, Westwood, Weymouth, Wrentham); PLYMOUTH (Hingham, Hull, Scituate); SUFFOLK

	Rates	Fringes
PLUMBER	$ 69.84	36.43

PLUM0051-005 08/26/2024

BARNSTABLE; BRISTOL; DUKES; NANTUCKET; NORFOLK (Avon, Holbrook, Randolph, Stoughton) PLYMOUTH(Remainder of County)

	Rates	Fringes

Plumbers and Pipefitters.....$ 52.49 33.60

PLUM0537-001 03/01/2025

MIDDLESEX (Arlington, Cambridge, Everett, Malden, Medford, Melrose, Reading, Wakefield, Winchester and Woburn); NORFOLK (Bellingham, Braintree, Brookline, Canton Cashasset, Dedham, Foxboro, Franklin, Millis, Milton, Sharon, Walpole, Westwood, and Wrenthan); PLYMOUTH (Hingham, Hull, Scituate); ESSEX (Ames, Andover, Beverly, Boxford, Byfield, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence,Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuem, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfieild, Wenham, West Newbury)

	Rates	Fringes
PIPEFITTER	$ 66.58	39.22

TEAM0379-001 06/01/2025

	Rates	Fringes
Truck drivers:		
Group 1	$ 40.78	37.35+a+b
Group 2	$ 40.95	37.35+a+b
Group 3	$ 41.02	37.35+a+b
Group 4	$ 41.14	37.35+a+b
Group 5	$ 41.24	37.35+a+b
Group 6	$ 41.53	37.35+a+b
Group 7	$ 41.82	37.35+a+b

POWER TRUCKS $.25 DIFFERENTIAL BY AXLE
TUNNEL WORK (UNDERGROUND ONLY) $.40 DIFFERENTIAL BY AXLE
HAZARDOUS MATERIALS (IN HOT ZONE ONLY) $2.00 PREMIUM

TRUCK DRIVERS CLASSIFICATIONS

Group 1: Station wagons; panel trucks; and pickup trucks

Group 2: Two axle equipment; & forklift operator

Group 3: Three axle equipment and tireman

Group 4: Four and Five Axle equipment

Group 5: Specialized earth moving equipment under 35 tons other than conventional type trucks; low bed; vachual; mechanics, paving restoration equipment

Group 6: Specialized earth moving equipment over 35 tons

Group 7: Trailers for earth moving equipment (double hookup)

FOOTNOTES:

A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day and Christmas Day

B. PAID VACATION: Employees with 4 months to 1 year of service receive 1/2 day's pay per month; 1 week vacation for 1 - 5 years of service; 2 weeks vacation for 5 - 10 years of service; and 3 weeks vacation for more than 10 years of service

---

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the

type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for

the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio.
The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024
in the example, indicates the date the wage determination was
updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to
reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union
rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by
computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted
average rate includes all rates reported in the survey, it may
include both union and non-union rates. Example: SUFL2022-007
6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that
classification. FL indicates the State of Florida. 2022 is the
year of the survey on which these classifications and rates are
based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date
for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey

is conducted. However, the Wage and Hour Division (WHD) has the
discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and
prevailing wage rates set by a state (or local) government were
adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007
01/03/2024. SA reflects that the rates are state adopted. ME
refers to the State of Maine. 2023 is the year during which the
state completed the survey on which the listed classifications
and rates are based. The next number, 007 in the example, is an
internal number used in producing the wage determination.
The date, 01/03/2024 in the example, reflects the date on which
the classifications and rates under the ?SA? identifier took
effect under state law in the state from which the rates were
adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can
be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on
a wage determination matter
d) an initial conformance (additional classification
and rate) determination

On survey related matters, initial contact, including requests

for summaries of surveys, should be directed to the WHD Branch
of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be
directed to the WHD Branch of Construction Wage Determinations.
Requests can be submitted via email to BCWD-Office@dol.gov or
by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested
party (those affected by the action) that disagrees with the
decision can request review and reconsideration from the Wage
and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).
Requests for review and reconsideration can be submitted via
email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the

interested party's position and any information (wage payment
data, project description, area practice material, etc.) that
the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an
interested party may appeal directly to the Administrative
Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

==========

END OF GENERAL DECISION"

"General Decision Number: MA20250006 02/21/2025

Superseded General Decision Number: MA20240006

State: Massachusetts

Construction Type: Heavy Dredging

Counties: Massachusetts Statewide.
STATEWIDE

Massacusetts All Dredging, except self-propelled hopper dredges, on the Atlantic Coast & tributary waters emptying into
the Atlantic Ocean.

Note: Contracts subject to the Davis-Bacon Act are generally
required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658.
Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage

		determination, if it is
		higher) for all hours
		spent performing on the
		contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.	

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the
Executive Orders and a classification considered necessary for
performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker

protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	02/21/2025

* ENGI0025-001 10/01/2024

STATEWIDE

	Rates	Fringes
Dredging:		
CLASS A1	$ 47.07	15.34+a+b
CLASS A2	$ 41.94	14.99+a+b
CLASS B1	$ 40.71	14.90+a+b
CLASS B2	$ 38.31	14.73+a+b
CLASS C1	$ 37.26	14.66+a+b
CLASS C2	$ 36.07	14.57+a+b
CLASS D	$ 29.96	14.15+a+b

CLASSIFICATIONS:
CLASS A1: Deck Captain; Mechanical Dredge Operator, Leverman, Licensed Tug Operator over 1000 HP.
CLASS A2: Crane Operator (360 swing).
CLASS B1: Derrick Operator (180 swing), Spider/Spill Barge Operator, Engineer, Electrician, Chief Welder, Chief Mate, Fill Placer, Operator II, Maintenance Engineer, Licensed Boat Operator, Licensed Crew Boat Operator.
CLASS B2: Certified Welder.
CLASS C1: Mate, Drag Barge Operator, Assistant Fill Placer, Welder, Steward.
CLASS C2: Boat Operator.
CLASS D: Oiler, Deckhand, Shoreman, Rodman, Scowman, Cook, Messman, Porter/Janitor.

INCENTIVE PAY: (Add to Hourly Rate)
Operator (NCCCO License/Certification) $1.80 Licensed Tug

Operator over 1000 HP (Assigned as Master) (USCG licensed
Master of Towing Vessels (MOTV) $1.80; Licensed Boat Operator (Assigned as lead boat captain) USCG licensed boat operator $1.30; Engineer (QMED and Tankerman endorsement or licensed engineer (USCG) $1.80
Oiler (QMED and Tankerman endorsement (USCG) $1.80; All classifications (Tankerman endorsement only) USCG $1.55; Deckhand or Mate (AB with Lifeboatman endorsement (USCG) $1.80; All classifications (lifeboatman endorsement only (USCG) $1.55; Welder (ABS certification) $1.55

FOOTNOTES APPLICABLE TO ABOVE CRAFTS:
a. PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr.'s
Birthday, Memorial Day, Good Friday, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day
b. VACATION: Eight percent (8%) of the straight time rate,
multiplied by the total hours worked.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this
contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their
own illness, injury or other health-related needs, including

preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers.
0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio.
The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the

collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME

refers to the State of Maine. 2023 is the year during which the
state completed the survey on which the listed classifications
and rates are based. The next number, 007 in the example, is an
internal number used in producing the wage determination.
The date, 01/03/2024 in the example, reflects the date on which
the classifications and rates under the ?SA? identifier took
effect under state law in the state from which the rates were
adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can
be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on
a wage determination matter
d) an initial conformance (additional classification
and rate) determination

On survey related matters, initial contact, including requests
for summaries of surveys, should be directed to the WHD Branch
of Wage Surveys. Requests can be submitted via email to
davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as
conformance decisions, requests for initial decisions should be

directed to the WHD Branch of Construction Wage Determinations.
Requests can be submitted via email to BCWD-Office@dol.gov or
by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested
party (those affected by the action) that disagrees with the
decision can request review and reconsideration from the Wage
and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).
Requests for review and reconsideration can be submitted via
email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the
interested party's position and any information (wage payment
data, project description, area practice material, etc.) that
the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an
interested party may appeal directly to the Administrative
Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

==========
=====

END OF GENERAL DECISION"

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00801

SPECIAL PROVISIONS

PEABODY
Federal Aid Project No. TAP/CMQ-0034(027)X
Independence Greenway Extension

Labor participation goals for this Project shall be 15.3% for minorities and 6.9% for women for each job category. The goals are applicable to both Contractor's and Subcontractor's on-site construction workforce. Refer to Document 00820 for details.

SCOPE OF WORK

All work under this Contract shall be done in conformance with the *2025 Standard Specifications for Highways and Bridges, the Supplemental Specifications* contained in this book, the *Construction Standard Details* in effect as of June, 2025, the *1990 Standard Drawings for Signs and Supports*, the 2015 *Overhead Signal Structure and Foundation Standard Drawings*, the *2009 Manual on Uniform Traffic Control Devices (MUTCD) with Revisions 1, 2, and 3 and the November 2022 Massachusetts Amendments to the MUTCD, the 1968 Standard Drawings for Traffic Signals and Highway Lighting*, the latest edition of The *American Standard for Nursery Stock*, the Plans and these Special Provisions.

The work under this Contract consists of the construction of the Independence Greenway Extension in the City of Peabody. The project is approximately 1.3 miles in length. The work included in this project will consist of clearing and grubbing; paving; installing wood rail fence; installing granite curb, pedestrian curb ramps and sidewalks; installing drainage structures; installing new catch basins; installing 2 precast concrete culverts; furnishing and installing traffic signals, signs and pavement markings; placing loam and seed; planting trees and shrubs; landscape amenities; constructing a timber bridge boardwalk; and other incidental items of work listed in the proposal.

The multi-span timber boardwalk carries the path over Proctor Brook and continues through the wetlands for approximately 440-feet. The boardwalk will be comprised of structural timber framing and railing system, with Black Locust decking and coated or stainless steel hardware. The boardwalk will be supported by steel helical piles, and GRS-IBS Abutments are the beginning and end of the boardwalk.

SUBSECTION 7.05 INSURANCE REQUIREMENTS
B. Public Liability Insurance

The insurance requirements set forth in this subsection are in addition to the requirements of the Standard Specifications and supersede all other requirements.

Paragraphs 1 and 2

The Massachusetts Department of Transportation and applicable railroads shall be named as additional insureds.

Paragraph 4

Asbestos Liability Insurance shall be obtained for this project. The Contractor and the Massachusetts Department of Transportation shall be named as additional insureds.

CONTRACTOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS

Prospective bidders are required to submit all questions to the Construction Contracts Engineer by 3:00 P.M. on the Tuesday of the previous week before the scheduled bid opening date. Any questions received after this time will not be considered for review by the Department.

Contractors should email questions and addendum acknowledgements to the following email address massdotspecifications@dot.state.ma.us The MassDOT proposal number and municipality is to be placed in the subject line.

HOLIDAY WORK RESTRICTIONS
(Supplementing Subsection 7.09)

The District Highway Director (DHD) may authorize work to continue during these specified time periods if it is determined by the District that the work will not negatively impact the traveling public. DHD may allow work in those areas on a case by case basis and where work is behind barrier and will not impact traffic

Below are the holiday work restrictions:

New Years Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

HOLIDAY WORK RESTRICTIONS (Continued)

Martin Luther King's Birthday (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

President's Day (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Evacuation Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

Patriot's Day (State Holiday)
Work restrictions will be in place for Districts 3 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as to not to impact the marathon. All other districts work restrictions will be as per DHD.

Mother's Day
No work on Western Turnpike and Metropolitan Highway System from 5:00 AM on the Friday before, until the normal start of business on the following day.

Memorial Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Bunker Hill Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

Juneteenth
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Independence Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

Labor Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Columbus Day (Federal Holiday)
No work on major arterials from 5:00 AM on the Friday before, until the normal start of business on the following day

HOLIDAY WORK RESTRICTIONS (Continued)

Veterans' Day (Federal Holiday)
No work restrictions due to traffic concerns.

Thanksgiving Day (Federal Holiday)
No work on major arterials from 5:00 AM two days before until the normal start of business on the following Monday.

Christmas Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day.

LANE CLOSURE RESTRICTIONS
(Supplementing Subsection 7.09)

Work requiring lane closures shall be performed between 9:30 a.m. and 3:30 p.m. for daytime work or between 8:00 p.m. and 6:00 a.m. for nighttime work.

PROTECTION AND RESTORATION OF PROPERTY
(Supplementing Subsection 7.13)

If available, existing bridge plans indicate the location of the existing known utilities in the vicinity of the work. As the accuracy and completeness of the plans are not guaranteed in any manner, it is the Contractor's responsibility to make their own investigation to assure that no damage to existing structures, drainage lines, traffic signal conduits, etc., will occur.

NOTICE TO OWNERS OF UTILITIES
(Supplementing Subsection 7.13)

Written notice shall be given by the Contractor to all public service corporations or officials owning or having charge of publicly or privately owned utilities of the Contractor's intention to commence operations affecting such utilities at least one week in advance of the commencement of such operations and the Contractor shall at that time file a copy of such notice with the Engineer.

A list of public and private utilities can be found on the MassDOT website at:
https://www.mass.gov/info-details/utility-contacts-by-district-and-municipality
Select the District, select the City/Town, and then locate the utility. The utility contact list is for guidance only and is not guaranteed to be complete or up to date.

----------ELECTRIC----------

Peabody Municipal Light Plant	Brian Abcunas
201 Warren Street Ext.	Tel: (978) 531-5975
Peabody, MA 01960	Ext: 234

NOTICE TO OWNERS OF UTILITIES (Continued)

----------GAS----------

National Grid Gas
170 Data Drive
Waltham, MA 02451
Melissa Owens
Tel: (781) 907-2845

Tennessee Gas Pipeline Company
8 Anngina Drive
Enfield, CT 02451
David Wood
Tel: (860) 763-6005

Enbridge
8 Wilson Way
Westwood, MA 02090
Kathy M. Aruda
Tel: (508) 938-7728

----------TELEPHONE----------

Verizon
385 Myles Standish Blvd.
Taunton, MA 02780
Karen Mealey
Tel: (774) 409-3160

----------WATER----------

Peabody Public Services
50 Farm Ave.
Peabody, MA 01960
William Paulitz
Tel: (978) 536-7126

MWRA
2 Griffin Way
Chelsea, MA 02150
Ralph Francesconi
Tel: (617) 461-3573

----------SEWER----------

Peabody Public Services
50 Farm Ave.
Peabody, MA 01960
William Paulitz
Tel: (978) 536-7126

South Essex Sewer District
50 Fort Avenue, P.O. Box 989
Salem, MA 01970
Peter Pmmersheim
Tel: (978) 744-4550

NOTICE TO OWNERS OF UTILITIES (Continued)

----------CABLE----------

Comcast Cable Corporation
5 Omni Way P.O. Box 6505
Chelmsford, MA 01824
Wendy Brown
Tel: (978) 848-5163

Crown Castle
80 Central Street
Boxborough, MA 01719
Mark Bonanno
Tel: (508) 616-7818

Astound
956 Massachusetts Avenue
Arlington, MA 02476
Alex Ortiz
Tel: (781) 316-8878

----------FIRE ALARM----------

Peabody Fire Alarm
47 Lowell Street
Peabody, MA 01960
Joseph Dasilva
Tel: (978) 531-3444

----------DPW----------

Peabody City Engineer
50 Farm Ave.
Peabody, MA 01960
William Paulitz
Tel: (978) 536-7126

----------OTHER----------

First Light
359 Corporate Drive
Portsmouth, NH 03801
Keith Mellor

Verizon Wireless Small Cell
20 Alexander Drive
Wallingford, CT 06492
Liz Glidden

Peabody Community Development
24 Lowell St.
Peabody, MA 01960
Curt Bellavance
Tel: (978) 538-5770

NOTICE TO OWNERS OF UTILITIES (Continued)

Peabody Police Department 6 Allens Ln. Peabody, MA 01960	Thomas M. Griffin Tel: (978) 538-6308
MBTA Bus Operations	Joshua Weiland jweiland@mbta.com Tel: (617) 352-4845
MBTA Bus Operations	Miles Taylor mtaylor@mbta.com Tel: (617) 721-9646

SOIL STOCKPILING DIRECTIVE P-22-001

Any stockpiling of soil must be performed in compliance with Policy Directive P-22-001, Off-Site Stockpiling of Soil from MassDOT Construction Projects. This directive limits the allowable locations for off-site stockpiling of soil generated during MassDOT projects and includes various requirements that must be satisfied by the contractor prior to off-site stockpiling. The Contractor is responsible for identifying a suitable stockpile location.

SUBSECTION 8.02 SCHEDULE OF OPERATIONS
Replace this subsection with the following:

An integrated cost and schedule controls program shall be implemented by the Contractor to track and document the progress of the Work from Notice to Proceed (NTP) through the Contractor Field Completion (CFC) Milestone. The Contractor's schedules will be used by the Engineer to monitor project progress, plan the level-of-effort required by the Department's work force and consultants and as a critical decision-making tool. Accordingly, the Contractor shall ensure that it complies fully with the requirements specified herein and that its schedules are both accurate and updated as required by the specification throughout the life of the project. Detailed requirements are provided in Division II, Section 722 Construction Scheduling.

SUBSECTION 8.06 LIMITATIONS OF OPERATIONS

Add/amend the following at the end of the Section:

Access Restraints:

This contract will contain Access Restraint(s) to provide an anticipated start date for certain portions of the Work that are restrained by a Utility Party or by another party. An Access Restraint is a restriction of physical work, of a specific area or operation in the Contract, to allow all bidders to evaluate anticipated work restrictions, equally, during the pre-bid planning stages.

In respect to utilities, the Contract Time (duration) has considered these portions of the utility work and has been developed with the initial information that has been provided by the Utility Party and accepted by MassDOT. The Contractor shall be required to communicate and coordinate with all affected Utilities and may be required to perform support aspects of the utility relocation (as noted in the Contract Documents) well in advance of the start of the applicable utility relocation. As part of this work, the Contactor is to demonstrate proper coordination and notification with the impacted Utility(s), no less than 45 days before the start of the work.

The Contractor must clearly identify all aspects of this work in the preparation of the Construction Schedule and throughout the contract duration. This contract contains the following Access Restraints that are to be included in the Contractor's Baseline Schedule submission:

AR#01 – Access Restraint #01: The Contractor shall complete all utility work between Northshore Road and Endicott Street by May 25th, 2027, to avoid any delays to the project.

AR#02 – Access Restraint #02: The Contractor shall carry out all in-water work at Proctor Brook between June 1st and October 1st.

AR#03 – Access Restraint #03: The Contractor shall perform Native Seeding only during the periods of April 1st to May 15th and October 1st to December 1st for dormant seeding.

AR#04 – Access Restraint #04: The Contractor shall perform planting in the wetland replication area only from May 15th to June 15th and Sepetember 1st to November 1st.

AR#05 – Access Restraint #05: The Contractor shall perform Deciduous plantings only between April 1st and June 15th, and between September 15th and November 15th.

AR#06 – Access Restraint #06: The Contractor shall perform Evergreen plantings in the wetland replication area only between April 15th and June 15th, and between September 1st and October 14th.

TRUCK SAFETY DEVICES
(Supplementing Subsection 7.04: Motor Vehicles)

All motor vehicles subject to Section 7 of Chapter 90 to be operated under this Contract shall be equipped with safety devices as provided therein and in 540 CMR 4.00.

By December 31, 2025, the Contractor shall certify to the Registry of Motor Vehicles, in a manner prescribed by the Registrar, that all applicable vehicles are equipped with Lateral Protective Devices, Convex Mirrors, Cross Over Mirror(s) and Back Up Cameras in accordance with the requirements of 540 CMR 4.00.

The Contractor shall provide evidence satisfactory to the Department to demonstrate compliance with the above certification requirement for all applicable vehicles operated under this Contract by the Contractor and its subcontractors and vendors in a manner set forth by the Department. Thereafter, the Contractor shall have an affirmative obligation to continue to provide such evidence of compliance on an ongoing basis and no later than 7 days after certification with the Registry of Motor Vehicles of any additional vehicles operated under this Contract by the Contractor and its subcontractors and vendors.

Non-compliance with respect to a vehicle that is subject to 540 CMR 4.00 may subject the Contractor to statutory fines as established in M.G.L. c. 90, § 7 and/or contractual remedies up to and including termination of the Contract.

SUBSECTION 8.14 UTILITY COORDINATION, DOCUMENTATION, AND MONITORING RESPONSIBILITIES

A. GENERAL

In accordance with the provisions of Section 8.00 Prosecution and Progress, utility coordination is a critical aspect to this Contract. This section defines the responsibility of the Contractor and MassDOT, with regard to the initial utility relocation plan and changes that occur as the prosecution of the Work progresses. The Engineer, with assistance from the Contractor shall coordinate with Utility companies that are impacted by the Contractor's operations. To support this effort, the Contractor shall provide routine and accurate schedule updates, provide notification of delays, and provide documentation of the steps taken to resolve any conflicts for the temporary and/or permanent relocations of the impacted utilities. The Contractor shall provide copies to the Engineer of the Contractor communication with the Utility companies, including but not limited to:

- Providing advanced notice, for all utility-related meetings initiated by the Contractor.
- Providing meeting minutes for all utility-related meetings that the Contractor attends.
- Providing all test pit records.
- Request for Early Utility work requirements of this section (see below).
- Notification letters for any proposed changes to Utility start dates and/or sequencing.
- Written notification to the Engineer of all apparent utility delays within seven (7) Calendar Days after a recognized delay to actual work in the field – either caused by a Utility or the Contractor.
- Any communication, initiated by the Contractor, associated with additional Right-of-Way needs in support of utility work.
- Submission of completed Utility Completion Forms.

B. PROJECT UTILITY COORDINATION (PUC) FORM

The utility schedule and sequence information provided in the Project Utility Coordination Form (if applicable) is the best available information at the time of the bid and has been considered in setting the contract duration. The Contractor shall use all of this information in developing the bid price and the Baseline Schedule Submission, inclusive of the individual utility durations sequencing requirements, and any work that has been noted as potentially concurrent utility installations.

C. INITIATION OF UTILITY WORK

The Engineer will issue all initial notice-to-proceed dates to each Utility company based on either the:

1) Contractor's accepted Baseline Schedule
2) An approved Early Utility Request in the form of an Early Utility sub-net schedule (in accordance with the requirements of this Subsection)
3) An approved Proposal Schedule

C.1 - BASELINE SCHEDULE – UTILITY BASIS

The Contractor shall provide a Baseline Schedule submission in accordance with the requirements of Subsection 8.02 and inclusive of all of the information provided in the PUC Form that has been issued in the Contract documents. This is to include the utility durations, sequencing of work, allowable concurrent work, and all applicable considerations that have been depicted on the PUC Form.

SUBSECTION 8.14 (Continued)

C.2 – EARLY UTILITY REQUEST – (aka SUBNET SCHEDULE) PRIOR TO THE BASELINE

All early utility work is defined as any anticipated/required utility relocations that need to occur prior to the Baseline Schedule acceptance. In all cases of proposed early utility relocation, the Contractor shall present all known information at the pre-construction conference in the form of a 'sub-net' schedule showing when each early utility activity needs to be issued a notice-to-proceed. The Contractor shall provide advance notification of this intent to request early utility work in writing at or prior to the Pre-Construction meeting. Prior to officially requesting approval for early utility work, the Contractor shall also coordinate with MassDOT and all utility companies (private, state or municipal) which may be impacted by the Contract. If this request is acceptable to the Utilities and to MassDOT, the Engineer will issue a notice-to-proceed to the affected Utilities, based on these accepted dates.

C.3 – PROPOSAL SCHEDULE - CHANGES TO THE PUC FORM

If the Contractor intends to submit a schedule (in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02) that contains durations or sequencing that vary from those provided in the Project Utility Coordination (PUC) Form, the Contactor must submit this as an intended change, in the form of a Proposal Schedule and in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02. These proposed changes are subject to the approval of the Engineer and the impacted utilities, in the form of this Proposal Schedule and a proposed revision to the PUC form. The Contractor shall not proceed with any changes of this type without written authorization from the Engineer, that references the approved Proposal Schedule and PUC form changes. The submission of the Baseline Schedule should not include any of these types of proposed utility changes and should not delay the submission of the Baseline Schedule. As a prerequisite to the Proposal Schedule submission, and in advance of the utility notification(s) period, the Contractor shall coordinate the proposed utility changes with the Engineer and the utility companies, to develop a mutually agreed upon schedule, prior to the start of construction.

D. UTILITY DELAYS

The Contractor shall notify the Engineer upon becoming aware that a Utility owner is not advancing the work in accordance with the approved utility schedule. Such notice shall be provided to the Engineer no later than seven (7) calendar days after the occurrence of the event that the Contractor believes to be a utility delay. After such notice, the Engineer and the Contractor shall continue to diligently seek the Utility Owner's cooperation in performing their scope of Work.

In order to demonstrate that a critical path delay has been caused by a third-party Utility, the Contractor must demonstrate, through the requirements of the monthly Progress Schedule submissions and the supporting contract records associated with Subsection 8.02, 8.10 and 8.14, that the delays were beyond the control of the Contractor.

SUBSECTION 8.14 (Continued)

All documentation provided in this section is subject to the review and verification of the Engineer and, if required, the Utility Owner. In accordance with MassDOT Specifications, Division I, Subsection 8.10, a Time Extension will be granted for a delay caused by a Utility, only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form, and only if;

1) proper Notification of Delay was provided to MassDOT in accordance with the time requirements that are specified in this Section
2) the utility delay is a critical path impact to the Baseline Schedule (or most recently approved Progress Schedule)

E. LOCATION OF UTILITIES

The locations of existing utilities are shown on the Contract drawings as an approximation only. The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the affected area.

F. POST UTILITY SURVEY – NOTIFICATION

Following completion of a utility survey of existing locations, the Contractor will be responsible to notify the Engineer of any known conflicts associated with the actual location of utilities prior to the start of the work. The Engineer and the Contractor will coordinate with any utility whose assets are to be affected by the Work of this Contract. A partial list of utility contact information is provided in the Project Utility Coordination Form.

G. MEETINGS AND COOPERATION WITH UTILITY OWNERS

The Contractor shall notify the Engineer in advance of any meeting they initiate with a Utility Owner's representative to allow MassDOT to participate in the meeting if needed.

Prior to the Pre-Construction Meeting, the Contractor should meet with all Utility Owners who will be required to perform utility relocations within the first 6 months of the project, to update the affected utilities of the Project Utility Coordination Form and all other applicable Contract requirements that impact the Utilities. The Contractor shall copy the Engineer on any correspondence between the Utility Owner and the Contractor.

H. FORCE ACCOUNT / UTILITY MONITORING REQUIREMENTS

The Engineer will be responsible for recording daily Utility work force reports. The start, suspension, re-start, and completion dates of each of the Utilities, within each phase of the utility relocation work, will be monitored and agreed to by the Engineer and the Contractor as the work progresses.

I. ACCESS AND INSPECTION

The Contractor shall be responsible for allowing Utility owners access to their own utilities to perform the relocations and/or inspections. The Contractor shall schedule their work accordingly so as not to delay or prevent each utility from maintaining their relocation schedule.

COMPLIANCE WITH THE NATIONAL DEFENSE AUTHORIZATION ACT

(Supplementing Subsection 7.01)

On all projects, the "Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment" Regulation (2 CFR 200.216) prohibits the Contractor from using or furnishing the following telecommunications equipment or services:

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- Telecommunications or video surveillance services provided by such entities or using such equipment.
- Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

This prohibition applies to all products manufactured by the aforementioned companies, including any individual components or parts.

By submitting a bid on a project, the Contractor certifies that all work will be in compliance with the terms of 2 CFR 200.216. The Contractor shall submit a COC indicating compliance with the above provisions for all telecommunications equipment or services included in the Contract.

Payment for the item in which the materials are incorporated may be withheld until these COCs are received. Any cost involved in furnishing the certificate(s) shall be borne by the Contractor.

BIDDERS LIST

Pursuant to the provisions of 49 CFR Part 26.11 all official bidders will be required to report the names, addresses and telephone numbers of all firms that submitted bids or quotes in connection with this project. Failure to comply with a written request for this information within 15 business days may result in a recommendation to the Prequalification Committee that prequalification status be suspended until the information is received.

The Department will survey all firms that have submitted bids or quotes during the previous year prior to setting the annual goal and shall request that each firm report its age and gross receipts for the year.

BUILD AMERICA BUY AMERICA PREFERENCE

On Federally-aid projects the Buy America (23.CFR § 635.410) and Build America, Buy America Act. requires the following,

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, must occur in the United States. Foreign steel and iron can be used if the cost of the materials does not exceed 0.1% of the total Contract cost or $2,500, whichever is greater. The action of applying a coating to a covered material (i.e., steel and iron) is deemed a manufacturing process subject to Buy America. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of a material subject to requirements of Build America, Buy America. Steel used for temporary support of excavation, including H piles, soldier piles, and sheeting when the steel is required to be left in place is subject to requirements of Build America, Buy America. Temporary steel, shall remain in place when it falls within the influence zone of the soil supporting any structure or railroad tracks.

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States and

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. "Construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of:

- non-ferrous metals,
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables),
- glass (including optic glass),
- lumber; or
- drywall.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

All articles, materials, and supplies should be classified as an iron or steel product, a manufactured product, or another product as specified by law or in 2 CFR part 184 (such other products specified by law or in 2 CFR part 184 include "excluded materials" and "construction materials"); an article, material, or supply must not be considered to fall into multiple categories.

NOTE: The requirements for manufactured products indicated in paragraph (2) above are not in effect for this contract.

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION FILE NUMBER SIGN

This project is subject to Massachusetts General Laws, Chapter 131, Section 40 as amended. Signs shall be in accordance with the latest MassDOT Construction Standards. All costs for the manufacture, erection, maintenance, moving, and removal of the signs shall be absorbed by the contractor with no additional compensation other than the contract unit prices.

For this project the Massachusetts Department of Environmental Protection File Number is 055-0939.

ENVIRONMENTAL PERMITTING

If field conditions and/or Contractor-proposed erection, demolition, storage, or other procedures not originally allowed by existing environmental permits require work to occur in or otherwise impact water or wetland resource areas, the Contractor is advised that no associated work can occur until all required environmental permits have been either amended or obtained allowing such work. The Contractor must notify the District 4 Highway Director and Resident Engineer in writing at least 60 days prior to desired commencement of the proposed activity. All environmental submittals, including any contact with Local, State, or Federal environmental agencies, must be coordinated with the District 4 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that the Department will not entertain a delay claim due to the time required to modify or obtain the environmental permits.

NORTHERN LONG-EARED BAT AND TRICOLORED BAT PROTECTION

The northern long-eared bat (*Myotis septentrionalis*; NLEB) and tricolored bat (*Perimyotis subflavus*; TCB) are listed as federally endangered or proposed endangered, respectfully, under the Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) developed this guidance to address ESA compliance and promote conservation of NLEB and TCB. This project has been consulted with the USFWS through the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and Federal Transit Administration (FTA) Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat revised February 5, 2018 and amended March 31, 2023.

On July 27- August 1, 2022, Stantec, on behalf of MassDOT Highway Division Environmental Services, conducted a northern long-eared bat summer presence/absence survey using acoustic detection methods, in accordance with the 2022 survey guidelines. The survey confirmed the presence of NLEB and/or TCB, and as stated within the survey guidelines, the survey is valid for five years. If additional stressor producing work is proposed by the Contractor past this date, additional review is required by the MassDOT Highway Division's Environmental Services Section, and additional review and restrictions may be required by the USFWS.

NORTHERN LONG-EARED BAT AND TRICOLORED BAT PROTECTION (Continued)

The project is eligible for a May Affect, Not Likely to Adversely Affect (NLAA) determination, with Avoidance and Minimizations Measures (AMMs), in accordance with the FHWA, FRA and FTA Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat. On behalf of FHWA, the lead federal agency for Section 7 consultation, MassDOT submitted a Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bat to the USFWS through the Information for Planning and Consultation (IPaC) webpage and generated a NLAA documentation letter (see **Document A00844**). Therefore, the project has completed Section 7 consultation through the ESA.

In advance of the uplisting of the TCB to endangered under the ESA, the following Avoidance and Minimization Measures (AMMs) must be strictly adhered to in order to protect NLEB and TCB and to be in compliance with the ESA. Contact MassDOT Environmental Services - Wildlife Unit Supervisor for questions about project limits, restrictions, or conservation measures.

General AMM

- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB and TCB, including all applicable AMMs. NLEB and TCB information (https://www.fws.gov/midwest/endangered/mammals/nleb/ and https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus) shall be made available to all personnel.

Lighting AMMs

- Direct temporary lighting away from suitable habitat during the active season: **April 1 to October 31.**

- When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

Tree Removal AMMs

- *If additional cutting is proposed by the Contractor that is outside the scope of this contract, additional review is required by the MassDOT Highway Division's Environmental Services Section, and additional review and restrictions may be required by the USFWS.*

- Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).

- No tree cutting shall be conducted during the active season: **April 1 to October 31.**

NORTHERN LONG-EARED BAT AND TRICOLORED BAT PROTECTION (Continued)

- No tree cutting shall be conducted during the active season: **April 1 to October 31**, or if cutting inside of this timeframe is required, tree removal is limited to 10 or fewer trees per project at any time of year within 100 feet of existing road/rail surface and outside of documented roosting/foraging habitat or travel corridors; and a visual emergence survey must be conducted by *MassDOT Highway Division's Environmental Services Section or appointed representative* with no bats observed.

- Do not remove **documented** or NLEB and/or TCB roosts that are still suitable for roosting, or trees within 0.25 miles of roosts, or **documented** foraging habitat any time of year.

- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB and/or TCB, including the **TOY** restriction. If this restriction needs to be waived at any location(s) the Resident Engineer shall send a locus map of the proposed work to MassDOT Highway Division's Environmental Services Section for review and a determination if the restriction can be waived.

NATIONAL GRID EMERGENCY TELEPHONE NUMBERS

GAS:
Emergency: 1-800-233-5325
New Service: 1- 877-696-4743
Customer Support: 1-800-732-3400

PEABODY MUNICIPAL LIGHT PLANT EMERGENCY TELEPHONE NUMBER

Emergency: 1-978-531-5975

SIMON PROPERTY GROUP (NORTHSHORE MALL) CONTACT

Mall Center Management: 1-978-531-3441

Scott DeCost
603-512-6280
sdecost@simon.com

Richard Kelly, Senior Director, Civil Engineering
317-478-0832
RiKelly@simon.com

MATERIAL OPTIONS

The Contractor shall inform the Engineer of his option prior to the installation of the material. Once the option is designated, all material for the option item(s) shall remain the same throughout the job.

OPTIONS

Item Number	Item Description	Unit
234.12	12 Inch Drainage Pipe-Option	Foot
234.15	15 Inch Drainage Pipe-Option	Foot
234.18	18 Inch Drainage Pipe-Option	Foot
234.36	36 Inch Drainage Pipe-Option	Foot

Pipe Options

Reinforced Concrete Pipe
Corrugated Plastic (Polyethylene) Pipe
Corrugated Plastic (Polypropylene) Pipe

EMERALD ASH BORER ADVISORY

To the extent possible, all trees and brush shall be disposed on site, typically chipped and spread in place. When trees or brush must be removed, such as in urban, or otherwise populated areas, Contractor shall identify proposed location for disposal, and provide written notification to the Engineer for approval. Disposal shall be in city or town of project, or at minimum, within county, of construction operations.

EQUIVALENT SINGLE AXLE LOADS (ESALS)

The estimated traffic level to be used for SUPERPAVE HMA mixture designs for this contract, expressed in Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period, is 3.3 Million 18-kip (80-kn) ESALs.

CONTAMINATED SOIL

Soil to be removed from the project area shall not be assumed to be uncontaminated and must be evaluated prior to off-site management for potential contamination with hazardous materials. No soil may be disposed of off-site without proper assessment by the contractor and approval from the Resident Engineer (RE), District Environmental Engineer (DEE), or the project designee.

2026 FIFA WORLD CUP – BOSTON, MASSACHUSETTS

The 2026 FIFA World Cup will be held at Gillette Stadium in Foxborough and related events will be held throughout the region. Matches and Fan Fest activities are scheduled from June 11, 2026 through July 19, 2026. MassDOT will impose work restrictions as necessary to minimize traffic impacts during FIFA events when the Contractor's operations could impact vehicular traffic, particularly on interstate highways and major arterials throughout the region and local roads near the event site. No additional compensation will be allowed for work restrictions except as determined under Subsection 8.10

VALUE ENGINEERING CHANGE PROPOSAL

This Subsection defines the conditions and requirements which apply to Value Engineering Change Proposals ("VECPs"). The purpose of this provision is to encourage the Contractor to propose changes in certain project requirements that will maintain the project's functional requirements at a savings in contract time, contract price, or both. The net savings obtained by using a VECP that meets the conditions and requirements set forth here will be shared by the Contractor and MassDOT.

VECP's under this provison are to be initiated, developed and submitted to MassDOT by the Contractor. The VECP must show the contemplated changes to the Drawings, Specifications and other requirements in the Contract. When a VECP submitted pursuant to this section is fully accepted by MassDOT, the VECP will be implemented by the Contractor and paid using the current cost and resource loaded schedule. Contractor shall demonstrate that the VECP is equal to, or better than, the original design or material; that there is an interest in public safety within the VECP; that there is a life-cycle cost benefit; and/or that end users will benefit from the shortened schedule. VECPs shall be consistent with the MassHighway/MassDOT Standard Specifications for Highways and Bridges and other applicable reference documents and directives. Any proposed deviation from these documents will need to be clearly identified in the VECP Proposal Documents, and must be approved by MassDOT's Chief Engineer before accepting this VECP.

A. In order to be considered for MassDOT review each VECP shall:

1. Be clearly labeled pursuant to this Subsection;

2. Yield a net savings at least two hundred and fifty thousand (250,000.00) Dollars and/or a net saving of contract completion duration of at least three (3) months;

3. The proposed changes to contract items must:

    a. maintain the specified items' required functions (service life, reliability);

    b. meet applicable safety regulations and codes;

    c. material substitutions must be in accordance with DOT prequalified/preapproved products and must be tested in accordance with standard material specs/testing methods (and considering all relevant environmental, load, and other relevant factors);

    d. show economy of operation, ease of maintenance, ease of construction, and necessary standardized features and appearance; and

4. Shall not require an extension of Contract Time or Contract Milestones, with the exception of cases when there are anticipated significant cost saving.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

The thresholds above are considered to be a general guideline. MassDOT will consider VECPs outside of these thresholds if a significant benefit is demonstrated. Additionally, notwithstanding this VECP process, MassDOT will consider minor revisions in the form of a Contract Modification.

Further, any VECP submitted shall be in sufficient detail to clearly define the proposed change. The Contractor's failure to provide information of the type, detail and in a format to facilitate the MassDOT's review, may be grounds for rejection of the VECP. Additionally, the Contractor will not be entitled to any equitable adjustment or increased Time, due to any aspect of any of the proposed VECP including permitting, right of way, utility coordination or delayed responses by MassDOT. If, after the progression of the work associated with the executed Contract Modification for the VECP, any additional costs are realized by the Contractor or any of the sub-consultants, sub-contractors, or suppliers, the Contractor shall be obligated to pay for any and all costs.

B. The following initial items shall be provided by the Contractor for MassDOT's review. *Items 1-6 need to be submitted prior to the start of MassDOT's review of the VECP and item 7 is an important consideration for the pricing of the VECP and the timeline of the proposed VECP schedule.*

1. ***VECP Description***: A description of the difference between the existing and the proposed Contract requirements, and the comparative advantages and disadvantages of each;

2. ***VECP Change Listing***: A listing of the Contract requirements that will need to be changed, modified, or reviewed as well as the proposed Contract document changes in the Instructions to Bidders, Contract, Standard Specifications, General Requirements and Special Provisions required by the VECP.

3. ***Construction Schedule Update*****:** Any changes in the Contract Time(s) or Contract Milestone(s), that will result from acceptance of the VECP, shall be accompanied by a contemporaneous schedule analysis *(i.e, the Contractor's baseline schedule submission, all past/required monthly schedule updates, a detailed assessment of all past delays, and a resource loaded Crticial Path Method schedule as specified in Section 8.0 / Subsection 8.02 of this Contract)* of the projected Work that remains including the proposed VECP related schedule changes *(inclusive of the timeline to review accept the VECP and the timeline for implementing the design changes)* in the remaining work. This shall be submitted in the form of a Proposal Schedule until the VECP has been formally accepted. Note: All of this information is to be updated, recertified, and formally accepted by MassDOT before final acceptance of this this VECP is issued.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

4. ***Date for MassDOT's Acceptance***: A statement that clearly justifies the date by which the VECP must be accepted to obtain the maximum price reduction, noting any effect upon the Contract Time(s) and/or Contract Milestone(s). This statement must include a narrative that demonstrates the most recent construction schedule has been utilized to justify that proposed acceptance date *(e.g. "in order to start to fabricate critical materials, authorization must be provided to work on the shop drawings by no later than [date]").* The Contractor should allow for at least sixty (60) to ninety (90) days for acceptance by MassDOT once all of the VECP documentation has been provided. Acceptance shall mean that MassDOT has received a finalized and executed contract modification. However, this is a proposed Contract change.

   The Contractor is fully obligated to progress the Work of the original Contract and MassDOT is not liable for any delays or costs that may occur in the review phase of any VECP proposal.

5. ***Cost and Savings Estimates***: A detailed estimate of the anticipated net savings, calculated as follows:

   a. ***Original Scope:*** Isolate the cost of performing the original contract construction activities, in accordance with the original Contract Documents, as originally bid by the Contractor, that are anticipated to be superseded by the VECP. *This cost is to include any original contract scope that is anticipated to be altered or eliminated by the VECP such as, shop drawing preparation, inspection work, testing, maintenance of traffic, or any other original contract costs, that have yet to have been performed at the time of this VECP submission.*

   b. ***New VECP Scope:*** Calculate the cost of performing the comparable construction activities associated with the VECP.

   c. ***Contractor's Engineer & Inspection***: Calculate the cost of engineering, inspection, and design work by the Contractor's Engineer/Designer. This should be a realistic estimate of the costs of any required engineering, design and review work by the Contractor's Engineer.

   d. ***MassDOT's Costs:*** MassDOT's estimate of costs to perform engineering/design reviews, cost estimate reviews, schedule reviews, and any other administrative costs to review and recommend implementation of the proposed VECP. *(including all anticipated increased costs to MassDOT on other Contracts and all anticipated follow-on increased costs to MassDOT, if any)* as provided by MassDOT. MassDOT's estimated costs must be included the VECP calculation and will be provided by MassDOT in support of the VECP evaluation process.

   e. ***Other Costs:*** Estimated costs associated with any revisions to other project related costs, such as Environmental Permits or Right of Way acquisitions, including other agency or municipality costs, as provided by MassDOT.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

Net Savings:
The net savings to be split between MassDOT and the Contractor shall be calculated using the items above as follows: a - (b+c+d+e) = net savings

6. *The Contractor shall also provide:*

   a. A proposed Change Order, which explains and justifies any required Equitable Adjustment in the Contract Price.

   b. The Contractor's actual costs expended for developing the VECP as of the date of the VECP submission;

7. ***Design Changes and Drawings*:** The costs that are outlined above should be inclusive of the following design and engineering responsibilities.

   a. Design changes shall be prepared and stamped by the Contractor's professional designer and/or engineer. In addition, in the development of the VECP; the Contractor is responsible for anticipating and managing all aspects associated with any VECP design work that must be performed by a licensed Engineer.

   b. The Contractor's engineer must analyze and stamp all components of any aspect of the project that has been redesigned, changed, or altered as a result of this VECP.

   c. The Contractor's engineer shall provide all calculations and supporting design/engineering documentation that was utilized to develop the changes and stamped drawings. These will be used by MassDOT's Designer-of-Record to review the VECP changes. The Contractor is limited to selecting only those engineer's that have been pre-qualified by MassDOT's A&E Board.

   d. MassDOT's Designer-of-Record will review and respond to all completed design submissions related to this VECP within thirty (30) calendar days, unless determined to be a non-critical path item.

   e. MassDOT will be responsible for estimating and managing MassDOT's Designer-of-Record during the VECP review and implementation. Should any significant conflicts arise, between the Contractor's Engineer and MassDOT's Designer-of-Record, the DOT and the Contractor will work expeditiously to resolve the conflict. Should this type of conflict continue for greater than five (5) days, the Contractor is to bear all financial and time related impacts of such delay and must seek to resolve the design conflict, in an acceptable manner to MassDOT. The resolution of this conflict will be funded at the Contractor's expense – exclusive of the net saving that was agreed to at the execution of the contract modification for this VECP.

   f. The Contractor's Engineer may also be required to inspect the construction work. The Contractor is to include such anticipated inspection costs in the initial VECP.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

g. MassDOT's Designer of Record will remain the Designer-of-Record for the entire Project. Any costs incurred in the use of MassDOT's Designer-of-Record by MassDOT or Contractor associated with the review of a VECP are to be included in the calculated net savings.

C. Approval of the VECP shall not occur until a Contract Modification, incorporating the VECP, is issued by MassDOT and properly executed by the Contractor. MassDOT may accept or reject part or all of any VECP at any time prior to an executed Contract Modification for the applicable VECP. The decision of MassDOT, concerning acceptance or rejection of any VECP, shall be final and shall not be subject to dispute resolution.

It is expected that several weeks may go by before the final VECP documentation has been executed with a Contract Modification. Therefore, MassDOT intends to make certain that the initial cost estimate information has not changed before entering into a Contract Modification. As the VECP evaluation process is finalized, and prior to the signed Contract Modification for the VECP, the Contractor and MassDOT must re-certify the current status of the originally proposed cost and/or schedule savings.

Until a contract modification is issued and schedule and cost/savings re-certification is complete and accepted by MassDOT, the Contractor shall remain obligated to perform the Work in accordance with the terms and conditions of the original Contract Documents.

Upon completion of the work associated with the VECP, MassDOT may require verification that the VECP savings has been achieved.

D. VECPs will be processed (distributed, reviewed, commented upon, accepted or rejected) expeditiously (pursuant to M.G.L. c. 30, § 39R); however, as this is an elective modification to the contract, MassDOT shall not be liable for any delay or cost in the review and acceptance of the VECP. During the review of the VECP, the Contractor remains obligated to progress the original Contract scope, and schedule, as planned; until a Contract Modification, accepting the Contractor re-certified VECP, has been executed by MassDOT.

The Contractor has the right to withdraw part, or all of any VECP, prior to acceptance by MassDOT. Such withdrawal shall be made in writing to the Engineer. The Contractor shall state the period of time, from the date of the initial VECP submittal, that the VECP shall remain valid and feasible. Revision of this validity and feasibility period shall be allowed only by mutual agreement of the Contractor and the Engineer in writing.

If the Contractor desires to withdraw the proposal prior to the expiration of this period for non-technical reason, MassDOT reserves the right to recover all actual costs that have been incurred to MassDOT.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

If the Contractor withdraws the VEC Proposal, MassDOT reserves the right to proceed with the VECP or any portion of the VECP as a normal change and the Contractor waives any right it may have had to share in net savings thereunder.

For purposes of this provision, expiration of the time established by the Contractor for approval shall be considered as withdrawal by the Contractor if MassDOT requests an extension of that time and the Contractor does not provide a written extension.

E. With regard to unknown conditions or sub-surface work, in general, the expectation is that the Contractor and MassDOT will strive to gain enough knowledge about the risks in order to provide a forward-priced Change Proposal. Therefore, any costs to fully evaluate the proposal, such as additional borings and/or test pits, must be considered in the cost evaluation of whether the VECP is worth pursuing. However, if it is impractical to gather conclusive exploratory information, before the VECP is executed, MassDOT may consider provisions in the VECP that clearly identifies the risk sharing (cost and time) related specifically to the unknown/sub-surface conditions. If these VECP provisions are acceptable to MassDOT they are to include supplemental language to provide a determination of the final savings/cost, and time impacts, no later than 45 days after the sub-surface work is completed. All other aspects of the VECP, unrelated to these Provisions, will be binding upon execution of the VECP.

NOTIFICATION OF FUNDING SOURCES FOR WORK TO BE PAID BY OTHERS

This contract has an agreement with the ***City of Peabody;*** whereas when the construction costs for the contract scope exceed the total participating contract bid price by more than ten percent (10%), the ***City*** shall be responsible for the amount over 110% of the total participating contract bid price.

SECTION 722
CONSTRUCTION SCHEDULING
DESCRIPTION

722.20 General

The Contractor's approach to prosecution of the Work shall be disclosed to the Department by submission of a Critical Path Method (CPM) schedule and a cost/resource loaded Construction Schedule as defined by the schedule type set forth below. These requirements are in addition to any requirements imposed in other sections.

This section establishes the requirement for scheduling submissions. There are four schedule types identified as types A, B, C and D.

All schedules shall be prepared and submitted in accordance with this specification and the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit.

Type A –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
  - Cost-loaded & Resource Loaded CPM
- Resources Graphic Reporting
- Cash Flow Projections from the CPM
- Cash Flow Charts
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type B –

- Schedule Planning Session
  - Baseline CPM Schedule
  - Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Cost-loaded & Resource Loaded CPM
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type C –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
  - Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

SECTION 722 (Continued)

Type D -

- Bar chart schedule updated monthly or at the request of the Engineer
- Short-term Construction Schedule
- Monthly Projected Spending Report (PSR)

EQUIPMENT, PERSONNEL

722.40 General

A. **Software Requirements**

The Contractor shall use Primavera P6 computer scheduling software.

In addition to the requirements of Section 740 – Engineer's Field Office and Equipment, the Contractor shall provide to the Department one (1) copy of the scheduling software, one (1) software license and one (1) computer capable of running the scheduling software for the duration of the Contract. This computer and software shall be installed in the Engineer's Field Office. The computer and software shall be maintained and serviced at no additional cost to the Department.

B. Scheduler Requirements

The Scheduler shall be approved by the Engineer.

For Type A, B and C Schedules the name of the Contractor's Project Scheduler together with his/her qualifications shall be submitted to the Department for approval by the Engineer within seven (7) Calendar Days after NTP. The Project Scheduler shall have a minimum of five (5) years of project CPM scheduling experience, three (3) years of which shall be on projects of similar scope and value as the project for which the Project Scheduler is being proposed. References shall be provided from past projects that can attest to the capabilities of the Project Scheduler.

SCHEDULING METHODS

722.60 General

A. **Schedule Planning Session**

The Contractor shall conduct a schedule planning session prior to submission of the Baseline Schedule. This session will be attended by the Department and its consultants. During this session, the Contractor shall present its planned approach to the project including, but not limited to:

1. the Work to be performed by the Contractor and its subcontractors;
2. the planned construction sequence and phasing; planned crew sizes;
3. summary of equipment types, sizes, and numbers to be used for each work activity;
4. all early work related to third party utilities;
5. identification of the most critical submittals and projected submission timelines;
6. estimated durations of major work activities;
7. the anticipated Critical Path of the project and a summary of the activities on that Critical Path;
8. a summary of the most difficult schedule challenges the Contractor is anticipating and how it plans to manage and control those challenges;

SECTION 722 (Continued)

9. a summary of the anticipated quarterly cash flow over the life of the project.

This will be an interactive session and the Contractor shall answer all questions that the Department and its consultants may have. The Contractor shall provide a written summary of the information presented and discussed during the session to the Engineer. The Contractor's Baseline Schedule and accompanying Schedule Narrative shall incorporate the information discussed at this Schedule Planning Session.

B. **Schedule Reviews by the Department**

1. Baseline Schedule Reviews
   The Engineer will respond to the Baseline Schedule Submission within thirty (30) Calendar Days of receipt providing comments, questions and/or disposition that either accepts the schedule or requires revision and resubmittal. Rejected Baseline Schedules shall be resubmitted within fifteen (15) Calendar Days after receipt of the Engineer's comments.
2. Contract Progress Schedule / Monthly Update Reviews / Recovery Schedules
   The Engineer will respond to each submittal within twenty-one (21) Calendar Days. Rejected schedules shall be resubmitted by the Contractor within five (5) Calendar Days after receipt of the Engineer's comments.

The Engineer's review comments shall not be construed as direction to change the Contractor's means and methods. The review and acceptance of the CPM schedule does not relieve the Contractor of the responsibility for accomplishing the work within the contract required completion dates. Omissions and errors in the accepted CPM schedule shall not excuse performance less than that required by the Contract.

722.61 Schedule Content and Preparation Requirements

All schedules shall be prepared and submitted in accordance with the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at:
https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit
and the following:

A. **LOGIC**

The schedules shall divide the Work into activities with appropriate logic ties to show:

1. conformance with the requirements of this Section and Division I, Subsection 8.02 - Schedule of Operations
2. the Contractor's overall approach to the planning, scheduling, and execution of the Work
3. conformance with any additional sequences of Work required by the Contract Documents, including, but not limited to, Subsection 8.03 - Prosecution of Work and Subsection 8.06 – Limitations of Operations.

SECTION 722 (Continued)

B. **ACTIVITIES**

The schedule shall clearly define the progression of the Work from the Notice to Proceed (NTP) to Contractor Field Completion (CFC) by using separate activities, or including attributes within appropriate activities, to address each of the following:

1. Notice to Proceed
2. Work Breakdown Structure
3. The Critical Path is clearly defined and organized.
4. Float shall be clearly identified.
5. Detailed activities to satisfy permit requirements.
6. Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
7. The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
8. The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be thirty (30) Calendar Days, unless otherwise specified or as approved by the Engineer.
9. Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
10. Each component of the Work defined by specific activities.
11. Right-of-Way (ROW) takings that have been identified in the Contract.
12. Early Utility Relocation (by others) that has been identified in the Contract.
13. Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
14. Utility work to be performed in accordance with the Project Utility Coordination (PUC) Form as provided in Section 8.14 - Utilities Coordination, Documentation and Monitoring Responsibilities
15. Access Restraints – restrictions on access to areas of the Work that are defined by the Department in the bid package, in Subsection 8.06 – Limitations of Operations or elsewhere in the Contract
16. Limitations of Work – time of year restrictions and any other limitations identified in the contract
17. Traffic work zone set-up and removal, night work and phasing
18. Material Certifications
19. Milestones listed in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents
20. For Type A and B Contracts only: All items to be paid for, including all Unit Price and Lump Sum pay items, shall be identified by activity. This shall include all non-construction activities such as engineering work; purchase of permanent materials and equipment, purchase of structural steel stock, equipment procurement, equipment delivery to the site or storage location and the representative amount of overhead/indirect costs that was included in the Contractor's Bid Prices.

SECTION 722 (Continued)

21. Contractor's request for validation of FBU (ready to open to traffic)
22. Full Beneficial Use (FBU) Contract Milestone per the following requirements: The majority of contract Work has been completed and the asset(s) has been opened for full multi-modal transportation use, except for limited contract work items that do not materially impair or hinder the intended public use of the transportation facility. All anticipated lane takings have been completed, except for minor, short term work items and as defined in Subsection 8.03 - Prosecution of Work
23. The Department's confirmation of completed work to allow for FBU.
24. Contractor's request for validation of Substantial Completion
25. Department generated punch list of twenty-one (21) Calendar Days
26. Substantial Completion Contract Milestone as defined in the standard specifications.
27. Punch list Completion Period of at least thirty (30) Calendar Days per the requirements of Subsections 5.11 - Final Acceptance, 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes
28. Contractor confirmation that all punchlist work and documentation has been completed.
29. Physical Completion of the Work Contract Milestone per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
30. Documentation Completion per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
31. Contractor Field Completion Contract Milestone (which can also be considered the completion date) per the following requirements: All physical contract Work is complete including punchlist. The Contractor has fully de-mobilized from field operations and as defined in Subsection 5.11

C. **EARLY AND LATE DATES**

Early Dates shall be based on proceeding with the Work or a designated part of the Work exactly on the date when the corresponding Contract Time commences. Late Dates shall be based on completing the Work or a designated part of the Work exactly on the corresponding Contract Time, even if the Contractor anticipates early completion.

D. **DURATIONS**

Activity durations shall be in Work Days. Planned Original Durations shall be established with consideration of resources and production rates that correspond to the Contractor's Bid Price. Within all of the Department-required schedules, the Contractor shall plan the Work using durations for all physical construction activities of no less than one (1) Work Day and no greater than fourteen (14) Work Days, unless approved by the Engineer as part of the Baseline Schedule Review.

SECTION 722 (Continued)

Should there be an activity with a duration that is determined by the Engineer to be unreasonable, the Contractor will be asked to provide a basis of the duration using bid documents, historic production rates for similar work, or other form of validation that is acceptable to the Engineer. Should the Contractor and the Engineer be unable to agree on reasonable activity durations, the Engineer will, at a minimum, note the disagreement in the Baseline Schedule Review along with a duration the Engineer considers reasonable and the basis for that duration. A schedule that contains a substantial number of activities with durations that are deemed unreasonable by the Engineer will not be accepted.

E. **MATERIALS ON HAND**

The Contractor shall identify in the Baseline Schedule all items of permanent materials (Materials On Hand) for which the Contractor intends to request payment prior to the incorporation of such items into the Work.

F. **ACTIVITY DESCRIPTIONS**

The Contractor shall use activity descriptions in all schedules that clearly describe the work to be performed using a combination of words, structure numbers, station numbers, bid item numbers, work breakdown structure (WBS) and/or elevations in a concise and compact label.

G. **ACTIVITY IDENTIFICATION NUMBERS**

The Contractor shall use the activity identification numbering system specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

H. **ACTIVITY CODES**

The Contractor shall use the activity codes specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

I. **CALENDARS**

Different calendars may be created and assigned to all activities or to individual activities. Calendars define the available hours of work in each Calendar Day, holidays and general or project-specific non-Work Days such as Fish Migration Periods, time-of-year (TOY) restrictions and/or area roadway restrictions. All calendars shall extend two years beyond the current project completion date.

Project Special Provisions identify specific calendar restrictions some examples of special calendars include, but are not limited to:

- Winter Shutdown Period, specific work is required by separate special provision to be performed during the winter. See Special Provision 8.03 (if applicable)
- Peak traffic hours on heavily traveled roadways. This shall be from 6:30 am to 9:30 am and from 3:30 pm to 7:00 pm, unless specified differently elsewhere in the Contract.
- Special requirements by sensitive abutters, railroads, utilities and/or other state agencies as defined in the Contract.
- Planting seasons for trees, shrubs and grasses and wetlands mitigation work.

SECTION 722 (Continued)

- Cape Cod and the Islands Summer Roadway Work Restrictions: A general restriction against highway and bridge construction is enforced between Memorial Day and Labor Day, unless otherwise directed by the Engineer. Cape Ann Summer Roadway Work Restrictions: While there are no general restrictions for Cape Ann as there are for Cape Cod and the Islands, project-specific restrictions may be enforced.
- Turtle and/or Fish Migration Periods and/or other in-water work restrictions: Refer to the Project Special Provisions for specific restrictions.
- Working over Waterways Restricted Periods.
- Night-time paving and striping operations, traffic, and temperature restrictions.
- Utility Restrictions shall be as specified within the Contract.

J. **FLOAT**

For the calculation of float in the CPM schedule, the setting for *Retained Logic* is required for all schedule submissions, starting with the Baseline Schedule Submission. Should the Contractor have a reason to propose that an alternative calculation setting such as *Progress Override* be used, the Contractor shall obtain the Engineer's approval prior to modifying to this setting.

K. **COST AND RESOURCE LOADING (Types A and B only)**

For all Type A and B Schedules, the Contractor shall provide a cost and resource-loaded schedule with an accurate allocation of the costs and resources necessary to complete the Work. The costs and resources shall be assigned to all schedule activities in order to enable the Contractor to efficiently execute the Contract requirements and the Engineer to validate the original plan, monitor progress, provide cash flow projections, and analyze delays.

1. Each schedule activity shall have an assigned cost that accurately represents the value of the Work. Each schedule activity shall have its resources assigned to it by craft and the anticipated hours to accomplish the work. Each schedule activity's equipment resources shall be assigned to it by equipment type and hours operated. Front-loading or other unbalancing of the cost distribution will not be permitted.
2. The sum of the cost of all schedule activities shall be equal to the Contractor's Bid Price.
3. Indicating the labor hours per individual, per day, by craft and equipment hours/day will be acceptable.
4. The Engineer reserves the right to use the cost-loading as a means to resolve changes, disputes, time entitlement evaluations, increases or decreases in the scope of Work, unit price renegotiations and/or claims.
5. For all Type A and B Schedules, all subnets, fragnets, Proposal Schedules, and Recovery Schedules shall be cost and resource- loaded to help to quickly validate and monitor the duration of the Work to be performed.
6. For Type A Schedules, cost-loading of the schedule will also be used for cash flow projection purposes.
7. The cost-loading of each activity shall indicate the portion of the cost for that activity that is applicable to a specific bid item (cost account.) The total cost for each cost account must equal the bid item price.

SECTION 722 (Continued)

L. **NOT TO BE USED IN THE CONTRACTOR'S CPM SCHEDULE**

1. Milestones or constraint dates not specified in the Contract.
2. Scheduled work not required for the accomplishment of a Contract Milestone
3. Use of activity durations, logic ties and/or sequences deemed unreasonable by the Engineer.
4. Delayed starts of follow-on trades.
5. Float suppression techniques.
6. Leads such as leads, lags, SS, SF, & FF relationships without the expressed permission of the Department.

722.62 Submittal Requirements

All schedules shall be prepared and submitted in accordance with the requirements listed below.

Each monthly Contract Progress Schedule submittal shall be uniquely identified.

Each Submission shall, at a minimum, include the following:

a. Narrative
b. Schedule submittals shall be signed by the Scheduler
c. Schedule Printout - All Activities
d. Schedule Printout - Critical Path Layout
e. Schedule Printout - Remaining Work
f. Schedule Printout - Top 3 Float Path
g. Work Breakdown Structure (WBS) Summary
h. Project Spending Report (PSR) in Portable Document Format (.PDF)
i. Project Spending Report (PSR) in Microsoft Excel spreadsheet (.XLS)
j. Oracle Primavera P6 Schedule File (.XER)

All digital file submittals will be labeled with the following information.

- Contract Number
- Project Number
- Project locations (i.e., town(s))
- Brief description
- Submittal description (i.e., UP07)
- Data Date (MM-DD-YY)
- File Description (i.e., Critical Path)

Example: C110464 (P606309) - Orange Route 2 over 202 – UP23 (07-15-22) - Critical Path

A. **Narratives**

A written narrative shall be submitted with every schedule submittal. The narrative shall:

1. itemize and describe the flow of work for all activities on the Critical Path in a format that includes any changes made to the schedule since the previous Contract Progress Schedule / Monthly Update or the Baseline Schedule, whichever is most recent.
2. provide a description of any specification requirements that are not being followed. Identify those that are improvements and those that are not considered to be meeting the requirements.

SECTION 722 (Continued)

3. provide all references to any Notice of Delay that has been issued, within the time period of the Contract Progress Schedule Update, by letter to the Engineer. Note that any Notice of Delay that is not issued by letter will not be recognized by the Engineer. See Subsection 722.64.A – Notice of Delay.
4. provide a description of each third-party utility's planned vs. actual progress and note any that are trending late or are late per the durations and commitments as provided in the PUC Form; provide a description of the five (5) most important responses needed from the Department and the need date for the responses in order to maintain the current Schedule of Record.
5. provide a description of all critical issues that are not within the control of the Contractor or the Department (third party) and any impact they had or may have on the Critical Path.
6. provide a description of any possible considerations to improve the probability of completing the project early or on time.
7. compare Early and Late Dates for activities on the Critical Path and describe reasons for changes in the top three (3) most critical paths.
8. describe the Contractor's plan, approach, methodologies, and resources to be employed for completing the various operations and elements of the Work for the top three (3) most critical paths. For update schedules, describe and propose changes to those plans and verify that a Proposal Schedule is not required.
9. describe, in general, the need for shifts that are not 5 days/week, 8 hours/day, the holidays that are inserted into each calendar and a tabulation of each calendar that has been used in the schedule.
10. describe any out-of-sequence logic and provide an explanation of why each out-of-sequence activity does not require a correction, if one has not been provided, and an adequate demonstration that these changes represent the basis of how these activities will be built, including considerations for resources, dependencies, and previously approved production rates.
11. identify any possible duration increases resulting from actual or anticipated unit price item quantity overruns as compared to the baseline duration, with a corresponding suggestion to mitigate any possible delays to the Critical Path. If the delay is anticipated to impact the Critical Path, refer to Subsections 4.06 – Increased or Decreased Contract Quantities and 8.10 – Determination and Extension of Contract Time for Completion and submit a letter to the Engineer notifying of a potential delay.
12. include a schedule log consisting of the name of the schedule, the data date and the date submitted.
13. include and describe any notifications, communications and coordination meetings with third-parties such as utility companies that occurred from the last update including personnel names, job titles and contact information, date of meeting(s)/correspondence(s), topics discussed, and reasons the third party provided for deviations from the PUC form.

SECTION 722 (Continued)

B. **CPM Bar Charts**

One (1) timescaled bar chart containing all activities shall be prepared and submitted using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements Activities shall be linked by logic ties and shown on their Early Dates. Critical Paths shall be highlighted, and Total Float shall be shown for all activities.

A second timescaled bar chart shall also be prepared containing only the Critical Path or, if the Critical Path is not the longest path, the Longest Path using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements. Activities shall be linked by logic ties and shown on their Early Dates. Total Float shall be shown for all activities.

C. Detailed Activity Schedule Comparisons

A Detailed Activity Schedule Comparison (DASC) is a simple reporting tool in the format of a graphical report that will provide Resident Engineers with immediate, timely and up-to-date information. The DASC consists of an updated bar chart that overlays the current time period's bar chart onto the previous time period's bar chart for an easily read comparison of progress during the present and previous reporting periods.

D. Activity Cost Report and Monthly Cash Flow Projections (Type A only)

With each Contractor Quantity Estimate (CQE), the Contractor shall submit an Activity Cost Report and Cash Flow Projection that includes all activities grouped by Contract Bid Item.

The Activity Cost Report shall be generated from the Schedule of Record and shall be the basis of the Monthly Cash Flow Projection. Within each contract Bid Item, activities shall be sequenced by ascending activity identification number and shall show:

1. activity ID and description,
2. forecast start and finish dates for each activity and,
3. when submitted as a revised schedule, actual start, and finish dates for each completed activity.
4. any variance to the estimated contract quantity shall be shown.

E. Resource Graphs (Type A only)

Monthly and cumulative resource graphs for the remaining Contract period using the Early Dates and Late Dates in the Contract Progress Schedule shall be included as part of each schedule submittal.

SECTION 722 (Continued)

F. Projected Spending Reports

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF.

722.63. Progress Schedule Requirements

A. Baseline Schedule

The Baseline Schedule shall be due thirty (30) Calendar Days after Notice to Proceed (NTP). The Baseline Schedule shall only reflect the Work awarded to the Contractor and shall not include any additional work involving Extra Work Orders or any other type of alleged delay. The Baseline Schedule shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements. Once the Baseline Schedule has been accepted by the Engineer, with or without comments, it shall represent the as-planned schedule for the Work and become the Contract Progress Schedule of Record until such time as the schedule is updated or revised under Subsections 722.63.C - Contract Progress Schedules / Monthly Updates, 722.64.C - Recovery Schedules and 722.64.D - Proposal Schedules.

The Cost and Resource-Loading information (Types A and B only) shall be provided by the Contractor within forty-five (45) Calendar Days after NTP.

The Engineer's review comments on the Baseline Schedule and the Contractor's responses to them will be maintained for the duration of the Contract and will be used by the Engineer to monitor the Contractor's work progress by comparing it to the Contract Progress Schedule / Monthly Update.

B. Interim Progress-Only Schedule Submissions

The first monthly update of the Contract Progress Schedule/Monthly Update is due within seventy (70) Calendar Days after Notice to Proceed (NTP.) The Baseline Schedule review period ends at sixty (60) Calendar Days after NTP, see Subsection 722.60.B - Schedule Reviews by the Department. If the Baseline Schedule has not been accepted within sixty (60) Calendar Days after NTP, an Interim Progress-Only Schedule shall be due within seventy (70) Calendar Days after NTP. The purpose of the Interim Progress-Only Schedule is to document the actual progress of all activities, including non-construction activities, from NTP until the Baseline Schedule is accepted.

SECTION 722 (Continued)

C. Contract Progress Schedules / Monthly Updates

The first Contract Progress Schedule shall be submitted by the Contractor no later than seventy (70) Calendar Days after NTP. The data date for this first Progress Schedule shall be two months (approximately sixty (60) Calendar Days) after NTP. Subsequent Progress Schedules shall be submitted monthly.

Each Contract Progress Schedule shall reflect progress up to the data date. Updated progress shall be limited to asbuilt sequencing and asbuilt dates for completed and inprogress activities. Asbuilt data shall include actual start dates, remaining Work Days and actual finish dates for each activity, but shall not change any activity descriptions, the Original Durations, or the Original Resources (as planned at the time of bid), without the acceptance of the Engineer. If any activities have been completed out-of-sequence, the Contractor shall propose new logic ties for affected in-progress and future activities that accurately reflect the previously approved sequencing. Alternatively, the Contractor may submit to the Engineer for approval an explanation of why an out-of-sequence activity does not require a correction and an adequate demonstration that the changes accurately represent how the activities will be built, including considerations for resources, dependencies, and previously approved production rates. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

No revisions to logic ties, sequence, description, or duration of future activities; or planned resource costs shall be made without prior approval by the Engineer.

Any proposed logic changes for in-progress or future activities shall be submitted to the Engineer for approval before being incorporated into a Contract Progress Schedule. The logic changes must be submitted using a Proposal Schedule or a schedule fragnet submission. Once approved by the Engineer, the Contractor may incorporate the logic in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

For any proposed changes to the original sequence, description or duration of future activities, the Contractor shall submit to the Engineer for approval an explanation of how the proposed description or duration change reflects how the activity will be progressed, including considerations for resources and previously approved production rates. Any description or duration change that does not accurately reflect how the activity will be progressed will not be approved by the Engineer. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

Contract Progress Schedules that extend performance beyond the Contract Time or beyond any Contract Milestone shall not be approved by the Engineer. The Contractor shall submit a Recovery Schedule, or a Time Entitlement Analysis, if any Contract Progress Schedule/Monthly Update indicates a failure to meet the Contract Dates.

SECTION 722 (Continued)

D. Short-Term Construction Schedule

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work for the two (2) week period prior and all planned work for the following three (3) week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities. Short-Term Construction Schedules shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements.

722.64 Impacted Schedule Requirements

A. Notice of Delay

The Contractor shall notify the Engineer in writing, with copies to the District and State Construction Engineers, within fifteen (15) of the start of any delays to the Critical Path that are caused by actions or inactions that were not within the control of the Contractor. Delay notifications that are not provided in a letter to the Engineer, such as a delay notification in the schedule narrative, will not be recognized as contractual notice in the determination of any Time Extension related to the impacts to the work associated with this specific alleged delay. Should such a delay continue for more than one (1) week, the Contractor shall note it in the Schedule Narrative until the delay is no longer impacting the Critical Path for the completion of the Contract Milestones. The Engineer will evaluate the alleged delay and its impact and will respond to the Contractor within ten (10) Calendar Days after receipt of a notice of delay.

B. Time Entitlement Analysis

A Time Entitlement Analysis (TEA) shall consist of a descriptive narrative, prepared in accordance with Subsection 722.62.A - Narratives, and an as-built CPM schedule, which may be in the form of a schedule fragnet that has been developed from the project's Contract Progress Schedule of Record, and illustrates the impact of a delay to the Critical Path, Contract Milestones and/or Contract Completion Date as required in Subsection 8.10 - Determination and Extension of Contract Time for Completion. TEAs shall also be used to determine the schedule impact of proposed Extra Work Orders (EWO) as also required in Subsection 8.10.

TEAs shall be prepared and submitted in accordance with the requirements of Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements and shall be based on the Contract Progress Schedule of Record applicable at the start of the delay or impact from an EWO. A TEA fragnet must start with a specific new activity describing the work contained in either a Notice of Delay previously submitted to the Department per Subsection 722.64.A - Notice of Delay or an EWO.

SECTION 722 (Continued)

TEAs shall be submitted:

1. as part of any Extra Work Order that may impact Contract Time,
2. with a request for a Time Extension,
3. within fifteen (15) Calendar Days after a request for a TEA by the Engineer for any other reason.

A TEA shall be submitted to the Engineer before any Time Extension is granted to the Contractor. Time Extensions will not be granted unless the TEA accurately reflects an evaluation of all past delays and the actual events that occurred that impacted the Critical Path. The TEA must also demonstrate a plan for the efficient completion of all of the remaining work through an optimized CPM Schedule. The analysis shall include all delays, including Contractor-caused delays, and shall be subdivided into timeframes and causes of delays.

TEAs shall incorporate any proposed activities, logic ties, resource considerations, and activity costs required to demonstrate the schedule impacts most efficiently in addition to detailing all impacts to existing activities, logic ties, the Critical Path, Contract Milestones, and the Contract Completion Date. In addition, TEAs shall accurately reflect any changes made to activities, logic ties, restraints, and activity costs, necessitated by an Extra Work Order or other schedule impact, for the completion of the remaining work. The Contractor shall provide TEAs that demonstrate that all delays have been mitigated to the fullest extent possible without requiring an Equitable Adjustment to the original bid basis.

All TEAs shall clearly indicate any overtime hours, additional shifts and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. The Engineer shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of Time Extensions if it is determined to be in the best interest of the Department to do so.

When accepted, the changes included in a TEA shall be incorporated into the next Contract Progress Schedule per the requirements of Subsection 722.63.C - Contract Progress Schedules / Monthly Updates. During the review of any TEA, all Contract Progress Schedules shall continue to be submitted as required.

The Engineer may request that the Contractor prepare a Proposal Schedule or a Recovery Schedule to further mitigate any delays that are shown in the accepted TEA or Contract Progress Schedule.

C. Recovery Schedules

The Contractor shall promptly report to the Engineer all schedule delays during the prosecution of the Work. Contract Progress Schedules that predict performance extended beyond the Contract Time or beyond any Contract Milestone shall not be approved as the schedule of record. This requirement is critical to the Department's ability to make informed decisions regarding Contract Time and costs.

The Contractor shall submit a Recovery Schedule within fifteen (15) Calendar Days of a Contract Progress Schedule submission that shows failure to meet the Contract Dates unless a recovery schedule is waived by the Department. Waiving the recovery schedule does not relieve the contractor of the responsibility for the delay. The Department may revoke the waiver of a Recovery Schedule, at which time a Recovery Schedule shall be submitted within fifteen (15) Calendar Days of the Contractor being notified.

Changes represented in accepted Recovery Schedules shall be incorporated into the next Contract Progress Schedule.

SECTION 722 (Continued)

D. Proposal Schedules

A Proposal Schedule is an alternative schedule used to evaluate proposed changes to the Contract scope or significant alternatives to previously approved approaches to complete the Work, which may include changes to activity durations, logic, and sequence. For Types A and B Schedules, the Proposal Schedule shall be cost and resource loaded.

A Proposal Schedule may be requested by the Department at any time or may be offered by the Contractor. The Engineer may request that the Contractor prepare a Proposal Schedule to further mitigate any delays that are shown in an accepted TEA or Contract Progress Schedule.

The Contractor shall submit the Proposal Schedule within thirty (30) Calendar Days of a request from the Department.

The Proposal Schedule shall not be considered a Schedule of Record until the logic, durations, narrative, and basis of the Proposal Schedule have been accepted by the Engineer. If the Proposal Schedule took the form of a fragnet, it must be incorporated into the Contract Progress Schedule of Record showing the current progress of all other activities and the impacts/results of the changes made by the Proposal Schedule before the Proposal Schedule is accepted by the Department.

Proposal Schedules shall clearly indicate any proposed acceleration including overtime hours, additional shifts, and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. Proposal Schedules that contain a cost element shall be submitted with a separate Cost Proposal.

Changes represented in the accepted Proposal Schedules shall be incorporated into the next Contract Progress Schedule. During the review of any Proposal Schedule, all Contract Progress Schedules shall continue to be required every month.

E. Disputes

All schedules shall be submitted, reviewed, dispositioned, and accepted in the timely manner specified herein so as to provide the greatest possible benefit to the execution of this Contract.

The Contractor may dispute a decision by the Engineer by filing a claim notice within seven (7) days after the Contractor's request for additional time has been denied or if the Contractor does not accept the number of days granted in a time extension. The Contractor's claim notice shall include a revised time entitlement analysis that sufficiently explains the basis of the time-related claim. Failure to submit the required time entitlement analysis with the claim notice shall result in denial of the Contractor's claim. A determination on the Contractor’s claim shall be in accordance with Subsection 7.16 Claims of Contractor for Compensation. Pending resolution of any dispute, the last schedule accepted by the Engineer will remain the Contract Schedule of Record.

SECTION 722 (Continued)

722.65 Schedule Type D Requirements

This section is to detail the requirements for Type D Schedules and is separate from the requirements listed above. These schedules are intended for a project in which a more formal schedule would not be practical.

Schedules for Type D projects shall be submitted for each work assignment. The Schedule Type D shall be submitted electronically in .XLS and .PDF format and meet the following requirements.

The schedule requirements for work assignments that are anticipated to last three weeks or less shall conform to the requirements for Short-term Construction Schedules below.

Work assignments that are anticipated to last longer than three weeks shall submit a bar chart baseline and provided update schedules upon request of the engineer as required under Bar Chart Schedule below in addition to meeting the Short-term Construction schedule requirements.

A. **Bar Chart Schedule**

A Bar Chart that shall include the following:

- Work Assignment start date.
- Activities to identify.
  - Major work operations broken down to be no longer than 14 days.
  - Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
  - The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
  - The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be shown as thirty (30) Calendar Days,
  - Detailed activities to satisfy permit requirements.
  - Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
  - Project Close out activities including a 21-calendar day creation of a punchlist activity and 30 calendar day minimum completion of punchlist activity.
- Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
- Access Restraints – restrictions on access to areas of the Work
- Traffic work zone set-up and removal, night work and phasing
- Contract Milestones including Full beneficial Use, Substantial Completion and Contractor Field Completion

The Bar Char Schedule shall be provided at the beginning of the project and updated with each work order created for the project.

SECTION 722 (Continued)

B. **Short-Term Construction Schedule**

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. See schedule toolkit for suggested format.

The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work on the assignment for the two week period prior and all planned work for the following three week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities.

C. **Project Spending Report (PSR)**

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall be for all active work assignments, broken down by work assignment. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF

SECTION 722 (Continued)

COMPENSATION

722.80 Method of Measurement

Schedule of Operations (Type A, B and C)

The project bid documents specify the fixed-price amounts to be paid to the Contractor for the Project Schedule requirements contained herein. Each bidder shall include this fixed price bid item amounts in their bid. Failure to do so may be grounds for the rejection of the bid.

This fixed price amount is for payment purposes only and is separate from what the Department considers to be the Contractor's General Condition costs. If the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs shall be included in the Contractor's overall bid price.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals will be paid for under the fixed price amount.

Twenty percent (20%) of this pay item will be paid upon the Engineer's acceptance of the Contractor's Baseline Schedule, prepared and submitted in accordance with Subsection 722.63.A.

The remaining eighty percent (80%) of this pay item will be paid in equal monthly installments distributed across the Contract Duration from Notice to Proceed (NTP) to Contractor Field Completion (CFC), less the 2 months required for the submittal and review of the Baseline Schedule in accordance with the following formula:

$$\text{Monthly Payment} = \frac{\text{Remaining Fixed Price amount (80\% of the Item Cost.)}}{\text{Contract Duration in whole months} - 2 \text{ months}}$$

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section.

Should there be a Time Extension granted to the Contractor, the Engineer may provide an Equitable Adjustment for additional Contract Progress Schedule Updates at intervals directed by the Engineer. The monthly payment will be the basis for this Equitable Adjustment.

Schedule of Operations (Type D)

For projects assigned with Type D schedule requirements, all scheduling work shall be considered incidental to the project with no separate payment under this section.

SECTION 722 (Continued)

722.81 Basis of Payment

The timely and accurate submission of the Baseline Schedule is critical to the Contract and the Department's ability to make informed decisions. Only payments under Item 740 - Engineer's Field Office and Item 748 – Mobilization will be made until the Baseline Schedule is accepted by the Engineer.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals (including monthly progress schedules, short-term schedules, project spending reports, TEAs, recovery schedules or impacted schedules) shall be included in this work.

No payment for any other pay item will be processed beyond seventy-five (75) Calendar Days from Notice to Proceed (NTP) until the Baseline Schedule is accepted by the Engineer. Until the Engineer's acceptance of the Baseline Schedule, the combined total of all payments made to the Contractor will be limited to an amount no greater than the total price for Item 748 - Mobilization or 3% of the contract price, whichever is less.

All Contract Progress Schedule Updates submitted later than ten (10) Calendar Days after the CQE (Contract Quantity Estimate) completion date, or greater than forty (40) Calendar Days from the Data Date of the previous submission, will be deemed to be no longer useful and will not qualify for payment. The late submission of Impacted schedules, including TEAs, recovery schedules and proposal schedules will result in the forfeiture of the monthly payment for the month in which they were due and subsequent months until the submission is made. Late submission of missed submittals will not result in recovery of the previously forfeited portion of the Schedule of Operations Fixed Price Payment Item.

Failure to submit schedules as and when required may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

Failure to submit schedules that are acceptable to the Engineer may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section.

The Contractor's failure or refusal to comply with the requirements of this Section shall be reasonable evidence that the Contractor is not prosecuting the Work with due diligence and may result in the Engineer withholding of full or partial payments of all work performed.

722.82 Payment Items

722.1	SCHEDULE OF OPERATIONS (TYPE A) - FIXED PRICE $_____	LUMP SUM
722.2	SCHEDULE OF OPERATIONS (TYPE B) - FIXED PRICE $_____	LUMP SUM
722.3	SCHEDULE OF OPERATIONS (TYPE C) - FIXED PRICE $_____	LUMP SUM

ITEM 102.3 HERBICIDE TREATMENT OF INVASIVE PLANTS HOUR

This work must be performed by persons who meet the qualifications below and are approved by the Landscape Design Section.

Work under this item consists of herbicide treatment of invasive plants currently existing within the project limits and as directed. An Invasive Plant Management Strategy (IPMS) shall be submitted to the Engineer for review and approval and the IPMS shall be implemented on-site. The IPMS shall be written and submitted per Item 102.33 Invasive Plant Management Strategy and shall be measured and paid for under that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation items.

Payment is per hour on-site and shall be compensation for a minimum crew of 2 licensed applicators, 2 back-pack sprayers and mist-blowers, a properly equipped spray truck with spray hoses, and a tank with sufficient capacity for a full day of work. If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

Date and time stamped photos indicating start and stop time of work must be submitted if requested.

This item is not intended for manual removal of plants.

Management of plants determined to have been introduced to the site via imported loam, compost, mulch, plants, equipment, or other construction activities will be the Contractor's responsibility and at the Contractor's expense.

Herbicide shall be applied during daytime hours only.

Measures to prevent the introduction of invasive plant species to the site and to address introduction due to construction-related activities shall be covered under the Standard Specifications, Division I - Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property as amended in these Special Provisions.

Plant species targeted for management under this item shall be as determined in the field per the site walk and as specified in the IPMS.

The definition of invasive plant species shall be as described by Massachusetts Invasive Plant Advisory Group (MIPAG): "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems."

ITEM 102.3 (Continued)

Control of invasive plants shall begin immediately with the initiation of construction activities and prior to any clearing or site disturbance. Treatment areas shall include stockpile locations and may, upon approval of the Engineer, extend outside the project limit. Treatment shall be done each consecutive year for the duration of the contract unless specified otherwise in the IMPS or unless directed otherwise by the MassDOT invasive species contact. Work shall be done during the growing season from May – October unless otherwise specified in the IPMS.

Areas identified for vegetation control measures shall be as shown on the plans and as determined in the field by the Engineer and a MassDOT Landscape Architect. Contact at MassDOT Landscape Design Section may be contacted at: Maxwell.R.McNulty@dot.state.ma.us.

QUALIFICATIONS

The applicators shall submit and meet the qualifications outlined below. A list of contractors specializing in invasive management and approved by MassDOT Landscape Design Section is available on the following website: https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Requirements

1. Company must provide proof of qualifications by providing the following:
    a. Narrative describing company, its expertise and experience with invasive plant control.
    b. Demonstrate experience with herbicide treatment as part of restorations and in sensitive areas.
    c. Describe company's technical qualifications and past performance.

2. Company must meet licensing requirements:
    a. All crew applicators must have a Massachusetts Commercial Applicator License (CORE).
    b. At least one or more applicator must have a ROW certification, if required for work.
    c. Company must provide name(s) of applicator(s) and Applicator License/Certification number for all contractor crew leaders working on the project.
    d. Company must provide documentation of any warnings, penalties or fines received in the last three (3) years.

3. Company must provide proof of experience with invasive plant control and include following:
    a. At least five (5) references from prior invasive plant control work completed in last five (5) years. Provide contact information including address, phone number and email.
    b. Provide a summary of each of these projects including nature of the problem, specific invasive vegetation treated, dates and period of treatment, methodologies used, and summary of success or not in terms of meeting performance objectives. Include summary of equipment used.
    c. Photo documentation of these projects.
    d. GPS coordinates of project locations, if available.

ITEM 102.3 (Continued)

4. Crew leader must have expertise with invasive plant control and provide the following:
   a. Have held Core license for at least five (5) years.
   b. Resume listing five (5) or more years of experience applying pesticides with the company or with another company specializing in vegetation management.

SUBMITTALS

No work shall begin without approval of the submittals.

Submittals include the following items:

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to proposed treatment the IPMS shall be submitted for approval by the Engineer and MassDOT Landscape Architect. All chemicals, methods and work done under this item shall be consistent with the IPMS. The IPMS shall be as described under Item 102.33.

Herbicide Use Report

Within two (2) weeks after each application, the Contractor shall provide to the Engineer and the MassDOT Landscape Architect a completed and signed MassDOT Herbicide Use Report.

Photo Documentation

Digital photos with date and time of herbicide application work, showing start time and completion time, are required and must be submitted for measurement of payment upon request.

MATERIALS

All proposed herbicides shall be as approved in the IPMS. Herbicides shall be labeled for the method of treatment and shall meet all federal, state and local regulation requirements. Application rates will depend on herbicide proposed and shall be per the manufacturer's label for specific application.

METHODS

All methods used shall be as approved in the IPMS which shall be determined during the Initial Site Walk as described under Item 102.33 Invasive Plant Management Strategy.

The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

The Contractor shall notify the Engineer a minimum of 3 days prior to date of expected herbicide application. Applicators shall notify the Engineer upon arriving on-site and upon leaving the site.

ITEM 102.3 (Continued)

Herbicide Applications

All herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau.

Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones.

Contractor shall not spray 2 hours prior to precipitation, during rain, or during windy conditions. The Contractor shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used.

Targeted vegetation shall be identified and marked prior to treatment. Plants treated by foliar spray, injection or glove application or other methods that leave standing vegetation, as opposed to cut-stump application, shall remain clearly marked for identification through the contract period.

Desirable vegetation shall be protected from both spray and other physical damage.

Contractor is responsible for any damage to vegetation not designated for removal or treatment. Vegetation damaged shall be restored. Cost of replacement plants and/or restoration shall be borne by the Contractor.

Contractor shall ensure that the public does not enter a work area while herbicide application or spraying is underway.

Disposal Of Invasive Plant Material

All material to be cleared shall become the property of the Contractor. The satisfactory disposal of all cleared plant material (seeds, roots, woody vegetation, associated soils, etc.) shall be the Contractor's responsibility.

The Contractor shall take measures to prevent viable plant material from leading to further infestations (seeds, roots, woody material, etc.) while stockpiled, in transit, or at final disposal locations. All precautions shall be taken to avoid contamination of natural landscapes with invasive plants or invasive plant material.

Chipping, shredding, or on-site burning of plant material must be approved by the Engineer and included in the IMPS.

For plant material taken to an incinerating facility per the IPMS, a receipt from that facility shall be submitted to the Engineer as proof of disposal.

ITEM 102.3 (Continued)

Where feasible, it is preferable to dispose of plants on-site or to bury them on-site with on-going monitoring for re-sprouting. Disposal locations and methods must be approved and included in the IPMS. Site work such as grading and seeding to stabilize and restore disposal area shall be incidental to this item.

The Contractor shall be responsible for treating or otherwise managing areas of re-growth due to improper disposal. Treatment shall be at the Contractor's expense.

Follow-Up Treatment

Plants and areas shall be re-treated as necessary and as appropriate to the time of year. Treatment shall be for the duration of the contract and per the IPMS.

MEASURE OF SUCCESS

The expectation is a minimum of 85-95 percent control achieved after the first treatment, depending on plants targeted and extent of population, and based on the expectations laid out in the IPMS. The expectation for the contract duration is 95-100% eradication by the end of the treatment period, unless otherwise specified in the IPMS.

METHOD OF MEASUREMENT

Item 102.3 will be measured for payment by the Hour of verified crew time spent on the project doing herbicide application as and where specified herein and in the IPMS. A crew shall be defined as a minimum of two licensed applicators each equipped with (at minimum) back-pack sprayer and mist blower. The crew shall also have a properly equipped spray truck with hoses and a tank with sufficient capacity for a full day of work.

BASIS OF PAYMENT

Item 102.3 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work.

Payment will be based upon verified time spent on the project doing herbicide application as and where specified in the IPMS and upon receipt and approval of submittals. Payment will not include travel time to and from the Contractor's place of business and nor time for investigative field trips.

If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

The Invasive Plant Management Strategy will be paid for under Item 102.33.

ITEM 102.33 INVASIVE PLANT MANAGEMENT STRATEGY HOUR

This item consists of providing an Invasive Plant Management Strategy (IPMS) for the control of invasive plants currently existing on the project site and/or as directed and shall be coordinated with Item 102.3 Herbicide Treatment of Invasive Plants. Unless otherwise approved, the IPMS shall be submitted in the form of the MassDOT Invasive Plant Management Strategy Report Form.

The IPMS shall be submitted for review and approval by the MassDOT Landscape Design Section or their representative, and the IPMS shall be implemented on-site.

The Invasive Plant Management Strategy Report Form is available online at https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Herbicide treatment for invasive plants shall be as described under Item 102.3 Herbicide Treatment of Invasive Plants and shall be compensated per that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation as relevant to the project.

Individual attending the site walk and determining the Invasive Plant Management Strategy must demonstrate expertise with vegetation management and invasive plant control and submit qualifications as described below.

QUALIFICATIONS

Individual shall be from the same company as that providing services for Item 102.3 Herbicide Treatment of Invasive Plants and shall submit the following, if not submitted under Item 102.3:

- Submit copy of current Core license.
- Submit a resume listing five (5) or more years of experience managing invasive plants with a company specializing in vegetation management.
- References shall be submitted if requested.

SUBMITTALS

Task Summary & Reports

For measurement of payment, the contractor shall submit the total sum and a breakdown of hours for the tasks performed. At a minimum, the tasks shall include the Initial Site Walk, submittal of an approved IPMS, and if requested to accommodate project or site changes, a Follow-up Site Inspection and accompanying IPMS Amendment.

Interim Site Monitoring Reports and/or a Final Report shall be submitted if requested by the MassDOT Landscape Design contact. The MassDOT Landscape Design contact must be notified to attend the site inspection walk when an Interim or Final Report has been requested.

ITEM 102.33 (Continued)

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to construction activities and/or any proposed treatment, the contractor shall submit the IPMS for approval by the Engineer and MassDOT Landscape Architect. All chemicals and methods proposed shall be consistent with applicable Massachusetts Wetlands Protection Act Order of Conditions.

The IPMS shall be completed in coordination with the Prime Contractor and the Engineer and shall include the following as appropriate and applicable to the project and to the IPMS Report Form questions and Guidance:

I. Project Information
- a. Company writing the IPMS and performing the herbicide application.
- b. Date of site walk
- c. Attendees at site walk
- d. Expected end date of contract and expected last treatment (month/season)

II. Brief Description of Conditions
- a. Provide a free-hand sketch on construction plans or aerial image showing species, location, and as relevant, show or note extent of population as relevant to Strategy (i.e., population extends off ROW preventing eradication, small population and eradication deemed feasible within contract schedule, etc.).

III. Coordination with Roadway Contractor regarding other work
- a. Tree Work: Note coordination to be implemented with tree removal, clearing, and clearing and grubbing as applicable to the project.
- b. Wetland Mitigation - Include management proposed for wetland mitigation areas in the IPMS, if and as required.
- c. Planting: If there will be planting in areas proposed for treatment, propose treatment and schedule to avoid herbicide damage to plants.
- d. Mowing: If coordination is required with state mowers, note need in IPMS.

IV. Soil Management
- a. Provide specifics on how soil with invasive plant roots (in particular) or seeds will be handled (i.e., separate stockpiles, plant material will be buried on-site, re-used on-site, disposed off-site and if so, where?).
- b. Show stockpile locations on plan and include treatment schedule.
- c. Note measures that will be implemented to avoid spread through equipment, including how and where equipment will be cleaned.

V. Invasive Plant Treatment & Management
- a. Proposed chemical and methods of treatment for each species or area.
- b. Time of treatment based on target plant species.
- c. Submit product label including application methods and rates (entire MSDS information need not be submitted if available online).
- d. Proposed performance metrics or measure of treatment success if different from that specified under Item 102.3.
- e. Method for disposing invasive plant material. This includes material that may result in spread (i.e., seeds, roots) and material that has been treated and/or is not viable (foliage, dead wood, etc.). Methods may include grinding in place, stockpiling and treating, and incinerating offsite.

ITEM 102.33 (Continued)

f. Expected follow-up treatment for duration of contract.

VI. Monitoring Schedule if requested by MassDOT.

Note: The IPMS is critical for identifying pre-construction conditions as well as strategies for minimizing import or spread of invasive plants. Failure to provide an approved IPMS may jeopardize this item, in which case, the contractor will be responsible for management of invasive plants found on-site at no cost to the contract.

Photo Documentation

Digital photos of site conditions, typical species, and extent of infestation must be provided with the IPMS and with any follow-up monitoring or reporting. Photos of follow-up monitoring and reporting must be date and time stamped for acceptance.

METHODS

Initial Site Walk

Prior to any construction activities and soil disturbance, the Contractor shall walk the site with the Engineer and the MassDOT Landscape Architect to determine the IPMS. During the site walk the Contractor shall identify limits of work and, as necessary, mark locations of areas designated for treatment and individual plants targeted for treatment or removal. The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

IPMS Follow-up Amendment

The IPMS may be amended to address additional concerns or adjust to conditions if required by the MassDOT Landscape Architect. The amended IPMS shall be submitted to the Engineer and MassDOT Landscape Architect for approval at least fourteen (14) days prior to any proposed treatment.

Interim Site Monitoring Inspection Reports

If required by the MassDOT Landscape Architect and Engineer, Interim Site Monitoring and an accompanying report shall be conducted. Interim Reports must include time and date stamped photos showing treated locations and species.

Final Inspection

A final inspection and report documenting the status of the invasive control may be required for regulatory purposes or for instances where control will be continued by others. The report shall include photo documentation of pre-construction (existing) and post-treatment conditions, notations on a plan or aerial image of area treated, summary of treatment performed, and control achieved. Final reports submittal must include time and date stamped photos.

ITEM 102.33 (Continued)

METHOD OF MEASUREMENT

Item 102.33 will be measured for payment by the Hour. The basis for measurement shall be per the completion of tasks as approved under the Task Summary submittal and acceptance of submittals and photos described above.

BASIS OF PAYMENT

Item 102.33 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work. Payment shall not include travel time to and from the Contractor's place of business.

ITEM 102.511 TREE PROTECTION -ARMORING AND PRUNING EACH

The work under this item shall conform to the relevant provisions of Subsection 771 of the Standard Specifications and the following:

Tree protection – armoring and pruning shall be used for instances where construction activity (the use of heavy equipment), comes within proximity to potentially damage tree trunk(s) or limbs.

The work shall include the furnishing and installing of temporary tree trunk protection, minor limb pruning, or removal of lower tree limbs to prevent injury to the tree from construction equipment and activities; as shown on the Drawings; and/or as required by the Engineer.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the latest edition of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance: Part 1-Pruning and Part 5-Construction Management Standard. Provision of reference shall be incidental to this item.

MATERIALS

Trunk armoring shall be such that it prevents damage to the trunk from construction equipment. Material used for trunk armoring or mounting shall be such that installation and removal shall not damage the trunk.

Acceptable trunk armoring materials shall include two by four (2x4) wood cladding, mounted with wire or metal strapping, or when duration of construction activities is less than three months, slotted corrugated plastic pipe, mounted with duct tape. Eight (8) once untreated burlap shall be used to wrap the tree trunk prior to installation of cladding.

Alternative armoring methods or materials may be acceptable if approved by the Engineer.

The height of tree trunk cladding shall be measured from the base of the tree (including root flare) to the bottom of the first branch, or to a height of eight (8) feet, or as may be required by the Engineer.

METHODS OF WORK

Prior to construction activities, the Engineer, Contractor, and the Arborist (if item is included in the contract), shall review trees noted on the Drawings to be protected. Final decision and selection of trees to be armored and/or pruned shall be per the Engineer.

Care shall be taken to avoid damage to the bark during installation and removal of armoring. Trunk armoring shall be maintained such that it is effective for as long as required or replaced when materials are found to be damaged or ineffective, as determined by the Engineer. Replacement, if required, shall be incidental to the work. Armoring shall be removed immediately upon completion of work activities adjacent to the protected tree(s).

ITEM 102.511 (Continued)

Pruning of limbs shall conform to the techniques and standards of the most recent ANSI A300 standards.

DAMAGES OR LOSS

If trees designated for protection under this item are damaged, including root damage from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist, described in Item 102.55. The Arborist shall be approved by MassDOT.

If, based on the recommendation of the Arborist, the Engineer determines that damages can be remedied by corrective measures, such as repairing trunk or limb injury; soil compaction remediation; pruning; soil injection fertilization; and/or watering; the damage shall be repaired as soon as possible, within the appropriate season for such work and according to industry standards.

If, based on the recommendation of the Arborist, the Engineer determines that damages are irreparable, or that the damages are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and topsoil filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate tree protection shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.511 will be measured and paid at the contract unit price per EACH tree to be armored and pruned. This will include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract or as required by the Engineer.

Payment for work under this item will be scheduled as follows:

- 40% of the value shall be paid upon installation of trunk armoring and completion of pruning work, if required.
- 60% of the value shall be paid at the end of construction operations that would potentially damage the tree and after protection materials have been removed and properly disposed of by the Contractor. In the event of repairable damages, payment shall be made after the completion of remediation measures.

No separate payment will be made for costs of remedial actions, including Arborist services, tree removal, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the contract price of the work.

ITEM 102.521 TREE AND PLANT PROTECTION FENCE FOOT

The work under this Item shall conform to the relevant provisions of Subsections 644 and 771 of the Standard Specifications and the following:

Work under this item shall consist of furnishing, installing, and maintaining tree and plant protection fence(s) in a vertical and taut position; removing and resetting fencing as may be required; and final removal of protection fence(s) at the completion of construction activities, or as otherwise required by the Engineer.

The purpose of the fencing is to signify a construction work-free zone and physical barrier, thereby preventing damage to tree roots, tree trunks, soil, and all other vegetation within this delineated Tree and Plant Protection Zone (TPPZ), as shown on the Drawings, as required by the Engineer, and as described herein.

Protection shall be for the duration of the construction activities unless otherwise required by the Engineer.

MATERIALS

Tree and plant protection fence(s) shall provide a minimum forty-eight (48) inch tall barrier, that remains vertical and taut. The Fence shall be orange plastic safety fence (recommended where high visibility is necessary), or wooden snow fencing, or other approved material. Posts and anchoring materials shall be incidental to the work.

Per requirements of the Engineer, additional posts, deeper post depths, and/or additional attachments shall be used if the fabric or fence sags, leans or otherwise is not providing visible or physical protection to the TPPZ.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 1, Pruning and Part 5, Construction Management Standard. Provision of reference shall be incidental to this item.

ESTABLISHMENT OF THE TPPZ

Fencing shall be used to delineate and establish the TPPZ, adjacent to construction areas, staging areas, stockpile areas, as shown on the Drawings, and/or as required by the Engineer.

Fencing shall be located as close to the work zone limit and as far from tree trunk(s) and plants as possible to maximize the area to be protected. Fence shall run parallel and adjacent to construction activity to create a barrier between the work zone and the root zone or designated limit of plants and soils to be protected.

ITEM 102.521 (Continued)

When construction activities surround (or have the potential to surround) trees or plants to be protected, a circular enclosure shall be used. In these instances, the TPPZ limit shall be the drip line of each tree or as close as possible to the drip line, and/or as shown on the Drawings. The drip line is defined as the outermost limit of tree canopy.

The Contractor shall not engage in any construction activity within the TPPZ without the approval of the Engineer. Activities may including operating, moving, or storing equipment, supplies, or materials; and locating temporary facilities, including trailers or portable toilets, Accessing or traversing the TPPZ shall not be permitted.

METHOD OF WORK

TPPZ fencing shall be installed prior to any construction work or staging activities. Fence(s) shall be repositioned where and as necessary for optimum tree and plant protection. Repositioning shall be incidental to this item. TPPZ fencing shall not be moved without prior approval by the Engineer.

The TPPZ shall be protected at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves, and roots of all plants; and contamination of the soil with construction materials, debris, silt, fuels, oils, and any chemicals substance.

After construction activities are completed, or when required by the Engineer, fencing, stakes, and other anchoring materials, if any, shall be removed and disposed off-site by the Contractor.

REQUIRED WORK WITHIN THE TPPZ

In the event that grading, trenching, utility work, or storage is unavoidable within the TPPZ, the Engineer shall be notified. Measures may be required for tree protection and preservations, including air spading; the use of six (6) inch depth of wood chips or approved matting for root protection; pruning of branches; and/or trunk protection. These protection measures shall be paid under applicable contract items.

Landscaping work specified within the TPPZ shall be accomplished by hand tools. Where handwork is not feasible, with permission of the Engineer, work shall be conducted with the smallest mechanized equipment necessary.

TREE AND PLANT INJURY OR LOSS

If the TPPZ is encroached by construction activity without approval, at the discretion of the Engineer, the Contractor may be required to provide a more durable barrier (e.g., Jersey Barriers, chain link fence (if not already in use) to secure the area. Costs of furnishing and installing additional or more durable barrier(s) shall be borne by the Contractor.

In such cases of encroachment, soils shall be considered compacted and tree root injury will be assumed. Action shall be taken as specified below.

ITEM 102.521 (Continued)

In the event that trees designated for protection under this item are injured, including root injury from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist, described under Item 102.55. The Arborist shall be approved by MassDOT.

In the event of spills, compaction or injury, the Contractor shall take corrective action immediately using methods approved by the Engineer, in coordination with the Arborist.

If, based on the recommendations of the Arborist, the Engineer determines that injuries can be remedied by corrective measures, such as repairing trunk or limb injury, soil compaction remediation, pruning, and/or watering; the injury shall be repaired as soon as possible, within the appropriate season for such work, and according to industry standards.

If, based on the recommendations of the Arborist, the Engineer determines that injuries are irreparable, or that the injuries are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate protection of the TPPZ shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

Shrubs removals from improper or inadequate protection of the TPPZ shall be replaced with plants of similar species and equal size or the largest size plants reasonably available. The Engineer shall approve the size, quality, and quantity of the replacement plant(s). Each replacement shall include a minimum of one year of watering and establishment care, specified under Subsection 771.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Tree and Plant Protection Fence will be measured by the FOOT, complete in place, by the length along the top of the fence.

Tree and plant protection fence will be paid for under the contract unit price per FOOT, complete in place and shall include all materials, labor, and equipment required to furnish, install, anchor, maintain, and remove the fence upon completion, as described herein. Posts, temporary footings, anchoring and removal upon completion, shall be incidental to this item.

No separate payment will be made for costs of remedial actions, including addition of more durable barriers, Arborist services, tree or plant removal, shrub replacement and establishment, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the contract price of the work.

ITEM 102.521 (Continued)

Payment for work under this item will be scheduled as follows:

- Forty (40) percent of the value payment will be made upon installation of fencing.

- Sixty (60) percent of the value payment will be made when fencing materials have been maintained to function as specified, for the intended duration, and removed and disposed off-site at the completion of protection measure requirement.

ITEM 152.71 PEASTONE DIAPHRAGM LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsections 150, 200, M2, and M9 of the Standard Specifications and the following.

The work under this Item includes furnishing and installation of a 2-foot wide by 6-inch deep peastone (M2.01.6) diaphragm adjacent to the proposed infiltration trench. The Contractor shall place peastone approved by the Engineer at the location shown on the plans.

MATERIALS

Peastone shall meet the following gradation requirements.

Sieve Size	Percent Passing by Weight
½ inch	100
3/8 inch	85-100
No. 4	20-50
No. 8	0-15
No. 16	0-5

Non-Woven Geotextile filter fabric shall meet MassDOT M 9.50.0 and Application Code 1 for subsurface drainage shall be installed along all sides of the peastone diaphragm.

BASIS OF PAYMENT

Item 152.71 will be paid for at the Contract Lump Sum price, which price shall include, furnishing, installation, excavation, peastone, filter fabric, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 180.01 ENVIRONMENTAL HEALTH AND SAFETY PROGRAM LUMP SUM

The work shall consist of ensuring the health and safety of the Contractor's employees and subcontracting personnel, the Engineer, their representatives, the environment, and public welfare from any on-site chemical contamination present in air, soil, water and sediment.

The Contractor shall prepare and implement a site-specific Environmental Health and Safety Plan (EHASP) which has been approved and stamped by a Certified Industrial Hygienist (CIH) and includes the preparer's name and work experience. The EHASP shall include appropriate components required by OSHA Standard 29 CFR 1910.120(b) and the Massachusetts Contingency plan (MCP) 310 CMR 40.0018 and must comply with all applicable state and federal laws, regulations, standards and guidelines, and provide a degree of protection and training appropriate for implementation on the project. The EHASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. The EHASP shall be developed and implemented independently from the standard construction HASP required to work on all MassDOT construction projects.

Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions, including but not limited to standards established by OSHA and National Institute for Occupational Safety and Health (NIOSH). Equipment used for the purpose of health and safety shall be approved by and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the most up-to-date version of the EHASP shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the MassDOT, Contractor, and Subcontractors involved with on-site activities. The employee's signature on the EHASP shall be deemed prima facie evidence that the employee has read and understands the plan. Updated copies of signature sheets shall be submitted to the Engineer.

The EHASP shall specify a Contractor Site Safety and Health Officer responsible for implementation of the EHASP and to oversee all construction activities, including handling, storage, sampling and transport, which require contact with or exposure to potentially hazardous materials.

The level of protection, required to ensure the health and safety of on-site personnel will be stipulated in the EHASP. The Site Safety and Health Officer shall implement the EHASP based on changing site and weather conditions, type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, air monitoring data, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and type of equipment to be utilized.

ITEM 180.01 (Continued)

During implementation of the EHASP, a daily log shall be kept by the Site Safety and Health Officer and a copy shall be provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personal protection being employed, screening data and any other information relevant to on-site environmental safety conditions. The Site Safety and Health Officer shall sign and date the daily log.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Preparation and implementation of the Environmental Health and Safety Program, including the monitoring, protection and storage of all contaminated materials, as well as subsequent modifications to the EHASP, will be measured and paid for at the Lump Sum Bid Price.

Payment of 50% of the Environmental Health and Safety Program contract price will be made upon the initial acceptance of the EHASP by the Engineer. Payment of the remaining 50% of the Environmental Health and Safety Program contract price will be made upon completion of the work. The bid price shall include preparation and implementation of the EHASP as well as the cost for its enforcement by the Site Safety and Health Officer along with any necessary revisions and updates. The work of implementing the Environmental Health and Safety Program includes work involving, but not limited to, the monitoring, protection, and storage of all contaminated materials.

ITEM 180.02 PERSONAL PROTECTION LEVEL C UPGRADE HOUR

The work shall consist of providing appropriate personal protective equipment (PPE) for all personnel in an area either containing or suspected of containing a hazardous environment.

Contingencies for upgrading the level of protection for on-site workers will be identified in the EHASP and the Contractor shall have the capability to implement the personal protection upgrade in a timely manner. The protective equipment and its use shall be in compliance with the EHASP and all appropriate regulations and/or standards for employee working conditions.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Personal Protection Level C Upgrade will be measured and paid only upon upgrade to Level C and will be at the contract unit price, per hour, per worker, required in Level C personal protection. No payment will be made to the Contractor to provide Level D PPE.

ITEM 180.03 LICENSED SITE PROFESSIONAL SERVICES HOUR

Within limited areas of the project site, media (i.e. soils, sediments, surface water and/or groundwater) requiring evaluation and/or management under the Massachusetts Contingency Plan (MCP) may be encountered. A Licensed Site Professional (LSP) shall be required to provide the services necessary to comply with the requirements of the MCP. These services may include a site walk, field screening, sampling, analysis and characterization of potentially contaminated media, preparation and implementation of Immediate Response Action (IRA) Plans, Utility-Related Abatement Measure (URAM) and Release Abatement Measure (RAM) Plans, Imminent Hazard Evaluations, status reports, transmittal forms, release notification forms, risk assessments, completion statements, and related documents required pursuant to the MCP. LSP services shall also be necessary to temporarily move material generated on the project to an off-site storage location.

The name and qualifications of the LSP and all environmental technicians to be assigned to the project shall be submitted to the Engineer for approval at least four weeks prior to initial site activities. The LSP shall have a current, valid license issued by the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals. The LSP shall have significant experience in the oversight of MCP activities at active construction sites. Qualification packages for the LSP and each technician shall include a resume, all recent work assignments with responsibilities identified (previous 5 years), and applicable training and certifications. A list of all Notices of Noncompliance, Notice of Audit Findings and Enforcement Orders issued by the Massachusetts Department of Environmental Protection (DEP) shall be submitted for all work assignments listed for the LSP and environmental technicians. Upon approval of the LSP Qualifications, the LSP will be designated as the LSP of Record unless MassDOT designates in writing otherwise. The LSP of Record will serve as the primary point of contact for all hazardous material matters on the project.

The LSP shall evaluate soil and/or sediment with discoloration, odor, elevated field screening results, presence of petroleum liquid or sheen on the groundwater surface, or any abnormal gas or materials in the ground which are known or suspected to be oil or hazardous materials. Excavated soil and sediment which is suspected of petroleum contamination shall be field screened using the jar headspace procedures according to established DEP Guidance. All field screening equipment must be pre-approved by the Engineer. The LSP shall ensure proper on-site calibration of all field screening instrumentation.

The Engineer shall be contacted immediately when observations or any field screening results verify contamination requiring further analysis, and/or enhanced management of suspect media. Any enhanced management of contaminated soil to ensure proper stockpiling and storage is incidental to the LSP Services item. The LSP shall evaluate the need for confirmatory sampling prior to backfill in areas where contaminated material has been excavated and disposed off-site for compliance with applicable regulatory requirements. The Engineer shall approve the locations of the testing sites prior to the sampling.

ITEM 180.03 (Continued)

Contaminated media shall be handled in accordance with all applicable state and federal statutes, regulations, and policies. The LSP shall adequately evaluate contaminated media for compliance with the requirements of the MCP and Department Policies.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and both shall be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations. The LSP shall maintain written records in a clear and concise tabular format which tracks the excavation, stockpiling, analysis and reuse/disposal of all known/suspect contaminated media. These records shall be up-to-date and submitted to the Engineer on a bi-weekly basis. The LSP shall review and summarize the laboratory data from any analyses performed on contaminated media in a tabular format and compare the results to applicable reporting thresholds. A report shall be delivered to the Engineer outlining the material sampling methods, laboratory analysis results, evaluation of applicable regulatory exemptions, reporting obligations, and proposed course of action. The laboratory report together with Chain of Custody forms for all analytical results shall be submitted to the Engineer within 14 days after completion of such analyses.

The LSP and Contractor shall be held responsible for the submission of all MCP-related documents to the Engineer at least 14 days in advance of any timeframe specified in the MCP and for the timely submission of data and tracking information as noted within this Item. All documents prepared under this Item must be reviewed and signed by the approved LSP. The Contractor and LSP shall be responsible for all fines, damages, and enforcement requirements imposed by applicable regulatory agencies for failure to meet regulatory and contract timeframes. No compensation will be provided for such fines, damages, and enforcement actions.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and shall both be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations.

If the Contractor causes a release of OHM, the Contractor shall be responsible for assessing and remediating the release in accordance with all pertinent State and Federal regulations, including securing the services of a LSP, at his own expense.

The LSP shall coordinate all activities involving both MassDOT and the DEP through the Engineer. Any notification of release shall be approved by the Engineer before submittal to the DEP, except if an imminent hazard condition exists as defined in 309 CMR 4.03(4)(b).

ITEM 180.03 (Continued)

LABORATORY TESTING IN SUPPORT OF LSP SERVICES

Laboratory testing provides for analytical testing in support of LSP services related to maintaining MCP compliance, such as delineating the extent and type of contamination present. Sampling and testing for disposal purposes are not included and are incidental to Items 181.11-181.14.

In order to maintain compliance with the MCP and Department Policies or other regulatory requirements, the LSP shall request approval from the Engineer to obtain samples from various locations and depths within the project area and to perform laboratory analyses on those samples. No sampling shall be conducted without prior approval from the Engineer. The samples shall be delivered to a DEP-certified laboratory using proper chain-of-custody documentation for analyses which, depending upon site conditions and suspected and/or identified contaminants of concern, may include, but are not limited to, metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbons (EPHs) and volatile petroleum hydrocarbons (VPHs). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (EPA Method 1311) for metals.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

LSP Services for work under this item will be measured per person, per hour of service provided by LSP, Environmental Technicians and other approved personnel. Travel time shall not be included in the billable hours.

The quantity and type of laboratory tests must be approved by the Engineer beforehand. The Contractor will be reimbursed upon satisfactory written evidence of payment. The Contractor may be required to obtain cost estimates from three DEP certified laboratories for the Engineer to choose the service provider.

LSP Services will be paid at the Contractor bid price for each hour, or fraction thereof, spent to perform the work as described above. The bid price shall be a blended rate that includes the cost of the LSP, environmental technicians and other personnel, the performance of all work tasks and field screening, including required equipment, materials and instrumentation, and production of all documentation described above. All requests for payment must be accompanied by the following information: the names of the personnel associated with the work charged under LSP Services, dates and hours worked, work conducted, including, where appropriate, locations as identified on the construction plans, and a copy of the field diary for the dates submitted.

ITEM 180.03 (Continued)

Laboratory testing will be reimbursed upon receipt of paid invoices for testing approved by the Engineer.

This item is for LSP work for compliance with the MCP and Department Policies. LSP hours and any laboratory testing related to off-site disposal of excess soil and sediment is incidental to Items 181.11-181.14 (including, but not limited to, disposal characterization, disposal package preparation, landfill acceptance, shipment paperwork preparation, field screening, and tracking). LSP hours for groundwater management (including characterization, obtaining off-site discharge permits, compliance testing, etc.) is incidental to Item 183.1.

ITEM 181.11	**DISPOSAL OF UNREGULATED SOIL**	**TON**
ITEM 181.12	**DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY**	**TON**
ITEM 181.13	**DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY**	**TON**
ITEM 181.14	**DISPOSAL OF HAZARDOUS WASTE**	**TON**

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as "disposal" for the purposes of this specification. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying disposal facility (ies) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

CLASSES OF CONTAMINATED SOILS

The Contractor and its LSP shall determine if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the MCP. Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

ITEMS 181.11 through 181.14 (Continued)

UNREGULATED SOIL consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas. Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to MassDOT the proposed disposal location for unregulated soils for approval. If such a disposal location is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the MassDOT construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal location that they have been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

ITEMS 181.11 through 181.14 (Continued)

REGULATED SOIL consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form. This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

HAZARDOUS WASTE consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.

MONITORING/SAMPLING/TESTING REQUIREMENTS

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Item 180.03 – LSP Services. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

ITEMS 181.11 through 181.14 (Continued)

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

WASTE TRACKING:

Copies of the fully executed Weight Slips/Bills of Lading/ Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with MassDOT to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

DECONTAMINATION OF EQUIPMENT

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item.

ITEMS 181.11 through 181.14 (Continued)

REGULATORY REQUIREMENTS

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts DEP, the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions shall apply. The Contractor shall reimburse MassDOT for all costs it incurs, including damages and/or fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

SUBMITTALS

I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option.

The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to MassDOT.

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis program. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a baseplan to record this information.

The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and, all analytical results.

ITEMS 181.11 through 181.14 (Continued)

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

II. Stockpiling, Transport, and Disposal.

At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to MassDOT.

Excavation and Stockpiling Protocol:
Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material.

Disposal and Recycling Facilities:

1. Provide the name, address, applicable licenses and approved waste profile for disposal and/or recycling location(s) where contaminated soil will be disposed. Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.

2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. MassDOT reserves the right to reject any facility on the basis of poor compliance history.

Transportation:
The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

III. Material Tracking and Analytical Documentation for Reuse/Disposal.

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to MassDOT.

ITEMS 181.11 through 181.14 (Continued)

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

Demolition Debris:
Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station-offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on-site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation range, quantity, and finish grade for said location. For demolition debris which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.

Soil/Sediment:
Soil excavation will be identified based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material off-site using the same categories identified for demolition debris above.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used. The work of the LSP for disposal under all of these items shall be incidental to the work with no additional compensation.

ITEM 181.11 Measurement for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in tons, of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 181.12 Measurement for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEMS 181.11 through 181.14 (Continued)

ITEM 181.13 Measurement for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 181.14 Measurement for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight in tons of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 182.1 INSPECTION AND TESTING FOR ASBESTOS LUMP SUM

The work shall include the inspecting and testing of all materials suspected of containing asbestos. When any demolition is required to enable the inspection and testing of the suspected material it will be considered incidental to this Item and the Contractor must perform all asbestos handling and testing in accordance with the regulations stated below.

Dust suppression in the form of light water sprays, foams, dust suppressants and calcium chloride will be implemented as required to control dusting during any disturbance of asbestos suspected material. Alternatively, intrusive activities may be reduced or curtailed under high wind or heavy rain conditions, which in the opinion of the Health and Safety Plan (HASP) may pose a safety hazard to the workers.

The Contractor shall employ the services of a Massachusetts licensed "Asbestos Inspector" to inspect the material to determine whether or not "ITEM 182.2 REMOVAL OF ASBESTOS" is required. Should the asbestos inspector determine laboratory testing is required, a state certified laboratory shall be used to perform all necessary tests.

REGULATIONS

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) including but not limited to:

29 CFR 1910 Section 1001 and 29 CFR 1926 Section 58 Occupational exposure to Asbestos, Tremolite, Anthophyllite and Actinolite, Final Rule
29 CFR 1910 Section 134 Respiration Protection
29 CFR 1926 Construction Industry
29 CFR 1910 Section 2 Access to Employee Exposure and Medical Records
29 CFR 1910 Section 1200 Hazard Communication
29 CFR 1910 Section 145 Specifications for Accident Prevention Signs and Tags

U.S. Environmental Protection Agency, (EPA) including but not limited to:

40 CFR 762, CPTS 62044, FRL 2843-9, Federal Register Vol. 50 no.134, July 12, 1985 p.28530 - 28540 Asbestos Abatement Projects Rule
40 CFR 61 Subpart A Regulation for Asbestos
40 CFR 61 Subpart M (Revised Subpart B) National Emission Standard for Asbestos

ITEM 182.1 (Continued)

U.S. Department of Transportation 49 CFR 172 and 173

Massachusetts Department of Labor Standards Regulations, (DLS) including but not limited to:

454 CMR 28.00 Removal, Containment and Encapsulation of Asbestos

Massachusetts Department of Environmental Protection (DEP) including but not limited to (supplementing subsection 7.01):

310 CMR 7.00, Section 7.09 Odor and Dust, Section 7.10 Noise, Section 7.15 Air Pollution Control Regulations
310 CMR 18.00 and 19.00 Solid Waste Regulations

Massachusetts Division of Industrial Safety 45 CMR 10.00

Local Requirements including but not limited to those of Health Departments, Fire Departments and Inspection Services Departments

Wherever there is a conflict or overlap of the above references, the most stringent provision shall apply.

BASIS OF PAYMENT

Item 182.1 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work as described and as required by the Engineer.

No separate payment will be made for the protection of general public, private property, the proper inspecting and testing of the material, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 184.1 DISPOSAL OF TREATED WOOD PRODUCTS TON

Work under this item shall include the transportation and disposal of all treated existing wood product as directed by the Engineer.

The timber components of the existing structure are suspected to be treated with creosote, pentachlorophenol and/or CCA. This item shall include all costs for sampling, laboratory testing, loading, transportation and disposal of the treated wood. The Contractor is required to submit disposal manifests to the Engineer prior to the completion of the project. All aspects of this Item are to be completed in accordance with state and federal regulations.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment will be by the weight, in tons, of treated timber transported and accepted at a licensed facility. The work shall be considered full compensation for all labor, tools, equipment, materials, testing, loading, transportation, approvals, and permits necessary for the completion of the work.

ITEM 201.7 CATCH BASIN – DOUBLE GRATE EACH

The work to be done under this Item shall conform to the relevant provisions of Subsection 201 of the Standard Specifications, and the following:

The work under this Item shall include furnishing and installation of double grate catch basins as shown on the details and required by the Engineer.

CONSTRUCTION METHODS

Catch Basin – Double Grate shall have an inside diameter of 5 feet.

Catch Basins – Double Grate shall be precast concrete structures with a 4 foot sump.

Catch Basins – Double Grate shall be installed as shown on the details.

METHOD OF MEASUREMENT

Item 201.7 will be measured for payment by the Each catch basin – double grate furnished and installed, complete in place.

BASIS OF PAYMENT

Item 201.7 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all excavation, all labor, materials, tools, equipment and incidental costs required to complete the work.

Catch Basin hoods shall be paid for under Item 224.12 – 12 Inch Hood.

Crushed stone for bedding shall be paid for under Item 156. Crushed Stone.

Frame and grates shall be paid for under Item 222. Frame and Grate – MassDOT Bar Type.

ITEM 203. SPECIAL MANHOLE EACH

The work under this Item shall conform to the relevant provisions of Subsections 201, 901, M4, and M8 of the Standard Specifications, and as follows:

The work under this Item includes furnishing and installing a special manhole at the location shown on the plans.

CONSTRUCTION METHODS

Drain manholes shall be precast concrete conforming to the latest ASTM Specifications for precast reinforced concrete sections (ASTM C478). Concrete shall have a minimum compressive strength of 4,000 psi. Reinforcing steel shall conform to the latest ASTM A185 Specifications. The manhole shall be capable of supporting an HS-20 load.

The joints of precast manhole sections shall be sealed with either a round rubber "O"-ring gasket or a flexible joint sealant. The "O"-ring shall conform to ASTM C443.

The cone sections of manholes shall be replaced with flat tops sections, when approved by the Engineer, at no additional cost.

The manhole shall be placed on a bedding of 12 inches of crushed stone when required by the engineer.

The manhole casting shall be a standard frame and cover. The cover shall be marked "DRAIN".

All castings located within the pavement area shall not be set to finished grade until after the binder course has been placed. Adjustment to grade for frame and cover shall be made using courses of brick conforming to ASTM C32, Grade 55, or by use of precast concrete rings conforming to ASTM C478, which will be paid for under Item 203.

All frames shall be set in a concrete collar conforming to Construction Standard Details, Drawing No. E 202.9.0 prior to placement of the top course pavement. The cost of the concrete collar shall be included in the unit price bid for this item.

METHOD OF MEASUREMENT

Item 203. will be measured for payment by the Each special manhole furnished and installed, complete in place.

BASIS OF PAYMENT

Item 203. will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, concrete collar, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

Crush stone for bedding shall be paid for under Item 156. Crushed Stone.

ITEM 220.8 SANITARY STRUCTURE REMODELED EACH

Work under this Item shall conform to the relevant provisions of Subsections 201 and 220 of the Standard Specifications and the following:

CONSTRUCTION METHODS

When the line or grade or both the line and grade of the structure changes by more than 6 in. the structure shall be remodeled. The sloped masonry and the vertical masonry shall be removed to such depths as directed by the Engineer and new masonry shall be constructed to conform to the proposed design and in conformity with the requirements of the applicable parts of Subsection 201: Basins, Manholes and Inlets. All associated work shall conform to the City of Peabody's requirements.

Frames and grates (or covers) determined to be unsatisfactory for reuse shall become the property of the Contractor and shall be removed and discarded. All frames and covers designated to be discarded shall be carefully removed, transported and discarded in accordance with all applicable regulations. The new masonry construction, replacing of castings, highly early strength concrete collars, backfilling around structures and other incidental work shall be as specified in Subsection 201: Basins, Manholes and Inlets. This work will be paid for under Item 220.8.

METHOD OF MEASUREMENT

Item 220.8 will be measured for payment by the Each sanitary structure remodeled, complete in place and approved by the Engineer.

BASIS OF PAYMENT

Item 220.8 will be paid for at the Contract unit price per Each, which price shall include remodeling, all labor, materials, equipment and all incidental costs required to complete the work.

ITEM 223.1 FRAME AND GRATE (OR COVER) REMOVED AND STACKED EACH

The work under this Item shall conform to the relevant provisions of Subsection 201 of the Standard Specifications and the following:

CONSTRUCTION METHODS

The existing frames and grates or covers from existing structures shown on the Plans to be abandoned, removed, or changed in type, shall be removed and stacked unless, in the judgment of the Engineer, they are unsuitable for salvage. Unsuitable frames, grates and covers shall become the property of the Contractor and shall be legally disposed of off the site at no additional cost to the Owner. New frames, grates, and covers shall be furnished and installed for new structures and change in type structures, and paid for under their respective items.

Existing frames and grates or covers owned by the Municipality shall be removed, transported, unloaded, and stacked at the Municipality's Department of Public Works Yard (50 Farm Ave, Peabody, MA 01960) as required by the Engineer.

METHOD OF MEASUREMENT

Item 223.1 will be measured for payment by the Each frame and grate (or cover) removed and stacked.

BASIS OF PAYMENT

Item 223.1 will be paid for at the Contract unit price per Each, which price shall include removal, stacking, disposal of unsuitable frames and grates or covers, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 228. CLOSED CIRCUIT TV INSPECTIONS OF SEWER LINE LUMP SUM

Work under this Item shall consist of furnishing all labor, materials, accessories, equipment, tools, transportation and services for performing all operations required to professionally execute the internal inspection of sewer line at for the following locations:

- Proposed boardwalk construction from Station 351+/- to Station 355+50+/-
- Proposed 16-inch diameter ductile iron pipe at Station 358+50+/- (near Endicott Street).

It shall be the sole responsibility of the Contractor to obtain information concerning depths of flow, manhole depths, air quality in the sewer, accessibility of manholes, and other safety considerations and to incorporate the necessary provisions into the overall lump sum prices to complete the specified work under the conditions existing in the sewer to be inspected.

The existing sewer line within the for the defined locations shall be inspected using Closed Circuit TV (CCTV) at the beginning of the project, prior to any major work activities or large equipment mobilizing on site. A CCTV inspection of the existing sewer line for the same limits shall also be performed at the end of construction to confirm its condition has not changed over the course of the project.

The Contractor shall submit a plan for the pre, and post CCTV inspection of the existing sewer line for the limits described in this special provision to the Engineer for review and approval before the work can commence.

System Description

The Contractor shall perform Closed Circuit TV (CCTV) inspection of the Lowell Branch Interceptor as specified herein. The 42” sewer passes through the project area, running adjacent to the proposed bikepath between Northshore Road and Endicott Street. The Contractor shall anticipate that inspections of the sewer shall be required along the section of sewer in proximity to the proposed bikepath bridge over Proctor Brook, which is approximately 300 feet long. These inspections will occur before and after the proposed Work.

Qualifications:

Work shall be performed by Contractor with a minimum of ten (10) years’ experience in Closed Circuit TV inspection of sewers with diameters in excess of 24 inches.

Procedures and Equipment

One basic method of internal pipe inspection shall be made available by the Contractor for this project; remote inspection.

1. Special industrial grade color inspection cameras, contained in waterproof housings, and mounted on floating skids or rafts.

ITEM 228. (Continued)

All cameras used shall be color units specifically designed or modified for use in sewer inspection work. The cameras shall be operable in 100% humidity conditions. The camera lens shall have not less than a 65-degree viewing angle and shall have either automatic or remote focus and iris controls. Camera lighting shall be sufficient for use with color inspection cameras. In all cases, the complete video system (camera, lens, lighting, cables, monitors and recorders) shall be capable of providing a picture quality acceptable to the Engineer, and if unsatisfactory, equipment shall be removed, and re-inspection shall be performed with more suitable equipment.

No payment will be made for unsatisfactory inspections.

Remote pipe inspections

Remote pipe inspections, using either electric or manually operated winches to pull the inspection camera through the sewer line, shall be performed in the sewer.

The camera shall be pulled through the sewer line in either direction at a speed not greater than 30 feet per minute, stopping as necessary to permit proper documentation of the sewer's condition. If, during the inspection operations the inspection camera will not pass through the entire manhole section, the Contractor shall reset his equipment so that the inspection can begin at the opposite manhole. If again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete and no additional inspection work will be required.

The camera used in remote pipe inspections shall in addition to requirements described above, be equipped with a rotating head capable of 90-degree rotation from horizontal and minimum 180-degree rotation about its centerline. The camera lens shall be capable of a minimum 140 degree viewing angle with automatic or remote focus and iris controls. Focal distance shall be adjustable through average of 6 inches to infinity.

In instances where manual or remote power winches are used to pull the camera through the sewer (i.e., where the recording technician does not directly control the winch), constant two-way communication shall be set up between the two manholes of the line being inspected to permit the recording technician to communicate clearly with the crew member controlling the camera's movement.

Execution

The Contractor shall perform an inspection prior to work beginning in the area adjacent to the sewer interceptor line between Warren Street Extension and Endicott Street. This inspection will record to the condition of the line prior to construction.

After the bikepath has been constructed within this area, the Contractor shall perform a post construction inspection of the sewer main to confirm the condition of the pipe.

Accurate and continuous footage readings shall be superimposed on the video recording for each line inspected by remote inspection methods. Also shown shall be the date of inspection and a three-digit manhole number designation for each manhole on the line section inspected.

ITEM 228. (Continued)

Lines scheduled for inspection shall be inspected in their existing condition. The Contractor shall be responsible for having the necessary camera skids, floats, and rafts available to allow for inspection of these lines in a manner acceptable to the Engineer under live flow conditions.

The following general criteria shall be followed:

1. The inspections shall occur at off-peak hours, between midnight and 4am. No inspections shall be performed where flow depths exceed 50% of pipe diameter without prior approval of the Engineer.

2. The maximum flow depth for remote or manual inspection work is 33% of the pipe diameter. The Contractor may be required to perform inspections during off-peak hours (night inspections) if specifically requested by the Owner to achieve this maximum flow standard.

The Contractor shall submit a listing of actual measured flow depths and times of measurement at a sufficient number of locations to indicate the flow depths that could be expected during inspection work. A minimum of one flow depth measurement shall be provided for each line section at no additional cost to MassDOT. Additional off-peak flow measurements (i.e., night flow measurements) may be requested by the Engineer at various locations also at no additional cost to the MassDOT.

A kick-off meeting shall be scheduled with the Engineer, MassDOT and the City of Peabody prior to beginning any internal pipe inspection work to review the Contractor's proposed schedule, procedures and inspection methods. At that time, the Contractor shall have available the necessary flow depth data described in above as well as the overall listing of proposed inspection methods.

Documentation and Reports

Video recordings shall include an audio track recorded by the inspection technician during the actual inspection work describing the parameters of the line being inspected (i.e., location, depth, diameter, pipe type), as well as describing connections, defects and unusual conditions observed during the inspection. All videotapes shall be of the 120 minute minimum DVD-R, DVD-RW, or DVD+R high quality color and each shall be professionally labeled showing the MWRA’s name, the lines recorded on the tape, and the name of the Contractor.

ITEM 228. (Continued)

Printed inspection reports shall be prepared by the Contractor for each sewer line inspected during the actual field inspection activities. These field logs shall then be reviewed by the Contractor's technical staff, along with reviewing the associated video record, as a means of insuring that no defects or entries are omitted or incorrect, and as a means of gaining a second opinion as to the condition of each sewer line. Edited field logs shall then be reprinted or typed for use in the final project reports. Detailed, one-page summaries shall also be prepared for each line section inspected, during the data review, presenting the synopsis of the general line condition and the relative severity of observed defects. These summaries shall also be included in all field report copies immediately before each associated inspected report to further assist the Engineer in understanding and using the results of the inspection project. Direct submittal of copies of the field technician's field logs, without this secondary review and summary pages, shall not be acceptable.

The 35 mm photographs taken during manual, walk-through inspections shall be properly mounted and labeled on 8.5 x 11 inch paper for inclusion in the final project reports. One copy of the final reports shall contain the original 35 mm photos, on fully laminated pages, and the remaining requested copies shall contain copies of these photo pages, The photo pages shall be presented immediately following the inspection report for the line section in which they were taken.

Photographs taken from the video monitor for remote TV inspections shall be properly mounted and labeled on 8.5 x 11 inch paper for inclusion in the final project reports. One copy of the final reports shall contain the original photos, on fully laminated pages, and the remaining requested copies shall contain copies of these photo pages, The photo pages shall be presented immediately following the inspection report for the line section in which they were taken. The Engineer and MassDOT desire photos of all significant defects observed during remote inspection work; however, it is understood that it may not be possible to obtain clear still photos from the monitor for inspections in lines where manual inspections are not performed.

Original DVDs for the project shall be forwarded to the Engineer with final report submittals. Additional copies of the DVDs, if requested, shall be made by the Contractor on professional tape duplication equipment.

BASIS OF PAYMENT

Item 228. will be paid for at the Contract Lump Sum price, which price shall include media, recordings, inspections of pipe access locations, inspections to evaluate sewer conditions, worker safety measures, cameras, lighting, photographs, inspection logs and reports, traffic control measures, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 238.36 36 INCH DUCTILE IRON PIPE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 230 of the Standard Specifications, and the following:

CONSTRUCTION METHODS

The pipe shall be one continuous pipe segment and located so that no bell end is located beneath the paved bikeway surface. The pipe shall be bedded and backfilled as shown on the design plans.

METHOD OF MEASUREMENT

Item 238.36 will be measured for payment according to the provisions of Subsection 230.80 of the Standard Specifications.

BASIS OF PAYMENT

Item 238.36 will be paid for according to the provisions of Subsection 230.81 of the Standard Specifications.

ITEM 285. INFILTRATION TRENCH FOOT

The work under this Item shall conform to the relevant provisions of Subsections 150, 200, M2, and M9 of the Standard Specifications, and the following.

The infiltration trench shall meet M2.01.0 of the Standard Specifications for 2" to 5" Crushed Stone.

CONSTRUCTION METHODS

The Work shall include the full depth excavation and subsequent installation of an infiltration trench system consisting of: three (3) foot crushed stone layer by four (4) foot wide as shown on the plans. Crushed Stone shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
5 inch	90-100
4 inch	80-100
3 inch	40-60
2 inch	0-20

Non-Woven Geotextile filter fabric that meets MassDOT M 9.50.0 and Application Code 1 for subsurface drainage shall be installed along all sides and ends (not the bottom) of the infiltration trench system. The 6-inch sand filter layer shall meet Section 150 of the MassDOT Standard Specifications and the requirements of MassDOT M 1.04.1.

METHOD OF MEASUREMENT

Item 285. will be measured for payment by the Linear Foot of infiltration trench installed, complete in place.

BASIS OF PAYMENT

Item 285. will be paid for at the Contract unit price per Linear Foot, which price shall include excavation, disposal of excavated material, installation, crushed stone, filter fabric, sand filter, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 431.1 HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE CUBIC YARD

The work under this Item shall conform to the relevant provisions of Subsection 430 of the MassDOT Standard Specifications and the following:

The work under this Item shall include furnishing and placing high early strength cement concrete base course at the locations and dimensions, including any encasement of conduits, shown on the plans, and as required by the Engineer.

METHOD OF MEASUREMENT

Item 431.1 will be measured for payment by the Cubic Yard of high early strength cement concrete base course furnished and placed, complete in place.

BASIS OF PAYMENT

Item 431.1 will be paid for at the Contract unit price per Cubic Yard, which price shall include furnishing, placement, all labor, tools, equipment, materials, and all incidental costs required to complete the work.

ITEM 506.2 GRANITE TRANSITION TYPE VB – SPLAYED END EACH

The work under this Item shall conform to the relevant provisions of Subsection 501 of the Standard Specifications, and the following:

The work under this Item shall include furnishing and installing Granite Transition Type VB– Splayed Ends as shown on the Contract Drawings.

MATERIALS

Materials shall meet Materials Specification for VB curb and be in accordance with sections M9.04.0, M9.04.01, and M9.04.02 of the Standard Specifications. Curb shall be as shown on the Plans. Standard length shall be 6 feet.

CONSTRUCTION METHODS

Granite Transition Type VB– Splayed End shall be installed at the final grades as shown on the Plans.

METHOD OF MEASUREMENT

Item 506.2 will be measured for payment by the Each Granite Transition Type VB– Splayed End furnished and installed, complete in place.

BASIS OF PAYMENT

Item 506.2 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 655. CEDAR RAIL FENCE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 644 of the Standard Specifications, and the following:

The work under this Item shall include furnishing and installing cedar rail fence consisting of cedar wood posts and cedar wood rails as shown on the Contract Drawings.

SUBMITTALS

The Contractor shall provide the following submittals:

Shop Drawings for the cedar rail fence showing complete construction detailing.

Manufacturer's product literature: Submit manufacturer's material descriptions.

MATERIALS

Posts and rails shall be made of No. 1 western red cedar. Both ends shall be cut square. Posts will be shown as on the drawings and incidental to the cost of the fence.

Included under this item is all the hardware, galvanized steel screws, etc., necessary to attach the 4-inch x 6-inch rail to the 6-inch x 6-inch fence post.

The cedar wood rail and cedar wood fence shall be pressure-treated with Chromated Copper Arsenate (CCA) chemical preservative. Pressure-treated rails shall be 4-inch x 6-inch. Fence post shall be set at maximum intervals of 8-feet and set so the top of the post is 42 inches from proposed ground level.

CONSTRUCTION METHODS

Cedar rail fence posts shall be set plumb, backfilled with gravel borrow, as required, and compacted to the lines and grades given. End and corner posts shall be backfilled with 4000, 1.5, 565 cement concrete in lieu of gravel borrow.

The Contractor shall embed each post the minimum depth required as shown in the plans. Longer post may be required at transition areas or where field conditions warrant.

Where solid rock or boulder is encountered without an overburden soil, posts shall be set at a minimum depth of 18-inches in the solid rock. The posts shall be cut before installation to lengths, which will give the required length of post above ground.

After the post is set and plumped, the hole shall be with 4000 psi, 1.5 inch , 565 cement concrete in lieu of gravel borrow.

When loose rock or small boulders are encountered, the post shall be set to the full depth as shown in the Drawings after removing the rock and small boulders.

ITEM 655. (Continued)

This item includes all associated incidental work necessary to install the item, including gravel borrow and cement concrete.

METHOD OF MEASUREMENT

Item 655. will be measured for payment according to the provisions of Subsection 644.80.

BASIS OF PAYMENT

Item 655. will be paid for according to the provisions of Subsection 644.81.

ITEM 657. TEMPORARY FENCE FOOT
ITEM 657.5 TEMPORARY FENCE REMOVED AND RESET FOOT

The work under these Items shall conform to the relevant provisions of Subsections 644 and 665 of the Standard Specifications, and the following:

The work under these Items shall include furnishing, installing, removing, resetting and final removal of temporary fence as required by the Engineer.

MATERIALS

Temporary fence for pedestrian protection shall be a minimum of 6 feet in height and shall be any type specified in Subsection 644. All end, corner and intermediate posts shall be driven into the ground and properly supported as outlined in Subsection 644.

CONSTRUCTION METHODS

The Contractor shall furnish and install all end, corner and intermediate brace posts and all other incidental materials, labor and equipment required for the installation, including concrete foundations if required, relocation and final removal from the site. Material need not be new, but shall not be deteriorated, nor in any way jeopardize the protection purposes intended. All fencing shall meet the approval of the Engineer.

The Contractor shall be responsible for maintenance of the temporary fence and shall be responsible and cognizant that it remains secure at all times. Fence fabric shall be placed on the face of the post away from the work area. The top edge of the fabric shall be finished with a "knuckled" selvage.

During construction it will be necessary to remove and reset the temporary fence at different locations to accommodate the stage construction.

Upon completion of the work, or as required by the Engineer, the fencing and supports shall be removed and disposed off-site by the Contractor at no additional cost.

METHOD OF MEASUREMENT

Item 657. will be measured for payment by the Foot of temporary fence furnished and installed, complete in place.

Item 657.5 will be measured for payment by the Foot of temporary fence removed and reset, complete in place.

ITEMS 657. and 657.5 (Continued)

BASIS OF PAYMENT

Item 657. Will be paid for at the Contract unit price per Foot, which price shall include furnishing, installation, final removal and disposal, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

Twenty (20) percent of the total bid price for Item 657. will be held and paid upon final removal of the temporary fence.

Item 657.5 will be paid for at the Contract unit price per Foot, which price shall include removal, resetting, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 665.2 CHAIN LINK FENCE REMOVED AND DISCARDED FOOT

Work under this Item shall conform to the relevant provisions of Subsection 665 of the Standard Specifications, and the following:

CONSTRUCTION METHODS

The Contractor shall remove the existing link fence, gates, posts, bracing, hardware and footings and legally dispose of all material away from the site.

METHOD OF MEASUREMENT

Item 665.2 will be measured for payment by the Foot of chain link fence removed and discarded.

Measurement will be made by the length from outside of end post to end post of fence removed, measured in its original location before removing.

BASIS OF PAYMENT

Item 665.2 will be paid for at the Contract unit price per Foot, which price shall include removal, disposal, all labor, materials, equipment, and all incidental costs required to complete this work.

ITEM 673. ACCESS ROAD GATE EACH

The work under this Item shall conform to the relevant provisions of Subsection 644 and 901 of the Standard Specifications, and the following:

This work under this Item shall consist of furnishing and installing a galvanized steel access road gate at the location indicated in the Contract Documents and as directed by the Engineer.

MATERIALS

The Roadway Gate shall meet the requirements of Subsection 644 and other related provisions in the Standard Specifications. Galvanized Steel shall be Grade B, Fy = 33,000 ksi. Footings shall conform to the requirements in Subsection 901 in the Standard Specifications for 4000 psi, 1.5 inch, 565 Cement Concrete. Reinforcing steel shall be Grade 60 Reinforcing Level 1.

CONSTRUCTION METHODS

The access road gate shall be installed across the access road at the locations shown on the plans and as directed by the Engineer. The gate shall be installed after embankment work is substantially complete and the Contractor no longer needs to use the access road.

The gate shall be installed to open away from Warren Street Extension.

METHOD OF MEASUREMENT

Item 673. will be measured for payment by the Each access road gate furnished and installed, complete in place.

BASIS OF PAYMENT

Item 673. will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, foundation including cement concrete and reinforcing steel, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 697.1 **SILT SACK** **EACH**

Work under this item shall conform to the relevant provisions of Subsections 227 and 670 of the Standard Specifications, and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in retained existing and proposed catch basins and drop inlets within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as specified in Section 227 of the Standard Specifications

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Silt sacks will be measured and paid at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 697.2 FLOATING SILT FENCE FOOT

The work under this Item shall conform to the relevant provisions of Subsections 670 of the Standard Specifications, and the following:

The work under this Item shall include installation, maintenance and removal of a temporary floating silt fence to prevent any sediment disturbed during construction from reaching adjacent waterways and further dispersing. The fence shall be installed within the waterway, approximately 50 feet downstream of the bridge or culvert.

MATERIALS

Floating silt fence shall be made of a woven polypropylene with a minimum 200 lb. tensile strength. The Contractor shall submit to the Engineer, for review and approval, product specifications and technical data provided by the manufacturer, prior to installation. The fence shall be continuously weighted at the bottom to maintain a vertical submerged position. Anchors shall be placed at both ends of the curtain and at intermediate locations, as necessary, to hold the fence securely in place. The fence shall be installed to withstand the forces of the flow of the waterway.

CONSTRUCTION METHODS

Floating silt fence shall be installed before construction begins and earth is disturbed. Silt fences shall be inspected and approved by the Peabody Conservation Commission Agent after installation and prior to commencement of further construction activities. The Contractor shall inspect silt fence at least weekly to ensure continuous effectiveness. Fence shall be maintained for effective performance at all times. If any fence becomes damaged or dislodged, construction activities shall be halted until all deficiencies are corrected by the Contractor with no additional compensation. The floating silt fence shall be removed after all construction activities are completed and in such a way that no collected sediment is dispersed into Waterways

METHOD OF MEASUREMENT

Item 697.2 will be measured for payment by the Foot of floating silt fence furnished, installed, maintained, and removed.

BASIS OF PAYMENT

Item 697.2 will be paid for at the Contract unit price per Foot, which price shall include furnishing, installation, maintenance, final removal, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 698.3 GEOTEXTILE FABRIC FOR SEPARATION SQUARE YARD

This work shall consist of furnishing and installing geotextile fabric in close conformity with the lines and grades shown on the plan or established by the Engineer. Geotextile fabric for separation shall be used for separation of soil from dumped riprap embankment and stone for pipe ends.

MATERIALS

Geotextile fabric shall conform to the requirements AASHTO M 288 for the intended application in accordance with Subsection M9.50.0, and shall be one of those included on the Department's Qualified Construction Materials List.

CONSTRUCTION METHODS

The geotextile fabric shall be installed in accordance with the manufacturer's instructions. The stone shall be placed on top of the fabric in a careful manner so as to not disturb or puncture the Fabric.

For seams, which are sewn in the field, the Contractor shall provide at least a 6 foot length of sewn seam for sampling by the Engineer before the geotextile is installed. The seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. The Contractor shall submit the seam assembly description along with the sample of the seam. This description shall include the seam type, stitch type, sewing thread, and stitch density.

The geotextile shall be placed in intimate contact with the soil without wrinkles or folds, and it shall be anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlaying materials will not excessively stretch so as to tear the geotextile.

The geotextile shall be placed so that the machine direction is horizontal and runs along the slope. Adjacent geotextile sheets shall be jointed by either sewing or overlapping. Overlapped seams at roll ends shall be a minimum of 1 foot except if placed under water. In such instances the overlap shall be a minimum of 3 feet. Overlaps of adjacent rolls shall be a minimum of 1 foot in all instances.

Care shall be taken during installation so as to avoid damage to the geotextile as a result of the installation process. Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 3 feet beyond the limits of damage.

The riprap placement shall begin at the toe of the slope and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. No stone material shall be dropped from a height exceeding 2 feet.

ITEM 698.3 (Continued)

Field monitoring shall be performed to verify that the dumped riprap placement does not damage the geotextile. Any geotextile damaged during this placement shall be replaced as directed by the Engineer, at the Contractor's expense.

The Contractor shall remove all excess material from the site.

METHOD OF MEASUREMENT

Item 698.3 will be measured for payment by the Square Yard of geotextile fabric for separation furnished and installed, complete in place.

Geotextile fabric will be measured per square yard on the surface of the fabric in a horizontal plane after installation. Geotextile fabric placed outside the specified limits will not be measured and the Contractor may be required to remove and dispose of the excess material without cost to the Owner. Overlapped material will not be included in the measurement.

BASIS OF PAYMENT

Item 698.3 will be paid for at the Contract unit price per Square Yard, which price will include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 698.4 GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL SQUARE YARD

This work shall consist of furnishing and installing geotextile fabric in close conformity with the lines and grades shown on the plan or established by the Engineer. Geotextile fabric shall be used for erosion control under the riprap embankment.

MATERIALS

Geotextile fabric shall conform to the requirements AASHTO M 288 for the intended application in accordance with Subsection M9.50.0 of the Standard Specifications and shall be one of those included on the Department's Qualified Construction Materials List.

CONSTRUCTION METHODS

The geotextile fabric shall be installed in accordance with the manufacturer's instructions. The stone shall be placed on top of the fabric in a careful manner to not disturb or puncture the Fabric.

For seams, which are sewn in the field, the Contractor shall provide at least a 6 foot length of sewn seam for sampling by the Engineer before the geotextile is installed. The seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. The Contractor shall submit the seam assembly description along with the sample of the seam. This description shall include the seam type, stitch type, sewing thread, and stitch density.

The geotextile shall be placed in intimate contact with the soil without wrinkles or folds, and it shall be anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlaying materials will not excessively stretch so as to tear the geotextile.

The geotextile shall be placed so that the machine direction is horizontal and runs along the slope. Adjacent geotextile sheets shall be jointed by either sewing or overlapping. Overlapped seams at roll ends shall be a minimum of 1 foot except if placed under water. In such instances the overlap shall be a minimum of 3 feet. Overlaps of adjacent rolls shall be a minimum of 1 foot in all instances.

Care shall be taken during installation to avoid damage to the geotextile as a result of the installation process. Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 3 feet beyond the limits of damage.

The riprap placement shall begin at the toe of the slope and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. No stone material shall be dropped from a height exceeding 2 feet.
Field monitoring shall be performed to verify that the dumped riprap placement does not damage the geotextile. Any geotextile damaged during this placement shall be replaced as directed by the Engineer, at the Contractor's expense.

ITEM 698.4 (Continued)

The Contractor shall remove all excess material from the site.

METHOD OF MEASUREMENT

Item 698.4 will be measured for payment by the Square Yard of geotextile fabric for separation furnished and installed, complete in place.

Geotextile fabric will be measured per square yard on the surface of the fabric in a horizontal plane after installation. Geotextile fabric placed outside the specified limits will not be measured and the Contractor may be required to remove and dispose of the excess material without cost to the Owner. Overlapped material will not be included in the measurement.

BASIS OF PAYMENT

Item 698.4 will be paid for at the Contract unit price per Square Yard, which price will include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 701.3 CEMENT CONCRETE REINFORCED PAVEMENT SQUARE YARD

The work under this Item shall conform to the relevant provisions of Subsections 701, M8.01.0, and M8.01.2 of the Standard Specifications, and the following:

The work to be done under this item consists of constructing a cement concrete reinforced pavement at the trailheads.

SUBMITTALS

The Contractor shall submit joint layout plan for the cement concrete reinforced sidewalk at the trailheads as per the drawing.

CONSTRUCTION METHODS

Concrete at the trailheads shall be 6" depth concrete with welded wire mesh. The concrete shall be 8" depth at the expansion joints.

The Contractor shall place 6"x6" -, 1.4x1.4 welded wire mesh in the sidewalk at the trailheads as shown on the plans.

Dowels with an expansion sleeve shall be placed at the expansion joints as shown on the plans.

METHOD OF MEASUREMENT

Item 701.3 will be measured for payment by the Square Yard of cement concrete reinforced pavement furnished and placed, complete in place.

BASIS OF PAYMENT

Item 701.3 will be paid for at the Contract unit price per Square Yard, which price shall include furnishing, placement, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

The cost of furnishing and installing the welded wire mesh, dowels and expansion sleeves is included in the cost of this item.

ITEM 704.2 STONE DUST FOR SHOULDERS TON

The work under this Item shall conform to the relevant provisions of Subsection 150 of the Standard Specification, and the following:

The work under this Item shall include the furnishing and placing of stone dust for shoulders as shown on the Drawings and as required by the Engineer.

MATERIALS

Stone dust shall be crushed stone or gravel fines conforming to the following gradation:

- 100% passing 3/8"
- 50-70% passing 1/4"
- 50-60% passing #4 sieve
- 35-40% passing #16 sieve
- 25% passing #100 sieve

Color shall be dark gray. Submit stone dust sample for approval by Engineer.

CONSTRUCTION METHODS

Place, grade, and compact the stone dust over the gravel borrow subbase to produce the minimum required thickness with a firm, uniform surface at the lines and grades shown on the Plans and as required by the Engineer.

Compaction shall be in accordance with Subsections 150.60 and 150.62. All depressions shall be filled and material in high spots removed until the surface is smooth and compacted satisfactorily

METHOD OF MEASUREMENT

Item 704.2 will be measured for payment by the Ton of stone dust for shoulders furnished and placed, complete in place.

BASIS OF PAYMENT

Item 704.2 will be paid for at the Contract unit price per Ton, which price shall include furnishing, placement, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

Gravel borrow will be paid for under Item 151, “Gravel Borrow.”

ITEM 706.9 TEXTURED DECORATIVE PAVEMENT SQUARE YARD

The work under this Item includes furnishing and installing imprinted aggregate reinforced preformed thermoplastic pavement that replicate brick in a relief surface pattern in hot mix asphalt pavement areas. The work also includes pavement sawcutting, pavement removal and disposal to the limits of proposed imprint areas, pavement surface preparation in the areas to receive the imprint, and protecting the surface until accepted and open to traffic.

Unless otherwise authorized by the Engineer upon the Contractor's assurance that quality will not be compromised, it is assumed that the finish pavement course will be completed prior to the work of this item. Pavement removal refers to sawcutting and removal of that portion of the finished pavement required to install the imprint material.

A 3 foot by 3 foot "mock up" shall be constructed for review and approval by the City and the Engineer. Cost for constructing the "mock up" shall be included in the unit bid price for this item.

MATERIAL

Manufacturer: The preformed thermoplastic pavement manufacturer must be ISO 900 1:2008 certified for design, development and manufacturing of preformed thermoplastic, and provide proof of current certification.

Preformed thermoplastic material: The material shall consist of a resilient, aggregate reinforced preformed thermoplastic product which contains a minimum of thirty percent (30%) intermixed anti-skid/anti-slip elements and where the top surface contains anti-skid/anti-slip elements. These anti-skid/anti-slip elements must have a minimum hardness of 6 (Mohs scale).

The material shall be supplied in panels typically measuring 2ft x 2ft.

The preformed material must be resistant to the detrimental effects of motor fuels, antifreeze, lubricants, hydraulic fluids, etc.

Preformed thermoplastic material shall be composed of an ester-modified rosin impervious to degradation by motor fuels, lubricants, etc. in conjunction with aggregates, pigments, binders, and anti-skid/anti-slip elements. Pigments and anti-skid/anti-slip elements shall be uniformly distributed throughout the material. The material shall conform to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, being non-reflective, and potentially being of a color different from white or yellow. The preformed thermoplastic material shall be capable of application at ambient and road temperatures down to 45°F (7°C) without any preheating of the pavement to a specific temperature.

Pigments: The pigment system must not contain heavy metals nor any carcinogen, as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

ITEM 706.9 (Continued)

Skid Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303.
Slip Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum static friction of' coefficient of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.

Thickness: The material must be supplied at a minimum thickness of 150 mil (3.8mm).

Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.

Storage Life: The material may be stored for 12 months, if stored indoors and protected from the elements.

Packaging: The preformed thermoplastic material shall be packaged in cardboard cartons with a plastic sheet between each layer of preformed thermoplastic. The cartons in which packed shall be non-returnable and shall not exceed 25 in. in length and 25 in. in width. The cartons shall be labeled for ease of identification. The weight of the individual carton must not exceed seventy (70) pounds. A protective film around the carton must be applied in order to protect the material from rain or premature aging.

CONSTRUCTION METHODS

Preformed thermoplastic pavement shall only be applied to a stable, high quality asphalt pavement substrate over a stable base that is free of defects. The asphalt pavement substrate surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, deicing materials, and chemical residue.

The area of preformed thermoplastic pavement application shall be sawcut to neat straight lines and the asphalt pavement removed to a uniform depth having a smooth surface approved by the manufacturer's representative prior to application of the material.

ITEM 706.9 (Continued)

The material shall be applied to the asphalt pavement substrate using reciprocating infrared heating equipment. A two-part epoxy sealer shall be applied to the substrate prior to preformed thermoplastic application to ensure proper adhesion and to provide reinforcement for larger volumes of material. A specialized sealer dispensing gun specific to the application shall be used to dispense the required two-part epoxy sealer onto the substrate. Immediately following sealer application, panels of aggregate reinforced preformed thermoplastic shall be positioned properly on the asphalt substrate with the aggregate side facing up. The preformed thermoplastic shall then be heated to the required melting temperature. Additional anti-skid/anti-slip aggregate conforming to the properties of the preformed material aggregate shall be applied to the preformed thermoplastic surface as needed following the melting process to achieve added friction properties and a uniform surface appearance or if the factory applied anti-skid/anti-slip elements embed too deeply into the surface of the molten thermoplastic material during the heating process. The additional aggregate shall be applied by spray by means of an air powered spray hopper.

As the material is cooling, it shall be imprinted with a stamping template made from 3/8 inch flexible wire rope in the required design using a vibratory plate compactor to create crisp, clean lines which define the pattern. A hand held finishing tool shall be used that enables the applicator to complete the imprinting of the thermoplastic in areas which may be inaccessible to the stamping template.

The reciprocating infrared heating equipment shall be of a design specifically to elevate the temperature of the preformed thermoplastic material and asphalt pavement without adversely affecting it. The primary heating unit shall employ a bank of propane-fired infrared heaters, mounted on a track device that allows the heater bank to reciprocate back and forth over a designated area, thereby allowing the operator to monitor the temperature of the preformed thermoplastic at all times during the pavement heating process.

A smaller, mobile infrared heater designed specifically to heat areas such as borders and narrow areas that are inaccessible to the primary heaters shall be utilized as necessary for the work. This secondary heater also allows the operator to monitor the temperature of the preformed thermoplastic at all times during the heating process.

An approved hand-held propane heat torch shall be used to heat isolated areas of the preformed thermoplastic if required and approved by the Engineer.

A vibratory plate compactor (700-900 lb.) shall be used for pressing the 3/8 inch wire rope stamping templates into the thermoplastic to create the specified pattern in both the thermoplastic and asphalt substrate.

The color shall be Colonial Red and the surface pattern shall be a running bond brick pattern.

Any residue resulting from this work shall be removed and disposed of in a proper manner. The completed work area is to be left in a neat and clean condition.

ITEM 706.9 (Continued)

Special care must be exercised by the Contractor during the operation of work to save from harm and injury, any structure, public or private, situated above or below the surface and lying within the project limits. If during the execution of the work, the Contractor, through willfulness or carelessness, permits or causes any damage, the cost of satisfactory repair or replacement shall be the responsibility of the Contractor.

Manufacturer Certified Applicator Requirement: The preformed thermoplastic material shall be applied only by an approved certified applicator. The applicator shall provide proof of current certification by the manufacturer before commencing work. The certified applicator shall follow the manufacturer's current published application procedures.

METHOD OF MEASUREMENT

Item 706.9 will be measured for payment by the Square Yard of textured decorative pavement furnished and installed, complete in place and accepted by the Engineer.

BASIS OF PAYMENT

Item 706.9 will be paid for at the Contract unit bid price per Square Yard, which price shall include furnishing, installation, all labor, material, tools, equipment, and all incidental costs required to complete the work.

No separate payment will be made for sawcutting, existing pavement removal or “mock-up” but all costs in connection therewith shall be included in the contract unit price bid for this item.

ITEM 707.17 BENCH EACH

Work under this item includes furnishing and installing benches as shown on the drawings and as specified herein.

MATERIALS

The bench shall be comprised of supports manufactured from 3/8" x 4 1/2" ASTM A36 carbon steel flat bar and 3" x 3" x 1/4" wall ASTM A500 steel tubing. Seat slats shall be manufactured from 3" x 4" nominal HDPE recycled plastic slats. Integral armrests shall be manufactured from 1/4" x 2" ASTM A36 carbon steel flat bar. Anchoring shall be Stainless steel expansion anchors (1/2" x 3 3/4"). provided.

Finish shall be black polyester powder coating over zinc rich primer. Zinc-rich epoxy primer to an average of 4-5 mils. TGIC-polyester powder top coat shall be an AVERAGE of 4-5 mils. Submit color chart for approval.

Benches shall be model number 88-60PL S-1 surface mount with armrests as manufactured by DuMor, Inc. P.O. Box 142, Mifflintown, PA 17059-0142 (1-800-598-4018) www.dumor.com , model number PRS-10 as manufactured by Victor Stanley, 2103 Brickhouse Road Dunkirk, MD 20754, or Covington Collect 6 foot bench with back and recycled plastic slats surface mount as manufactured by Wabash Valley, DFW International Commerce Park 2580 Esters Road Suite 100 DFW Airport, TX 75261 or approved equal.

Cement concrete for bench pad shall be 4000 psi conforming to Section M 4.02.00 of the Standard Specifications.

Contractor shall submit shop drawings and color samples for approval by the Engineer, including anchoring device, prior to ordering.

CONSTRUCTION METHODS

The Contractor shall assemble and install benches as per manufacture's recommendations.

Anchors shall be long enough to penetrate through the concrete and be securely anchored with epoxy cement in the concrete sidewalk or concrete base course.

Contractor shall protect benches from damage until final acceptance. Touch-up, repair or replace damaged products before substantial completion. Damaged items will not be accepted, as determined by the Engineer.

ITEM 707.17 (Continued)

METHOD OF MEASUREMENT

Item 707.17 will be measured for payment by the Each bench furnished and installed, complete in place.

BASIS OF PAYMENT

Item 707.17 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 707.2 TRASH RECEPTACLE EACH

The work under this item shall consist of furnishing and installing trash receptacles as shown on the plans and as specified herein.

The Contractor shall provide product data and shop drawings for approval by the Engineer.

MATERIALS

Trash receptacle shall be the size and configuration shown on the drawing. Trash receptacle shall be model 84-32 FTO manufactured by DuMor, Inc., P. O. Box 142; Mifflintown, PA 17059-0142; Tel: 717-436-2106; www.dumor.com or model number RB-36 as manufactured by Victory Stanley, Inc. P.O. Drawer 330 Dunkirk, MD 20754, Tel. 301-855-8300; www.victorstanley.com, model Carnival 32 Gallon with no door as manufactured by Thomas Steele 1080 Uniek Dr, Waunakee WI 53597 Tel. 608-849-1080 or approved equal.

The trash receptacle shall be 32 gallon capacity with a detachable cover of spun 14-gauge steel coated with a vinyl-coated cable and plastic liner. All welds shall be continuous and ground smooth. Color shall be black.

Fasteners shall be stainless steel.

CONSTRUCTION METHODS

The Contractor shall install according to the manufacture's recommendations and as shown on the drawings.

Trash receptacles shall be installed with expansion anchor bolts that extend a minimum of 2 inches into the concrete pavement. Locations shall be as shown on the plans and as approved by the Engineer. Anchor bolts and nuts shall be stainless steel. Contractor shall coordinate the size of the anchor bolts with the openings in the trash receptacles. Each trash receptacle shall have four anchor bolts.

Trash receptacles shall be installed plumb, as approved by the Engineer.

Contractor shall protect trash receptacles from damage until final acceptance. Touch-up, repair or replace damaged products before substantial completion. Damaged items will not be accepted, as determined by the Engineer.

METHOD OF MEASUREMENT

Item 707.2 will be measured for payment by the Each trash receptacle furnished and installed, complete in place.

BASIS OF PAYMENT

Item 707.2 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 707.8 STEEL BOLLARD EACH

The work under this item shall consist of furnishing and installing bollards at the locations and to the dimensions shown on the plans in accordance with these specifications and/or as required by the Engineer. All materials shall be in accordance with the applicable sections of the Standard Specifications.

The work shall include the installation of 24" diameter concrete foundations and 6 ½" O.D. / 6" I.D., schedule 40 steel bollards filled with cement concrete. Steel Bollards shall be steel ASTM Grade B and, in accordance with the plan and detail, have yellow PVC color with white retroreflective bands. Paint shall conform to the requirements under section M7.00.0.

All bollards shall be installed plumb in a concrete foundation as detailed.

The Contractor shall submit shop drawing(s) of steel bollards, installation method, and associated foundations to be approved by MassDOT.

METHOD OF MEASUREMENT

Item 707.8 will be measured for payment by the Each steel bollard furnished and installed, complete in place.

BASIS OF PAYMENT

Item 707.8 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 707.9 BICYCLE RACK EACH

The work will consist of the furnishing and installation of steel bicycle racks in accordance with these specifications and at specific locations shown on the plans or established by the Engineer.

MATERIALS

The bike racks shall be manufactured by shall be U Rack U238-IG-P, 22" width, 34" height, with in ground mounting as manufactured by Madrax division of Garber Manufacturing 1080 Uniek Dr, Waunakee WI 53597, Heavy Duty Hoop Rack inground mount as manufactured by Dero of 5522 Lakeland Ave. Minneapolis, MN 55429 or Heavy Duty Hoop Rack HRHD-in ground Mount as manufactured Belson 627 Amersale Drive Naperville, IL 60563 or approved equal.

U shaped bicycle rack shall be constructed of 2 3/8" OD x 0.154 thick wall, ASTM A53, Schedule 40 steel pipe. Finish shall be electrostatically applied super TGIC (Triglycidyl isocyanurate) polyester powder coat. Finish shall be factory applied. Color shall be black.
Bicycle parking racks are to carry a one year manufacturer's limited warranty against defects in materials and workmanship.

Grout shall be pourable exterior anchoring hydraulic cement per item on MassDOT QCML.

Gravel Borrow	M1.03.0 (Type B)
Cement Concrete (Air-Entrained 4000 psi, ¾", 610)	M4.02.00

CONSTRUCTION METHODS

The Contractor shall consult the manufacturer in order to install the bicycle rack properly and shall provide a representative who is thoroughly familiar with the installation process. The Contractor shall install the bicycle racks level, plumb and true.

Engineer shall approve the locations of the bicycle racks prior to installation of the footings.

The Contractor shall protect bicycle rack finishes on exposed surfaces from damage by applying a temporary protective covering or wrapping before shipping. Materials shall be stored in compliance with the manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other causes.

Each end of the bicycle rack shall be installed on a concrete footing as shown on the drawings as per manufacturer's recommendations Top of footing shall be set below the finished paving course. The spacing of each rack shall be a minimum of 3feet on center or as recommended by the manufacturer or as deemed reasonable by the Owner in order to fit within the available site conditions.

The Contractor shall inspect the bike rack after installation is completed and remove spots, dirt, and debris from all components. The Contractor shall repair damaged finishes to match the original finish or replace the damaged component.

ITEM 707.9 (Continued)

METHOD OF MEASUREMENT

Item 707.9 will be measured for payment by the Each bicycle rack furnished and installed, complete in place.

BASIS OF PAYMENT

Item 707.9 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 740. ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH

The work under this Item shall conform to the relevant provisions of Subsection 740 of the Standard Specifications and the following:

Two computer systems and printer system meeting minimum requirements set forth below including installation, maintenance, power, paper, disks, and other supplies shall be provided at the Resident Engineer's Office:

All equipment shall be UL approved and Energy Star compliant.

The Computer System shall meet the following minimum criteria or better:

Processor:	Intel, 3.5 GHz
System Memory (RAM):	12 GB
Hard Drive:	500 GB
Optical Drive:	DVD-RW/DVD+RW/CD-RW/CD+RW
Graphics Card:	8 GB
Network Adapter:	10/100 Mbit/s
USB Ports:	6 USB 3.0 ports
Keyboard:	Generic
Mouse:	Optical mouse with scroll, MS-Mouse compliant
Video/Audio	the computer system shall be capable of allow video calling and recording:
Video camera	shall be High Definition 1080p widescreen capable video calling and recording with built in microphone. The microphone system shall capture natural audio while filtering out background noise.
Audio	shall be stereo multimedia speaker system delivering premium sound.
OS:	Latest Windows Professional with all security updates
Web Browser:	Latest Internet Explorer with all security updates
Applications:	Latest MS Office Professional with all security updates Latest Adobe Acrobat Professional with all security updates Latest Autodesk AutoCAD LT Antivirus software with all current security updates maintained through the life of the contract.
Monitors:	Two 27" LED with Full HD resolution. Max. resolution 1920 x 1080
Flash drives:	2 (two) - 128GB USB 3.0
Internet access:	High Speed (min. 24 mbps) internet access with wireless router.

ITEM 740. (Continued)

The Multifunction Printer System shall meet the following minimum criteria or better:

Color laser printer, fax, scanner, email and copier all in one with the following minimum capabilities:

- Estimated volume 8,000 pages per month
- LCD touch panel display
- 50 page reversing automatic document feeder (RADF)
- Reduction/enlargement capability
- Ability to copy and print 11" x 17" paper size
- email and network pc connectivity
- Microsoft and Apple compatibility
- ability to overwrite latent images on hard drive
- 600 x 600 dpi capability
- 30 pages per minute print speed (color),
- 4 Paper Trays Standard (not including the bypass tray)
- Automatic duplexing
- Finisher with staple functions
- Standard Ethernet. Print Controller
- Scan documents to PDF, PC and USB
- ability to print with authenticated access protection

The Contractor shall supply a maintenance contract for next day service, and all supplies (toner, staples, paper) necessary to meet estimated monthly usage.

The Engineer's Field Office and the equipment included herein including the computer system, and printer shall remain the property of the Contractor at the completion of the project. Disks, flash drives, and card readers with cards shall become the property of the Department.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Compensation for this work will be made at the contract unit price per month which price includes full compensation for all services and equipment, and incidentals necessary to provide equipment, maintenance, insurance as specified and as directed by the Engineer.

ITEM 751.7 COMPOST BLANKET CUBIC YARD

The work under this Item shall conform to the relevant provisions of Subsection 751 and M1.06.0 Compost of the Standard Specifications and the following:

Work shall consist of furnishing and pneumatically applying compost as a thin mulch blanket (1/2- 1 inch depth) over prepared soil to provide temporary soil stabilization and organic matter for plant growth.

SUBMITTALS AND MATERIALS

No materials shall be delivered until the required submittals have been approved by the Engineer. Delivered materials shall match the approved samples. Approval of test results does not constitute final acceptance.

Contractor shall submit to the Engineer samples and certified test results no sooner than 60 days prior to application of compost. Vender certification that material delivered meets the test results shall be submitted if requested.

Compost shall meet the requirements for M1.06.0: Compost, Type 2, as referenced in the MassDOT– Highway Division Standard Specifications for Highways and Bridges, Division III: Materials Specifications, latest edition.

The Engineer shall approve the Contractor's equipment for application.

CONSTRUCTION METHODS

Application of compost material shall not begin until the Engineer has approved the site and soil conditions. Soil preparation shall be as specified under the applicable item for soil placement or for seeding. The Contractor shall notify the Engineer when areas are ready for inspection and application of compost.

Compost blanket shall be pneumatically applied (blown on) to a minimum depth of one half to one inch. Where shown on the plans or when directed by the Engineer depth may be increased to provide berms for sediment control or to otherwise prevent slope erosion.

When compost blanket is proposed with seeding, seed shall be broadcast and shall occur in conjunction with compost blanket, as specified under the relevant item for seeding.

When compost blanket is proposed for areas with planting, compost (and seed if applicable) shall be applied after planting. If compost and seed occur prior to planting, areas shall be regraded and compost and seed reapplied to the satisfaction of the Engineer and at the Contractor’s expense.

ITEM 751.7 (Continued)

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 751.7 will be measured and paid for at the Contract unit price per Cubic Yard which price shall include all labor, materials, equipment, and all incidental costs required to complete the work of pneumatically applying compost.

Surface preparation of substrate receiving compost blanket shall be compensated under the applicable item for placement of loam, sand, ordinary borrow, wetland soil, topsoil rehandled and spread, tilled existing soil, or other specified substrate.

Seeding, if utilized, will be compensated for under the appropriate seeding items.

ITEM 755.35 INLAND WETLAND REPLICATION AREA LUMP SUM

The work under this item shall conform to the relevant provisions of Subsections 120, 770, 771 of the Standard Specifications and the following:

Work under this item shall include furnishing material and the construction and maintenance of inland wetland replication areas as shown on the drawings and as required by the Engineer. Inland Wetland Replication Area shall hereafter be referred to as Replication Area. All work shall be in coordination with an approved Wetland Specialist as specified under that item.

Wetland Restoration work shall be as specified and compensated under that item. Construction of tidal wetlands shall be as specified under the appropriate item for tidal wetland mitigation.

The Replication Area shall be constructed prior to wetland impacts unless otherwise approved by the Engineer, specified herein, or specified in permit conditions and approvals. Construction schedule shall be appropriate to planting and seeding season (see below). Changes to this schedule will require written approval from the Engineer.

DESCRIPTION OF WORK

Construction of the Replication Area shall be completed as shown on the drawings at the following location(s):

Area/s A at Road: ***Gilmore Terrace*** Area = ***2,500*** sf.

Replication Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, U.S. Army Corps of Engineers Permit.

The Contractor is responsible for protection and preservation of natural areas adjacent to the Replication Area both within and outside the project limits and for the duration of the Contract; including but not limited to damage to soils or vegetation due to erosion, sedimentation, compaction, trampling, vehicles, storage of materials, or other negligence shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

The Wetland Specialist overseeing the Wetland Replication construction work shall not be from the same company as that which is performing planting, seeding, or participating in any aspect of the Wetland Replication construction.

SUBMITTALS - DOCUMENTS

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): As specified below, shall be submitted to the Engineer for distribution to appropriate regulatory agencies.

ITEM 755.35 (Continued)

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.75 and 755.76.

SUBMITTALS - MATERIAL

Soil and Amendments

No soil, compost, or other soil amendment imported to the work site shall contain seeds, roots, stems, or other viable parts of invasive plants or other noxious plants.

At least sixty (60) days prior to installation and prior to ordering, the Contractor shall submit for approval sources of soil, compost, and amendments. Submittal shall include the supplier and location of the source. Off-site sources shall be identified and available for inspection by the Wetland Specialist prior to transport of material to the site to verify that they are likely to be free of invasive plant species, including all viable plant parts.

Samples of tested and approved wetland soil and soil amendments for soil texture, organic carbon content or other routine soil analysis parameters (e.g., pH, Cation Exchange Capacity, Percent Base Saturation) and Soil Organic Matter Analysis will be required if requested by the Engineer. The grab samples shall be collected by the Contractor or Wetland Specialist from multiple representative locations in the wetland topsoil mix following the "Umass Soil and Plant Tissue Testing Laboratory Sampling and Collection Protocols" (or equivalent certification paperwork provided by the soil supplier). The lab analysis shall be provided to the Engineer along with written certification from the Contractor or Wetland Specialist that the wetland topsoil was collected per the referenced protocol and meets the desired specification. The analysis and written certification of same shall be provided to the Engineer prior to placing the wetland topsoil in the Replication Area.

Seed Mix

Certificate of Materials from the supplier shall be submitted 30 days prior to seeding and must be approved prior to ordering materials. Seed species listed on the certificate shall include ecotype region (i.e., *Asclepias incarnata*, PA Ecotype).

Seed tag from the bag of seed used shall be submitted to the Engineer at the time of seeding. Seed tag shall include ecotype region and species, guaranteed percentages of purity, weed content and germination of the seed, and the net weight. Seed tag shall match the Certificate of Materials, include the name of the supplier, and date material was sent.

Bill of lading or notarized Certificate of Compliance from the Supplier serving as proof of purchase shall be submitted if requested by the Engineer. Document shall include date of sale, quantity, lot number, and address of Supplier. This shall match the seed tag. Notary shall not work for either the contractor or seed supplier.

ITEM 755.35 (Continued)

Plant Certification

Plant Certification shall be per the applicable requirements of Subsection 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the Standard Specifications. The nursery source shall certify the provenance or origin of all plants.

MATERIALS

Sediment Control Barrier and Erosion Prevention Measures

Sediment control barriers shall be per Item 767.121.

Erosion prevention measures for disturbed areas adjacent to the Replication Area shall include but not necessarily be limited to compost blankets, jute mesh, seeding, and/or combinations thereof as approved by the Engineer.

Sediment controls and erosion prevention devices and measures shall be compensated under the respective items.

Wetland Soil

Soil appropriate for the Replication Area may be either hydric soil excavated from the impacted wetland, a manufactured mix of compost and on-site borrow, or a combination thereof, as approved by the Engineer.

Hydric soil from the impacted wetland area may be spread on the surface of the constructed Replication Area as an inoculant or can be placed in a bulk fashion in a roughly 1:1 ratio of area and depth. Soil shall be handled such that the original soil structure is preserved and shall not be compacted, screened, or otherwise processed.

Hydric soil from the impacted wetland that is infested with invasive plant species identified on the Massachusetts Invasive Plant Advisory Group (MIPAG) shall not be used in the Replication Area unless approved by the Wetland Specialist and Engineer. To the extent possible, infested soil shall be disposed of within the project limits in an upland area outside of regulated areas and as approved by the Invasive Plant Management Strategy item (if in the contract) or by the Engineer.

A manufactured mix suitable for wetlands shall consist of on-site borrow from the proposed Replication Area (if approved by the Wetland Specialist and Engineer) thoroughly mixed with compost to achieve a target organic carbon content of 10-12% (up to 21% percent organic matter) by dry weight. The organic material used for mixing shall be well or partially decomposed. Clean leaf compost is the preferred soil amendment to achieve these standards though other materials may be used if approved by the Wetland Specialist and Engineer. Note that “clean” refers both to a negligible amount (<1%) of physical contaminants such as plastic and to the lack of chemical contaminants that might pose a hazard to plants or animals. Off-site borrow may be used for mixing if approved in advance by the Engineer.

ITEM 755.35 (Continued)

No soil or soil amendment shall be brought on site without approval of the material source by the Wetland Specialist and the Engineer. Soils used in the replacement area shall be free of rocks greater than 4 inches in diameter.

Plants

Plant material shall conform to the applicable requirements of Section 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the latest edition of the Standard Specifications and as amended below.

Plants shall be native species, not cultivars. To the extent possible, plants shall originate from the applicable EPA Level III Ecoregion.

Plant species and sizes to be included in the Replication Area shall be as specified on the plans. Requests for substitutions shall be submitted in writing to the Engineer for review by the Wetland Specialist, MassDOT Landscape Architect, and, if required, the relevant regulatory agency at least thirty (30) days prior to planting. All proposed substitutes shall be in conformance with the requirements herein and suitable for the site conditions.

Transplanting and plant material collected from the wild is prohibited unless approved in writing by the Engineer. Plants shall be selected from certified nurseries that have been inspected by state and/or federal agencies.

Seed Mix

Seeding shall conform to the Standard Specifications Section M6, ROADSIDE DEVELOPMENT MATERIALS.

ITEM 755.35 (Continued)

Wetland Seed mix shall be:

Mix 765.554 **Wetland – Seasonally Flooded Mix** **LB**

	Botanical Name	Common Name	% PLSBy Weight
Grass			
	Elymus riparius	Riverbank Wild Rye	20.00%
	Andropogon gerardii NY Eco	Big Bluestem NY Eco	12.00%
	Carex lupulina	Hop Sedge	10.00%
	Panicum clandestinum 'Tioga'	Deer Tongue 'Tioga'	10.00%
	Carex vulpinoidea	Fox Sedge	10.00%
	Carex scoparia	Broom sedge	8.00%
	Sorghastrum nutans NY Eco	Indiangrass NY Ecotype	8.00%
	Panicum virgatum	Switch Grass	8.00%
	Juncus effusus	Soft Rush	2.00%
	Juncus tenuis	Path Rush	1.00%
			89.00%
Herb/Forb			
	Verbena hastata	Blue Vervain	4.00%
	Desmodium canadense	Showy Tick Trefoil	2.00%
	Eupatorium maculatum	Joe-pye Weed	1.00%
	Asclepias incarnata	Swamp Milkweed	1.00%
	Aster novae-angliae	New England Aster	1.00%
	Eupatorium perfoliatum	Boneset	0.70%
	Helenium autumnale	Common Sneezeweed	0.50%
	Aster puniceus	Aster - Swamp	0.50%
	Mimulus ringens	Monkey Flower	0.20%
	Vernonia noveboracensis	New York Ironweed	0.10%
			11.00%
			100.00%

Species ecotype shall be as native to New England region as possible. Apply this mix at 20 lbs PLS/acre.

ITEM 755.35 (Continued)

Upland Seed Mix Surrounding Replication Area shall be:

765.451 Native Seed - Part Shade Roadside Mix LB

Botanical Name	Common Name	% PLS by Weight
Festuca rubra	Creeping Red Fescue	25.70%
Elymus virginicus	Virginia Wild Rye	24.00%
Schizachyrium scoparium	Little Blue Stem	22.50%
Panicum virgatum	Switch Grass	10.00%
Panicum clandestinum 'Tioga'	Deer Tongue 'Tioga'	7.00%
Carex vulpinoidea	Fox Sedge	2.00%
Agrostis perennans	Upland Bentgrass	2.00%
Juncus effusus	Soft Rush	0.20%
		93.40%
Chamaecrista fasciculata	Partridge Pea	3.00%
Penstemon digitalis	Beard-tongue	1.00%
Zizia aurea	Golden Alexanders	0.30%
Desmodium canadense	Showy Tick Trefoil	0.30%
Solidago bicolor	White Goldenrod	0.20%
Solidago caesia	Woodland Goldenrod	0.20%
Rudbeckia hirta-VT ecotype	Black-eyed Susan-VT	0.20%
Aster novae-angliae	New England Aster	0.20%
Solidago odora	Licorice Scented Goldenrod	0.20%
Aster divaricatus	White Wood Aster	0.20%
Heliopsis helianthoides	Ox-Eye Sunflower	0.20%
Pycnanthemum tenuifolium	Slender Mountain Mint	0.20%
Monarda fistulosa	Wild Bergamot	0.10%
Eupatorium perfoliatum	Boneset	0.10%
Aster lateriflorus	Calico Aster	0.10%
Oenothera fruticosa var. fruticosa	Sundrops	0.10%
		6.60%
Seeding Rate: 15.0 lbs PLS/Acre		**100.00%**

Fertilizers shall not be used.

ITEM 755.35 (Continued)

Water

The Contractor shall provide water and all equipment required at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plants and wildlife. Water from the adjacent water bodies or waterways shall not be utilized. It is the Contractor's responsibility to correct injury or damage due to the lack of water, too much water, or use of contaminated water.

Mulch/Compost Blanket for Seeding

Hydromulch shall be per the manufacturer's recommendations and shall be wood fiber or straw mulch only. Mulch shall be incidental to seeding.

Compost Blanket may be used in lieu of mulch for seeding. Compost Blanket shall meet the material and submittal requirements of that Item and shall be applied as specified below. Compost Blanket shall be compensated under that item.

CONSTRUCTION METHODS & SEQUENCE

SITE PROTECTION MEASURES

Minimizing Damage

The Contractor shall plan and execute operations in a manner minimizing the amount of excavated and exposed fill or other foreign materials that could be washed or otherwise carried into Replication Area and nearby resource areas.

Construction of and access to the Replication Area shall minimize damage to existing vegetation and soils as specified herein. Damage to soils or vegetation shall be repaired to the satisfaction of the Engineer and at the Contractor's expense. If required for soil remediation, tilling and the addition of compost shall be at the Contractor's expense.

Wetland topsoil shall be deposited and graded in the Replication Area in a manner that minimizes travel and subsequent compaction of the subgrade (including any specified pit and mound topography) to the extent practicable, including use of track mounted excavators as appropriate. Should soils be compacted, they shall be loosened by a method such as disking, spring-tooth harrowing and/or rototilling. The Contractor shall use boards, timber or composite mats, or other approved materials as necessary, to protect existing and/or new wetlands from compaction due to heavy foot traffic or if equipment is required to travel over wetland soil. All labor and materials required for protection and preservation of site shall be incidental to this item.

ITEM 755.35 (Continued)

Stockpiling of Soil

Stockpiling of soil, including hydric soil for replication, shall be at least 100 feet from the edge of the bordering and isolated vegetated wetlands and inland banks, unless approved otherwise by the Engineer. Stockpiled soils shall be securely stabilized and contained. Any areas of exposed soil or stockpiles within and adjacent to the Replication Area that will remain inactive for more than 7 calendar days shall be sown with a mix of rapid germinating annual grasses (e.g., annual rye) covered with a layer of straw mulch applied at a rate of 90 pounds per 1,000 square feet. As necessary, the mulch shall be anchored with a tacking coat (non-tar) applied by a hydro seeder or other method recommended by the Wetland Specialist in consultation with the Engineer. In the event that there is excess borrow, it shall be disposed of under Excavation, Item 120.

Sediment Barriers

Placement: Sediment barriers shall be installed along the downslope perimeter of the Replication Area beginning and ending in the surrounding upland so that no excavated material or disturbed soil can enter adjacent wetlands or waters. Where construction work is immediately upgradient of the wetland, barriers shall be located so as to protect the Replication Area until slopes are stabilized. Sediment barriers shall be in place and approved by the Engineer prior to excavation work. No work shall take place outside the barriers.

Maintenance: The Contractor shall ensure that all sediment barriers function as intended and at all times per the specifications of those respective items.

Existing Trees to Remain

Tree protection shall be per the relevant specifications and as shown on the plans or as required by the Engineer. To protect root systems of existing trees to remain, the limits of the Replication Area may be adjusted, but, the total area of replication required by the permits shall not be reduced. Access route may be adjusted as required.

Trees to be retained as snags (upright dead or dying trees left for wildlife habitat) within or adjacent to the Replication Area shall be as shown on the plans or as directed by the Wetland Specialist or Landscape Architect during the initial site walk. Trees to remain as snags shall be clearly marked prior to clearing. Trees that pose a potential fall hazard (i.e., are near a roadway) should have limbs and trunk cut such that the tree does not pose a fall hazard.

Coarse woody debris in the form of cut trees, stumps, logs, and brush shall be incorporated as shown on the plans or as directed by the Wetland Specialist or Landscape Architect. On site material shall be selected and marked by the Wetland Specialist, retained on the project site, and placed as specified below under Placement of Coarse Woody Debris.

All trees, stumps, or brush not specified to remain shall be removed and shall not be stockpiled in the wetland resource areas while awaiting disposal.

Work shall be coordinated with Clearing or Tree Removal Item and compensated under that Item.

ITEM 755.35 (Continued)

PRE-WETLAND CONSTRUCTION SITE WALK

Delineating the Replication Area and Access Route. The Contractor shall stake out the Replication Area boundaries and the intended access route and set grade stakes for approval by the Wetland Specialist and Engineer. Following staking and demarcation of areas, the Engineer and Wetland Specialist shall approve or modify as necessary the limits of work, the access route, final location and configuration of replication, grade stake elevations, proposed location of sediment barriers, and review proposed construction methods.

As part of the delineation and approval process, the Wetland Specialist shall mark trees to be converted to snags, select course woody debris to be retained for re-use, and select rocks or other elements to be used for habitat features.

Invasive Plants: As part of the initial site walk, the wetland to be impacted and the proposed replication site shall be inspected for the presence of invasive plants. If invasive plants are found they shall be addressed as described herein under Invasive Plants.

SOIL WORK

Final grades in the Replication Area shall meet the target elevations as shown on the Plans or as adjusted by the Wetland Specialist to achieve the desired hydrology and micro-habitat. If adjustments are required, a Request for Information (RFI) shall be submitted to the Engineer for approval. Adjustments shall be documented and included in the As-Built plans (if required) and/or other applicable required documents.

Excavation & Grading

When required by permits, the Wetland Specialist shall notify MADEP and the ACOE (as applicable) at least 72 hours prior to excavation.

Soil in the proposed wetland areas that must be removed for grades to conform to the proposed elevations shall be stripped and disposed of, or, if suitable for reuse, be stockpiled in an approved location. Stockpiled soils shall be kept wet and not allowed to dry out. Procedures for maintaining appropriate moisture levels shall be documented by the Wetland Specialist and provided to the Engineer and the Contractor.

Replication area shall be excavated as shown on the drawings. Where replication area is adjacent to existing reference wetland, finish grade of replication shall generally match existing grades and micro-topography, notwithstanding any deviations that are necessary to achieve the desired hydrology and habitat in the Replication Area.

Prior to placement of backfill, scarify subgrade to a depth of 4 to 6 inches.

ITEM 755.35 (Continued)

Placement of Wetland Soil

Following excavation, scarification, and grading of sub-grade, and after the sub-grade elevations are approved by the Wetland Specialist, suitable soil previously removed or an evenly mixed organic/mineral soil created on-site shall be spread to the design depth and thickness over the proposed wetland areas as shown on the plans and as directed by the Wetland Specialist.

Vehicles used to transport soil from offsite shall be washed or cleaned with air pressure to prevent exotic or invasive seeds or root fragments from contaminating the Replication Area.

Final Grading

The finished grade of the Replication Area shall be at an elevation that will provide an unrestricted hydrologic connection between the Replication Area and adjacent resource areas. The hydrologic connection should be in keeping with restoring the intended function of the replacement wetland relative to the impacted reference wetland. The Contractor shall verify that this elevation is not at a level that could negatively alter the hydrology of an adjacent wetland. Microtopography in the form of hummocks, pits and mounds shall be as shown on the plans or as adjusted by the Wetland Specialist. Final elevations and grading of wetland soil shall be approved by the Wetland Specialist and the Engineer.

To avoid compaction once soil has been placed, no heavy equipment shall travel across placed soil and no work shall occur in wet or moist soil. Soil that is compacted due to construction activities shall be replaced with soil as specified herein and at the Contractor's expense.

Installation of Monitoring Wells in Replication Area

For a constructed Replication Area over 1,000 square feet, a representative number of monitoring wells shall be installed in locations as shown on the Plans. Monitoring wells shall include data loggers. For purposes of this specification, a data logger refers to a battery powered device that records groundwater level. Data shall be collected by the Wetland Specialist and submitted with Monitoring Reports and as required by applicable permits. Wells shall be installed immediately following completion of construction of the Wetland Replication Area. Wells shall be installed in accordance with USDA/NRCS technical report entitled: "Sprecher, S.W. 2008. Installing monitoring wells in soils (Version 1.0). National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, NE." or equivalent methodology approved by Engineer.

ITEM 755.35 (Continued)

RESTORING VEGETATION

Placement of Coarse Woody Material

If specified within this Contract or if directed by the Wetland Specialist or Landscape Architect during the initial site walk, woody debris shall be placed in the Replication Area and/or adjacent upland buffer. Material shall be placed as shown on the plans or as directed following placement of wetland soil and prior to application of compost and/or seed. Woody material shall cover a minimum of 5-20 percent of the Replication Area, depending on whether it is a meadow or woodland wetland and how much wood is available from construction clearing. Where trees are cut for construction purposes, logs of a minimum length of 8 feet must comprise a minimum of 50% of the woody material left on site. Brush shall be included along with logs and stumps as directed. Woody material shall be placed in a deliberate and naturalistic manner.

Planting

Following placement of wetland soil and approval of final grade and conditions, Replication Area shall be planted. Planting shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUNDCOVER of the Division I Standard Specifications and as amended below.

Planting Season shall be May 15-June 15 and September 1-November 1 unless otherwise specified in applicable permit conditions.

Prior to planting, the Wetland Specialist shall approve the condition of the plant material and the method of installation and shall oversee the planting work. Replication Area shall be planted in the dry. Plants shall be placed according to the planting details and within the range of target elevations and at the spacing shown on the Plans or, if spacing is not indicated on the Plans, at the direction of the Wetland Specialist. Unless otherwise noted on the Plans, final plant locations shall be determined on site and located with regard to expected hydrology, plant growth characteristics, habitat desired, and water protection.

Plant material shall be installed as soon as possible after delivery. Plants stored on-site prior to installation shall be stored in the shade and watered twice daily up until time of installation. Plants showing signs of stress or compromised health may be rejected by the Engineer or Wetland Specialist and shall be replaced at the Contractor’s expense.

Plant material shall be furnished and installed as indicated including all labor, materials, plants, equipment, incidentals, re-setting of plants (frost heaves, etc), irrigation, re-planting and clean up. If previously approved species are not available at the time of planting, the Wetland Specialist may propose substitutions relative to species, size, and quantities for review and approval by the MassDOT Landscape Architect. Upon approval by MassDOT, substitutions shall be approved by the regulating authority, if and as necessary. Provisions shall be made for a growth warranty of at least two (2) calendar years from the date of Conditional Acceptance as described below or as required by permits.

ITEM 755.35 (Continued)

Seeding

Following placement of wetland soil and planting,the Replication Area shall be seeded using one of the following methods:

- Broadcast by hand or with a hand-held spreader followed by application of straw mulch. If necessary, seed shall be lightly raked to insure good seed-to-soil contact.
- Hydro-seeded with hydro mulch per the Standard Specifications and per the manufacturer's directions.
- Hand broadcast seed with Compost Blanket pneumatically applied at the same time to ensure light cover of soil topdressing over seed.

If spring conditions are drier than usual, supplemental watering may be required. If sowing during the summer months, supplemental watering will likely be required until germination.

If required, seeding limits for different seed mixes shall be determined by the Wetland Specialist.

PLANT ESTABLISHMENT AND INVASIVE MANAGEMENT

Plants shall be watered as necessary to maintain healthy establishment. Plants that fail by September 1 after spring planting or by May 15 after fall planting shall be replaced within the immediate or next planting period and at the Contractor's expense.

Seeding that fails to established according to the conditions of acceptance below shall be over-seeded as required by the Engineer. Washouts and channels shall be repaired and stabilized prior to overseeding. Excessive weed growth shall be pulled out by the roots or, with approval from the Engineer, cut prior to over-seeding. Soil repair and weed control are incidental to this item.

Invasive Plants: Corrective measures shall be taken to remove or treat invasive plant species in the Replication Areas. Invasive plants shall include those listed as invasive by Massachusetts Invasive Plant Advisory Group (MIPAG) and the US Army Corp of Engineer's New England District's Compensatory Mitigation Guidance

The strategy for chemical and/or manual removal shall be as directed by the Wetland Specialist, shall continue for the duration of the monitoring period, and shall be incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland construction work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist demonstrating that the wetland replication construction work was done according to plans (or how modified) and meets required permit conditions. The narrative shall include, photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

ITEM 755.35 (Continued)

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Replication Area and surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

- The final finished target elevations have been met and maintained relative to the approved plans and reference wetland. Areas that are too high or too low should be identified along with suggested corrective measures.
- Hydrology meets performance standards.
- Specified seed mix has been seeded. If inspected 30 or more days after seeding, seeded species in the wetland and adjacent upland shall show signs of good germination and healthy growth.
- Planted woody and herbaceous species meet specifications and are establishing well.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- There are no invasive plants visible in the replication area.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Replication work is not approved, MassDOT will issue a rejection letter requiring corrective actions. The Wetland Specialist shall recommend corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

REQUEST FOR CERTIFICATE OF COMPLIANCE

If required, a request for a Certificate of Compliance (Partial or Full) pursuant to the Massachusetts Wetlands Protection Act regulations shall be prepared and submitted to MassDOT within 30 days following Conditional Acceptance.

The Request for Certificate of Compliance shall include the following:

- A brief narrative of the work on company letterhead signed by the Wetland Specialist. Narrative shall be prepared as a MS Word document and shall include substantive explanation that demonstrates compliance with EACH relevant permit condition. Narrative shall note variations from the originally permitted design.
- As-built Drawings signed by the Contractor's PE registered in the Commonwealth of Massachusetts. As-built drawings shall show hydrologic conditions, status of plantings and seeding, and shall include a narrative and minimum of 4 photographs documenting site conditions. Plans should note variations from the originally permitted design.

ITEM 755.35 (Continued)

When required, drawings shall meet the Army Corp of Engineer's New England District's Compensatory Replication Guidance, including: scale in the range of 1"=20' to 1" = 100', contours at 1' intervals, spot elevations for intermediate elevations, and polygons outlining each Replication Area, and, as applicable, plant community types. The As-built Drawings shall be provided to the Engineer electronically in Portable Document Format (PDF). If requested by the Engineer, the Drawings shall be provided in printed paper format (11" x 17" sheets, unless otherwise directed). Drawings must be scalable.

- Other documents as required.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Contractor, Wetland Specialist and regulatory representative (if required) shall assess the Replication Area. Final Acceptance will initiate the start of the Wetland Monitoring Period.

The following conditions shall be inspected and approved for acceptance and payment.

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover at least 95 percent of the Replication Area, excluding areas of open water areas or planned bare soil.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species are living and establishing well.
- There are no visible invasive plants.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

If the mitigation work does not meet the above condition and is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions. Work not approved will be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

ITEM 755.35 (Continued)

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover 95 percent of the area, excluding areas of open water areas or planned bare soil.
- No sediments have entered into wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species (if included) are living and establishing well.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.35 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, equipment, submittals, maintenance, all required soil, site preparation, grading, wetland seeding, planting, mulching, watering, monitoring wells, registered surveyor, as-built plans, Request for Certificate of Compliance, and all incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 60% upon Conditional Acceptance.
- 20% after receipt and acceptance of Certificate of Compliance by the Engineer and once all permit construction requirements have been met and approved.
- 20% upon Final Acceptance.

Excavation will be paid under Item 120.
Compost Blanket will be paid under Item 751.7
Sediment Control Barrier will be paid under Item 767.121
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76

ITEM 755.45 WETLAND RESTORATION SQUARE YARD

The work under this item shall conform to the relevant provisions of Subsections 120, 751, 765, 767, and 771 of the Standard Specifications and the following:

The work under this item shall include all labor and furnishing of materials to complete the work specified herein to protect and restore existing inland wetland areas that will be temporarily impacted as shown on the drawings and as required by the Engineer.

Inland Wetland Replication work shall be as specified and compensated under that item. Tidal wetland mitigation shall be as specified under the appropriate item for tidal wetlands.

Restoration Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, U.S. Army Corps of Engineers General Permit.

All work shall be in coordination with an approved Wetland Specialist. Wetland Specialist qualifications and requirements shall be per Item 755.75, Wetland Specialist.

SUBMITTALS – DOCUMENTS

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): If applicable, request for a Certificate of Compliance shall be submitted to the Engineer for distribution to appropriate regulatory agencies as specified below.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.76 Wetland Monitoring Reports.

ASSOCIATED ITEMS AND MATERIALS

Timber Mat shall be as specified under that Item 767.91.

CONSTRUCTION METHODS & SEQUENCE

Site Protection Prior to Impacts

Prior to any land work, as part of the initial site-walk, the Wetland Specialist shall photo-document the site and provide a summary report of existing conditions as outlined under Item 755.75 Wetland Specialist.

Where and as required vegetation shall be cut flush and area surveyed to establish pre-construction elevations.

ITEM 755.45 (Continued)

Following the cutting and surveying, timber matting shall be placed as required to protect soil and vegetation from compaction, contamination, and/or other damages. Timber mats shall be placed as specified under the respective items and the Engineer shall approval placement.

Restoration Upon Completion of Construction Work

Sediment Barriers

If required for sediment control during Restoration work (i.e, tilling is required to restore soil), sediment barriers shall be installed along the downslope perimeter of the Restoration Area beginning and ending in the surrounding upland so that no disturbed soil can enter adjacent wetlands or waters. Sediment barriers shall be in place and approved by the Engineer prior to any soil disturbance. No work shall take place outside the barriers.

Removal of Fill and Grading

Timber mats shall be removed and disposed of as specified under the respective items.

If required, grades shall be restored to pre-construction elevations as shown in the baseline survey or as required by the Engineer and Wetland Specialist to restore hydrologic functions. Final elevations shall be approved by the Engineer prior to soil preparation and seeding. Grading shall be incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland restoration work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist (if applicable to project) demonstrating that the wetland restoration work was done according to plans (or how modified) and meets required permit conditions (if applicable). The narrative shall include, photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Restoration Area and the surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

ITEM 755.45 (Continued)

- The target elevations have been restored per the survey or adjusted per the Engineer. Areas that are too high or too low should be identified along with suggested corrective measures.
- Soil compaction has been mitigated.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- Hydrology meets performance standards and has been adequately restored.
- There are no invasive plants visible in the restored wetland area.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Restoration work is not approved, MassDOT will issue a rejection letter requiring corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Wetland Specialist and regulatory representative (if required) shall assess the Restoration Area. Final Acceptance will initiate the start of the Monitoring Period (if required).

The following conditions shall be inspected and approved for acceptance and payment:

- Hydrology is functioning as intended.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- There are no visible invasive plants.

If the restoration work is not approved, MassDOT will issue a rejection letter requiring corrective action. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation. Work not approved shall be addressed by the Contractor at no extra cost.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

ITEM 755.45 (Continued)

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended, relative to the preexisting condition of the restored wetland.
- No sediments have entered into wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.45 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, compost and amendments, seed, mulch, equipment, submittals, maintenance, grading, and incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 50% upon completion of removal of timber mats and any grading or soil modifications
- 25% upon Conditional Acceptance
- 25% upon Final Acceptance or approval of the Engineer

Sediment Control Barrier will be paid under Item 767.121
Timber Mat will be paid under Item 767.91
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76

ITEM 755.75 WETLAND SPECIALIST HOUR

Work under this Item shall be for services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications hereafter referred to as the "Wetland Specialist."

"Wetland Mitigation" shall be used herein for applicable wetland work. For this project, applicable wetland work is fo*r:* **Item 755.35 Inland Wetland Replication Area and Item 755.45 Wetland Restoration.**

The Wetland Specialist shall demonstrate knowledge and expertise to coordinate and oversee all work associated with the Wetland Mitigation as defined herein, as shown on the Plans, as required by permits, and as specified under the relevant Wetland Mitigation items.

Regulatory monitoring reports following Final Acceptance of the Wetland Mitigation shall be per Item 755.76, Wetland Monitoring Reports.

For all onsite work, the Wetland Specialist shall sign in and sign out with the Engineer.

The Wetland Specialist shall not be from the same company as the company responsible for planting, seeding, and/or maintaining the wetland.

QUALIFICATIONS

The Wetland Specialist shall have a minimum of five (5) years of experience with construction and monitoring of wetland mitigation areas similar in size, type, and complexity to the Contract mitigation. When required by permits, at least ten (10) years of experience may be required. The Wetland Specialist shall be thoroughly versed in the Commonwealth of Massachusetts Wetlands Protection Act (MGL C.131, s.40), U.S. Army Corps of Engineers New England District Compensatory Mitigation Guidance, and all other relevant regulations of the Massachusetts Department of Environmental Protection and the U.S. Army Corps of Engineers New England District.

SUBMITTALS - QUALIFICATION

Within sixty (60) days following the Notice to Proceed, the Contractor shall provide proof of qualifications for the Wetland Specialist to the Engineer for approval. Submittals shall include, but not be limited to, the following:

- Resume of the individual on-site implementing the Wetland Specialist work. If the Wetland Specialist changes over the course of the project, the new individual shall submit resume and qualifications for approval 30 days prior to doing any work on-site.
- Resume of any personnel working on-site in place of the Wetland Specialist. Individual shall be approved prior to work on-site.
- Narrative describing the company, its expertise, technical qualifications and experience with wetland construction.
- At least three (3) references from prior work of a similar nature completed in the last five (5) years and by the individuals who will perform the work. Provide contact information for each reference including address, phone number and email.

ITEM 755.75 (Continued)

- A summary of each reference project including nature of the work, project size, dates, and period of construction and monitoring, methodologies used, and summary of success (or not) in terms of meeting performance objectives. Summary shall include a minimum of one before and one after photo for each project.

SUBMITTALS – DOCUMENTATION AND REPORTS

Wetland Construction Oversight

Wetland Specialist shall provide documentation of pre-existing conditions and wetland construction as specified below and as part of fulfilling the Scope of Work described below. Documentation shall include photos that are clear and legible. Photos are incidental to this item.

- ***Site Walk Prior to Disturbance and Construction of Wetlands:*** Provide brief assessment with photos, including documentation of the existing wetlands to be impacted (both permanent and temporary), proposed wetland replication area, and reference/model wetland areas (typically an adjacent undisturbed wetland or the existing wetland to be impacted). Photos of existing wetlands that will be temporarily impacted shall include a view from at least 3 angles.
- ***Excavation and Grading:*** Documentation shall include minimum of two photos of the excavated wetland and two photos after final grading prior to planting and seeding. For restoration areas, photos shall show soil preparation (i.e, tilling and grading), if applicable.
- ***Approval of Subgrades****:* The Wetland Specialist shall inspect the sub-grade of the Replication Area to ensure that proper hydrology is likely to be established and shall provide the Engineer with written confirmation and photographs upon completion of subgrade excavation work. Written confirmation shall include recommended field adjustments, based on field observations, to achieve the desired hydrology and designed wetland system.
- ***Planting and Seeding:*** Provide assessment and photos of vegetation upon completion of planting and seeding work.
- ***Data logger output from Monitoring Wells*** shall be submitted with reports, if applicable and requested.

Wetland construction documentation and reports shall be submitted with Request for Conditional Acceptance and for the Order of Conditions, Water Quality Certifications, and other regulatory permits as required.

Requests for Acceptance of Work & Regulatory Compliance

The Wetland Specialist shall submit the following documents if and as specified herein and under Item the relevant Wetland Mitigation items:

- Request for Conditional Acceptance.
- Request for Certificate of Compliance (Partial or Full) when applicable.
- Request for Final Acceptance.

ITEM 755.75 (Continued)

SCOPE OF WORK

In the event of discrepancies with the applicable permits, the Wetland Specialist shall submit a Request for Information (RFI) to the Engineer.

General

The Wetland Specialist shall be responsible for the following:

- Review and have a comprehensive knowledge of the environmental permits relevant to the specific mitigation work being done so as to ensure compliance throughout the duration of the contract.
- Identify and inform the Contractor and Engineer of unique site conditions which may require adjustments to the schedule, design, or construction methods. For example, wildlife nesting, illegal dumping, or rare species.
- Identify and inform the Contractor and Engineer of any sediment or erosion control problems observed within mitigation areas.
- Advise so as to avoid impacts to adjacent areas and regulated wetland resources.
- Participate in necessary meetings as required by permits and when requested by the Engineer.

Inspections & Construction Oversight

The Wetland Specialist shall be responsible for, but not limited to, the following:

- Pre-Construction Site Walk
    - Following surveying, flagging, and staking of all relevant boundaries and elevations by the Contractor, the Wetland Specialist shall walk the site with the Engineer and the Contractor to review existing and proposed conditions, recommend changes if necessary, and approve the following: location and boundaries of the Mitigation Area, target elevations and grades, location of tree protection associated with the Mitigation Area, and final layout and limits of clearing for access route.
    - Select and mark snags, logs, and woody material to be retained for placement in the Wetland Mitigation, as appropriate.
    - Note invasive plants in and adjacent to Wetland Mitigation.
    - Provide summary report if and as specified under Wetland Mitigation items.
- Excavation, Soil Placement, Grading for Replication Areas
    - Approve excavated depth and grading for appropriate wetland hydrology, subsoil preparation, and finished grade of placed wetland soil.
    - Adjust grades as required and approve microtopography. If grades need to be adjusted, submit an RFI to the Engineer.
    - If requested by the Engineer, the Wetland Specialist shall inspect stockpiled wetland soil for moisture content and signs of undesirable weeds.
- Soil Protection and Restoration Measures for Restoration Areas
    - Review and approve methods of soil protection and restoration if required.
    - Confirm decompaction will adequately restore appropriate wetland hydrology. If decompaction measures need to be adjusted, submit an RFI to the Engineer.

ITEM 755.75 (Continued)

- Re-vegetation of Mitigation Area
    - Placement of woody material to be re-used.
    - Verify seed used complies with specifications and site conditions, determine limits for wetland seeding based on elevations, approve seeding and mulching methods, and collect seed tags to submit with Request for Conditional Acceptance.
    - Review planting methods (if applicable) prior to installation and oversee layout of wetland plants.

Conditional Acceptance

Upon completion of construction of the wetland, as part of the Request for Conditional Acceptance, the Wetland Specialist shall provide a brief narrative demonstrating that the wetland construction work was done according to plans (or how modified) and meets the conditions required for acceptance as specified under the Wetland Mitigation items. Submittal shall include a report and photo documention of pre-construction conditions, construction work, seeding, planting, and other work as specified under the Wetland Mitigation items. Photos of completed Wetland Restoration areas shall include the same views as the pre-construction reference photos.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the Wetland Mitigation items.

Upon approval, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Mitigation work is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

Request for Certificate of Compliance

If required, a Request for Certificate of Compliance shall be prepared and submitted to the Engineer immediately following Conditional Acceptance. Request shall be as specified under the relevant Wetland Mitigation items.

Request for Final Acceptance

Following one full growing season, the Wetland Specialist shall provide a brief narrative of the status of the Wetland Mitigation to be submitted with the Request for Final Acceptance.

Upon receipt of the Request, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the relevant Wetland Mitigation items.

If the Wetland Mitigation is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

ITEM 755.75 (Continued)

METHOD OF MEASUREMENT

Item 755.75 Wetland Specialist shall be measured per hour for on-site service provided by the Wetland Specialist.

Work shall include all inspections, photos, submittals, and associated tasks for construction and restoration oversight, narratives for Conditional and Final Acceptance, Request for Certificate of Compliance (Partial or Full) if required, documentation required for permits, and all other work specified above. Payment shall not include travel time or time spent off-site on reports. Decimal Pay Limits will be 0.25 hours.

BASIS OF PAYMENT

Item 755.75 Wetland Specialist shall be paid at the Contractor bid price for each hour, or fraction thereof, spent on-site to perform the work as described above. Reports and photo documentation are required for payment.

Post wetland construction reports shall be per Item 755.76, Wetland Monitoring Reports.

ITEM 755.76 WETLANDS MONITORING REPORTS LUMP SUM

Work under this item shall be for the submittal of Wetland Monitoring Reports following the completion of wetland construction and shall include all inspections, photos, and other work required to complete those reports as specified herein.

"Wetland Mitigation" shall be used herein for applicable wetland work, whether Wetland Replication (creation of a new wetland) and/or Wetland Restoration (restoration after temporary impacts).

The Contractor shall retain the services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications, hereafter referred to as the "Wetland Specialist," to complete the Wetland Monitoring reports. Wetland Specialist shall meet requirements specified under Item 755.75 Wetland Specialist.

All on-site Wetland Specialist services required to complete the construction and revegetation of the wetland replication, including preparation and submission of monitoring reports during construction, shall be per Item 755.75 Wetland Specialist.

SCOPE OF WORK

Post-Construction Wetland Monitoring Reports

Final Acceptance of the wetland construction work as specified under Items 755.35 and 755.45 shall initiate the beginning of the Monitoring Period.

Inspections and reports shall be performed to ensure compliance with mitigation requirements defined under the relevant Wetland Mitigation items and with all applicable environmental permits. Monitoring reports shall cover the following:

- Identification of all plant species present
- Percent cover for each plant species and overall percent surface area cover by indigenous wetland plant species for replication area and upland
- Description of the viability, health, and vigor of installed plants as well as volunteer plant species within the replication areas
- Description of remedial measures taken to ensure criteria are met
- Depth to apparent water table and/or depth of surface inundation, both as measured from the soil surface and data loggers, as appropriate.
- A conclusion regarding the success of the wetland mitigation area relative to the performance standards at 310 CMR 10.55(4)(b) (unless varied), the design plans, and performance criteria established by MADEP in the variance conditions (when applicable), and the reference wetland.
- Recommendation for a corrective plan of action if needed.

ITEM 755.76 (Continued)

Reports shall be submitted to the Engineer as a digital copy in Portable Document Format (PDF) unless otherwise requested. Hard copies shall be provided as requested by the Engineer. All reports shall be marked with the applicable permit numbers and identifying information as required in the permits. Reports shall include photo documentation of the wetland/s being monitored and shall include a minimum of 3 views from different orientations. Views shall be labeled.

Spring Reports, when required, shall be submitted to the Engineer by July 1 for dispersal to the appropriate permitting agencies.

End of Year Reports (which may serve as the Fall Report) shall be based on inspections that occur prior to October 15th. Reports shall be submitted to the Engineer no later than November 1 of each year.

Monitoring Reports shall be as follows for ***2*** years:

- *MassDEP: 1 Report - (1 end of year).*
- *ACOE: #1 Report (1 end of year).*

Conservation Commission: 4 Reports (1 spring and 1 end of year for two years).

BASIS OF PAYMENT

Item 755.76 Wetland Monitoring Reports and associated inspections shall be at the Contract unit price per Lump Sum and shall include all labor, materials, equipment, and all incidental costs required to complete the work. Lump Sum will be paid in equal installments of the Lump Sum divided by the number of reports submitted. Payment shall be upon submittal and acceptance of each report, based on the following schedule:

- Year 1 = ***one spring and one end of year report***
- Year 2 = ***one spring and one end of year report***

ITEM 756. NPDES STORM WATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit (CGP) issued by the U.S. Environmental Protection Agency (EPA).

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the EPA for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. The Contractor shall be fully responsible for compliance with the most recently issued CGP and any subsequent revisions. Should a fine or damages be assessed against it, or MassDOT, as a result of a local, state, or federal enforcement action due to non-compliance with the CGP, the Contractor shall take full responsibility.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a fourteen (14) day review period commencing from the date on which EPA enters the Notice into their database. Based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan (SWPPP) for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The CGP also requires the preparation and implementation of a SWPPP in accordance with the afore-mentioned statutes and regulations. The Plan will include the CGP conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. The contractor shall prepare the SWPPP and update it as necessary. The Contractor shall submit the Plan to the Engineer for approval at least four (4) weeks prior to any site activities. It is the responsibility of the Contractor to comply with the CGP conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to the project and to include in the SWPPP the methods and means necessary to comply with applicable conditions of said permits.

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA CGP, provide all information required, and obtain any and all certifications as required by the CGP. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, regulations, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

ITEM 756. (Continued)

In addition to the CGP requirements for inspections, MassDOT requires inspection of all erosion controls and site conditions on a weekly basis. Inspections are also required at portions of sites that discharge to sediment or nutrient impaired or high quality waters per the CGP when each incidence of rainfall exceeding 0.25 inches in twenty-four hours or after snowmelt discharge from a storm event that produces 3.25 inches or more of snow within twenty-four hours occurs. The CGP requires that inspections be performed by a qualified individual as outlined in the CGP. MassDOT requires proof of completion of a 4 hour minimum sedimentation and erosion control training class current to the latest CGP. This individual can be, but not limited to, someone that is either a certified inspector, certified professional, or certified storm water inspector. The documentation shall be included as an appendix in the SWPPP. The inspector's qualifications shall be submitted to the Engineer for approval prior to beginning any work. This individual shall be on-site during construction to perform these inspections. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the CGP. The Standard Specifications require adequate erosion control for the duration of the Contract. All control measures must be properly selected, installed, and maintained in accordance with manufacturer specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or is no longer adequate, it is the responsibility of the Contractor to replace or modify the control for site conditions at no additional cost to the Department. Contractor must maintain all control measures and other protective measures in effective operating conditions and shall consider replacement of erosion controls for each construction season.

The work under this item shall also include the preparation, submission and implementation of a Flood Contingency Plan. The plan shall address the potential need for the temporary relocation of construction and auxiliary equipment situated within the 1% annual chance of flooding zone to designated upland locations above the Base Flood Elevation during flood events. The Flood Contingency Plan shall address any additional MassDEP-required information requirements, as applicable. The Flood Contingency Plan shall be submitted to the Engineer for review and approval at the same time as the SWPPP.

ITEM 756. (Continued)

This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, preparation of monthly reports and Flood Contingency Plan. In addition, any erosion controls beyond those specified in bid items which are selected by the

Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

The CGP provides specific requirements for temporary and final stabilization. This shall be incorporated into the project schedule. The permit defines specific deadline requirements for Initial Stabilization ("immediately", i.e., no later than the end of the next work day following the day when earth-disturbing activities have temporarily or permanently ceased) and for Complete Stabilization Activities (no later than 14 calendar days after the initiation of stabilization). Stabilization criteria for vegetative and non-vegetative measures are provided in the CGP.

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved, as well as removal and proper disposal of all construction materials, waste and waste handling devices, removal of all equipment and construction vehicles, removal of all temporary stormwater controls, etc. Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate. The permittee shall use EPA's website to prepare and submit the NOT.

BASIS OF PAYMENT

Item 756 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, SWPPP & Flood Contingency Plan preparation, revisions/addenda during construction, monthly reports, filing fees, and all incidental costs required to complete the work.

Payment of 50% of the Lump Sum price of this item will be made upon acceptance of the NPDES Stormwater Pollution Prevention Plan & Flood Contingency Plan.

Payment of 40% of the Lump Sum price of this item will be will be paid in equal monthly installments distributed across the time remaining in the accepted baseline schedule until substantial completion.

The remaining 10% of the Lump Sum price of this Item will be paid following accepted submission of a Notice of Termination (NOT) when final stabilization has been achieved.

ITEM 765.451 NATIVE SEED – PART SHADE ROADSIDE MIX POUND

Work under this item shall consist of furnishing the mix(es) specified below in the required quantity.

SUBMITTALS

1) Pre-Verification of Seed Availability. Within 30 days after the Notice to Proceed, the Contractor shall submit to the Engineer the supplier's verification of availability of seed species in the required quantities and for the anticipated date of seeding. Verification shall be on the supplier's letterhead and notarized by the supplier's notary. Species not expected to be available should be noted and substitutions recommended.

2) Final Verification of Seed Availability. No earlier than 21 days prior to ordering, the Contractor shall submit to the Engineer the supplier's verification of availability of seed species and in the required quantities. Verification shall be on the supplier's letterhead and notarized by the supplier's notary. A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section. Substitutions or changes in the mix at this time must be approved by MassDOT Landscape Design Section.

3) Seed Worksheet provided herein shall be submitted to the Engineer prior to ordering seed to determine the number of pounds of Pure Live Seed required.

4) Seed Tags. The contractor shall submit original seed tags from each bag of seed used on the project or ensure that each tag is photo documented by the Engineer while on the unopened bag.

   Number of tags submitted must correspond to number of bags delivered.

   Species listed on the seed tag shall match the Final Verification of Seed Availability (Submittal #2) unless approved otherwise. Tag must include: variety and species name; lot number; purity; percentage of inert matter; percentage of weeds, noxious seeds, and other crop seeds; germination, dormant or hard seed; total viability; origin of seed; germination test date, net weight, and name and address of seller. The origin of seed must be listed on the seed tag for all species in the mix to provide verification of original (generation 0) seed source. The smallest known geographic area (township, county, ecotype region, etc.) shall be listed. Ecotypes and cultivars shall be as close to Massachusetts as possible and appropriate to the site conditions.

   A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section.

5) Verification of Seed Delivery. Prior to payment, contractor shall submit the Seed Delivery Verification form contained within the contract or the Supplier's Verification on company letterhead or a bill of lading. Supplier verification must include all information requested on the Verification form within this contract. The bill of lading must include variety and species name, lot number, net weight shipped, date of sale, invoice, project or seeding location, and name and address of Supplier. All information must be filled in and complete for acceptance. Information must match the seed tags and quantity of seed used on the job. A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section

ITEM 765.451 (Continued)

6) Seed Sample. If requested or if seed is from a previously opened bag, the contractor may be asked to submit to the Engineer a sample of seed from the seed bag (1-2 cups) at the time of seeding.

SEEDING SEASON

The appropriate seeding seasons are:

Spring: April 1 - May 15
Fall: October 1 - December 1 for dormant seeding

PERMANENT SEED MIX(ES)

Calculating Pure Live Seed (PLS)

Quantities specified are PURE LIVE SEED. Greater quantities of ordered seed may be required to achieve actual specified seeding rates.

Pure Live Seed (PLS) is defined as a percentage calculated by multiplying the percent of pure seed by the percent of viable seed (total germination, hard seed, and dormant seed). For example:

If a seed label indicates 90% purity, 78% germination, 10% hard seed, and 2% dormancy, it is calculated to be 90% x [78 + 10 + 2]% = 81% PLS.

Therefore, each pound of PLS would need 1 pound / 0.81 = 1.2 pounds of seed with a 90% purity and 90% total germination

ITEM 765.451 (Continued)

Seed Mix(es) shall be as specified below. Ecotypes and cultivars shall be as close to Massachusetts as possible and appropriate to the site conditions.

765.451 Part Shade Roadside Mix

	Botanical Name	Common Name	% PLS by Weight
Grass			
	Festuca rubra	Creeping Red Fescue	25.70%
	Elymus virginicus	Virginia Wild Rye	24.00%
	Schizachyrium scoparium	Little Blue Stem	22.50%
	Panicum virgatum	Switch Grass	10.00%
	Panicum clandestinum 'Tioga'	Deer Tongue 'Tioga'	7.00%
	Carex vulpinoidea	Fox Sedge	2.00%
	Agrostis perennans	Upland Bentgrass	2.00%
	Juncus effusus	Soft Rush	0.20%
			93.40%
Herb/Forb			
	Chamaecrista fasciculata	Partridge Pea	3.00%
	Penstemon digitalis	Beard-tongue	1.00%
	Zizia aurea	Golden Alexanders	0.30%
	Desmodium canadense	Showy Tick Trefoil	0.30%
	Solidago bicolor	White Goldenrod	0.20%
	Solidago caesia	Woodland Goldenrod	0.20%
	Rudbeckia hirta-VT ecotype	Black-eyed Susan-VT	0.20%
	Aster novae-angliae	New England Aster	0.20%
	Solidago odora	Licorice Scented	0.20%
	Aster divaricatus	White Wood Aster	0.20%
	Heliopsis helianthoides	Ox-Eye Sunflower	0.20%
	Pycnanthemum tenuifolium	Slender Mountain Mint	0.20%
	Monarda fistulosa	Wild Bergamot	0.10%
	Eupatorium perfoliatum	Boneset	0.10%
	Aster lateriflorus	Calico Aster	0.10%
	Oenothera fruticosa var.	Sundrops	0.10%
			6.60%
			100.00%

Seeding Rate: 15.0 lbs

Seeding Rate:
Species ecotype shall be as native to New England region as possible. Apply this mix at 20 lbs PLS/acre.

ITEM 765.451 (Continued)

FOR USE WITH SLOPES: Add 30 lbs/acre of a cover crop. For a cover crop use either grain oats (1 Jan to 31 July) or grain rye (1 Aug to 31 Dec).

Application Rate

Wetland riparian mix: 20 lbs/acre PLS. In addition, apply 30 pounds of cover crop (grain oats or grain rye) as appropriate to the season.

Any species substitutions shall be with a species having similar characteristics and function. Substitutions must be approved by MassDOT Landscape Design Section per the documentation submittal process.

50% Increase Adjustment for Field Conditions

Seeding under the following conditions requires a 50% increase in the permanent mix at the time of construction:

- Seeding out of season
  OR
- Seeding after Compost Blanket has been applied (unless already increased for out of season).

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Wetland riparian mix will be measured for payment by the pound of Pure Live Seed delivered and complete in place.

Wetland riparian mix will be paid at the contract unit price per pound of Pure Live Seed delivered upon approval of all Seed Submittal Documentation. Overseeding required to correct poor germination or establishment shall be incidental to the item.

Cover crop not included as part of the permanent mix composition will be paid for under Item 765.21, Annual Cover Crop.

Application and care of native seed mix will be paid for separately under Item 765.635 Native Seeding and Establishment.

ITEM 765.451 (Continued)

NATIVE SEED WORKSHEET

Project Description: _____ Project No: _____

Contractor: _____ Contract No: _____

Seed Mix Number & Description: _____

Contractor: Complete Prior To Ordering

Pounds of Seed Required Per Contract:

_____lbs./acre for _____Acre(s) OR _____ SY

Additional 50% increase if required (out of season or seeding over compost blanket):

_____**lbs. Total Seed Required**

Calculated Quantity for **P**ure **L**ive **S**eed (PLS[1]):

_____ **Total Pounds PLS**

Engineer: Verification at Time of Application

Number pounds delivered to site[2]: _____ Date(s): _____

Actual Seed Bag Tag/s Received or photo documented by Engineer: _____

[1] PLS=% pure seed x % viable seed (total germination, hard seed, and dormant seed).
*[2]Quantity delivered should match pounds **Total Pounds PLS** and **Verification of Seed Delivery**. Pounds should be shown on each Seed Tag.*

ITEM 765.451 (Continued)

SUPPLIER VERIFICATION OF SEED DELIVERY FOR MASSDOT PROJECTS

Date_____

We hereby certify that (*Seed Supplier*): _____

Furnished to (*Contractor*):_____

For use on: (*Project Description*) _____

Project #: _____ Contract #: _____

Pounds of Pure Live Seed: _____

Of Mix (*Description*): _____

Lot Number _____

The material was delivered on (*Date*)_____.

The labels and contents meet all State and Federal regulations. The mixture consists of the following species, including cultivars (as applicable) and ecotype region, and at the following percentages (may be attached separately):

Name (print): _____ Title: _____

Supplier: _____

Signature and Seal: _____

ITEM 765.635 NATIVE SEEDING AND ESTABLISHMENT SQUARE YARD

Work shall conform to the relevant provisions of Subsections 765 and 767 of the Standard Specifications and the following:

The work under this item shall consist of seeding, mowing, and other care to establish a stand of grass in the areas shown on the plans or as required by the Engineer. For the purposes of these specifications, the term "grass" shall apply to all the forbs, grasses, sedges, and rushes included in the materials.

QUALIFICATIONS

Seeding shall be done by a company having a minimum of five years of experience with native seed establishment. Prior to beginning work, the seeding Contractor shall furnish proof of qualifications to the Engineer for approval. Proof of qualifications shall include providing documentation (photos and contacts) to demonstrate knowledge and expertise with native seeding and establishment and proof of having completed successful native seeding projects.

SEEDING SEASON

Seeding seasons for native mixes is April 1 - May 15 and October 1 - December 1 for dormant seeding. Written approval must be obtained for seeding outside the seeding season and, if approved, the permanent seed rate shall be increased by 50%.

Seeding season for cover crops shall be grain oats January 1 – July 31 and grain rye August 1 – December 1.

MATERIAL AND SUBMITTALS

Seed Mixes and Submittals shall be per the item(s) for permanent and annual (cover crop) seed mixes.

Compost Blanket, if used, shall meet the material and submittal requirements for that item.

Hydromulch shall be wood fiber or straw applied per the Standard Specifications and at the rates specified below and per the manufacturer.

A certified statement shall be furnished, prior to start of work, to the Engineer by the Contractor as to the number of pounds of hydromulch, tackifier, and seed, per 100 gallons of water and as applicable to products used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above.

Fertilizer

No fertilizers shall be applied.

ITEM 765.635 (Continued)

Water

Water, including hose and all other watering equipment required for the work, shall be furnished by the Contractor to the site at no additional cost. Water shall be suitable for irrigation and free from ingredients harmful to plant life. All plants injured or work damaged due to the lack of water or the use of too much water shall be the Contractor's responsibility to correct.

SEEDING

Hand broadcast method shall be used for all areas smaller than half an acre and when specified on the plans for areas over half an acre.

Seeding shall occur within 72 hours of placement of loam and final grading or the Contractor shall propose a reasonable, alternative schedule that shall be approved by the Engineer.

Surface Preparation

No seeding or soil preparation shall be done if soils are muddy or dry and compacted. Bare soils shall be raked to remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Ruts and depressions shall be filled with additional loam or compost and the soil shall be re-graded to a relatively smooth finish corresponding to the required grades.

When seeding over existing or compacted soil or soil that has sat bare for more than 30 days, surface will be prepared by tilling or raking to a minimum depth of 2 inches prior to seeding and prior to Compost Blanket application (when applied).

Surface preparation shall be compensated for under for loam placement or topsoil rehandled and spread as appropriate to the project.

Jute or coir mesh, when specified in the contract, shall be placed after seeding and per the Standard Specifications and the manufacturer’s instruction.

Surface preparation shall be approved by the Engineer prior to seeding.

Seeding over Various Substrates

Loam: Seeding shall occur within 72 hours of loam placement to prevent loss of topsoil. Seed shall be manually broadcast for areas less than half an acre (each area, not cumulative area) and when specified on the plans. Broadcasting shall be immediately followed by hydromulching as specified below. When not specified on the plans, larger areas may be hydroseeded as specified below.

Compost Blanket: Compost Blanket shall be applied as specified under that item. Seed should be hand broadcast at the same time as compost application to ensure a thin cover of compost over seed.

ITEM 765.635 (Continued)

When seeding is done after application of Compost Blanket the rate shall be increased by 50%. If the Compost Blanket is applied after December 1, seed shall be broadcast or hydroseeding over the compost in the Spring and the rate increased by 50% specified under Seed Application.

Compost Mulch over Modified Rock: Compost Mulch and seed shall be applied as specified under that item. No hydromulch is required.

Cover Crop

Cover crop shall be used when seeding out of season, when specified with the permanent native seed mix under that item, and as required to prevent erosion until the permanent seed establishes.
A cover crop should not be used with a steep slope mix or other permanent mix which already contains either cereal rye or oats in the composition of the mix. A cover crop is not necessary for wetland seeding and is not typically necessary for soil stabilization when seeding in conjunction with a compost blanket application.

Seed Application

All seed shall be mulched as specified herein.

Seed application shall be by broadcast seeding or by hydroseeding as described below.

Broadcast Seeding

Seed shall be broadcast spread using a cyclone or whirlwind seeder or hand broadcast. Small or light-seeded species such as bluestem may be mixed with approved filler to achieve an even distribution. Seed shall not be broadcast when wind velocities are greater than 15 mph.

Broadcast seeding shall be undertaken in two separate passes at ninety degrees to each other. One-half the seeding rate shall be applied in each direction (horizontally and vertically). To ensure seed to soil contact with broadcasting of seed, seeding shall be followed by rolling or tracking with equipment approved by the Engineer.

Broadcast seed shall be mulched with weed-free straw mulch unless seeding is done as part of Compost Blanket in which case it shall be as specified above under seeding with Compost Blanket application. Hydromulching shall be as specified under Hydromulching.

Hydroseeding and Hydromulching

Hydroseed and mulching shall be per the manufacturer's directions and as follows.

Hydroseeding shall only be used for sites over half an acre in size or with permission of the Engineer.

ITEM 765.635 (Continued)

Tank and hoses shall be cleaned from all previous hydroseeding and hydromulching projects. Seed shall be mixed into the slurry immediately before application and slurry applied within 30 minutes after seeds have been placed in the tank. Once seed has been placed in the tank, tank shall be agitated only enough to mix the seeds and keep slurry from separating.

A 2-step process shall be used for seeding in conjunction with hydromulch. Seed shall be applied with 500 lbs/acre of hydromulch in the first pass. A second pass with 1,000 lbs/ acre of hydromulch shall be applied in a second pass. Each pass shall be applied in a different direction.

Once the seed has been added to the tank mixture a one-hour time limit is set for spreading the mixture on the soil. Once the one hour has passed the excess mixture must be discarded.

For broadcast seeding, hydromulch shall be applied immediately following seeding at a rate of 1,000 lbs/acre. Tank shall be cleaned from any previous hydroseeding.

CARE DURING GERMINATION AND ESTABLISHMENT

Contractor shall care for seeded areas as necessary for successful germination. Care will include watering and weed control as necessary to achieve establishment of the specified seeded species after one growing season as specified below.

The contractor shall maintain the stand of grasses to ensure healthy growth of the seeded species. Work shall include mowing or weed-whacking for weed control, watering if necessary, and removal of invasive plants.

Watering shall be sufficient to achieve soil moisture to a depth of 2 inches or more and such moisture is uniform. Method of watering shall not erode or damage soil or grassed surfaces.

General Weed Control: Unless otherwise directed, mowing shall be as specified under Mowing for Weed Control for seed establishment. Weeds shall be mowed prior to weeds setting seed (by the end of July unless otherwise approved).

Control of Invasive and Aggressive Weeds: Invasive and aggressive weeds, including but not limited to mugwort, ragweed, knapweed, foxtail, crabgrass, and chicory must be cut or treated prior to going to seed. Herbicide treatment must be coordinated with MassDOT. Undesired species (such as chicory) introduced due to use of incorrect seed mix shall be removed at the Contractor's expense.

MOWING FOR WEED CONTROL

Mowing for weed control shall be completed after weeds have sprouted and show leaf and bud growth, but prior to setting seed, generally between July 7th and August 1st, unless directed otherwise by the MassDOT Landscape Architect and the Engineer.

ITEM 765.635 (Continued)

Mowing height shall be as needed for weed control, generally to a height of 8 inches and not below 4 inches, unless directed otherwise. Mowing shall be with a brush hog mower or string trimmer other approved equipment. Conventional lawn mowers which cannot achieve the appropriate cut shall not be used.

Contractor shall give 48-hour notice prior to mowing work. Mowing shall only occur in dry sunny weather. Litter pickup should occur prior to mowing in all areas. If required, cut grass shall be raked and removed. Litter pickup and raking and removal of grass shall be incidental to the work.

Mowing equipment shall be approved by the Engineer prior to work.

OVER-SEEDING

Areas of bare ground greater than 2-3 feet in diameter shall be over-seeded with the specified mix during the appropriate season for seeding. Where required for overseeding mowing shall be as close to the soil as possible. Soil that is compacted shall be raked or otherwise roughened prior to over-seeding.

Over-seeding rates and methods shall those specified above under Materials and Methods. Following over-seeding, soil shall be lightly tamped to ensure seed to soil contact and areas shall be mulched with straw mulch and watered with a fine mist to moisten soil to a depth of at least 2 inches.

Over-seeding, mulch, watering, and all work for over-seeding shall be incidental.

DETERMINING SATISFACTORY GRASS ESTABLISHMENT

A well-established stand of the specified seeded species as determined by the Engineer and the MassDOT Landscape Architect will be required for Final Acceptance. The expectation is that an acceptable number and variety of the desired permanent seeded species (not the cover crop) will be visible. Generally:

- A minimum of 75% coverage by the specified permanent seeded species after one growing season. Of that percentage, generally, depending on the mix species:
    - At least 3 types of the permanent seeded grass species shall be visible.
    - At least 3 species of wildflowers shall be visible.
- There will be no significant gaps or bare soil (generally 2-3 feet in diameter or greater).
- There will be no more than 25% coverage by weed species.
- All soil shall be stabilized and there shall be no channeling or erosion.
- There will be no invasive or aggressive species within the stand at the time of acceptance.
- There shall be no evidence of seed from non-native mixes (i.e., clover) due to failure to clean the hydroseeding tank or using incorrect mix.

Invasive and aggressive weeds (such as mugwort, ragweed, knapweed, and chicory) must be cut or treated prior to going to seed for Interim Acceptance. Herbicide treatment must be coordinated with MassDOT.

ITEM 765.635 (Continued)

A warm-season grass mix with perennials will not have uniform growth. A uniform stand of grass may indicate use of an incorrect mix.

ACCEPTANCE OF SEEDING AND ESTABLISHMENT WORK

Conditional Acceptance shall be based on proper application of seed as specified herein.

Interim Acceptance of Care. Seeding will be inspected by mid-July to assess germination and Establishment conditions as described above. When necessary for Interim Acceptance, areas shall be mowed prior to weed species producing seed and as specified above under Weed Control. ***Areas requiring weed control that are not mowed prior to weed seed dispersal will not be approved for Interim Acceptance.*** Seeding that shows good germination and is determined by the Engineer and Landscape Architect to not require weed control at time of inspection shall be accepted for Interim Acceptance payment.

Final Acceptance of Establishment shall be given upon satisfactory Establishment as described above.

If the seeded area fails to meet the requirements of Establishment by the end of the growing season, contractor shall propose and implement remediations and site shall be inspected during the following growing season after July 1st. All remediation shall be at the contractor's expense.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Native Seeding and Establishment will be measured for payment by the square yard, complete in place.

Native Seeding and Establishment will be paid at the Contract unit price by the square yard upon Conditional, Interim, and Final Acceptances as described above. This price shall include all submittals, seeding, rolling to ensure seed-to-soil contact, weed control other than mowing, water, over-seeding, labor, materials, equipment, and all incidental costs required to complete the work of establishing a satisfactory stand of grass.

Native seed and cover crop mixes shall be compensated under the respective items.

Site preparation, including raking, tilling, removal of debris and stones, and other work to the prepare site for seeding shall be compensated under loam placement or topsoil rehandled and spread as relevant to the project. If used, Compost Blanket shall be compensated under the respective item.

Mowing for weed control will be incidental to this item.

Schedule of payment shall be as follows:

30% upon Conditional Acceptance

20% upon Interim Acceptance of Care, except this amount will be reduced to zero and final payment will be reduced accordingly when areas requiring weed control are not mowed as specified in the Interim Acceptance criteria.

50% upon Final Acceptance of Establishment

ITEM 767.121 SEDIMENT CONTROL BARRIER FOOT

The work under this item shall conform to the relevant provisions of Subsections 670, 751 and 767 of the Standard Specifications and shall include the furnishing and placement of a sediment control barrier. Sediment control barrier shall be installed prior to disturbing upslope soil.

The purpose of the sediment control barrier is to slow runoff velocity and filter suspended sediments from storm water flow. Sediment barrier may be used to contain stockpile sediments, to break slope length, and to slow or prevent upgradient water or water off road surfaces from flowing into a work zone. Contractor shall be responsible for ensuring that barriers fulfill the intent of adequately controlling siltation and runoff.

Twelve-inch diameter (after installation) compost filter tubes with biodegradable natural fabric (i.e., cotton, jute, burlap) are intended to be the primary sedimentation control barrier. Photo-biodegradable fabric shall not be used.

For small areas of disturbance with minimal slope and slope length, the Engineer may approve the following sediment control methods:

- 9-inch compost filter tubes
- Straw bales which shall be trenched

No straw wattles may be used. Additional compost filter tubes (adding depth or height) shall be used at specific locations of concentrated flow such as at gully points, steep slopes, or identified failure points in the sediment capture line.

When required by permits, additional sediment barrier shall be stored on-site for emergency use and replacement for the duration of the contract.

Where shown on the plans or when required by permits, sedimentation fence shall be used in addition to compost filter tubes and straw bales and shall be compensated under that item.

Sediment control barriers shall be installed in the approximate location as shown on the plans and as required so that no excavated or disturbed soil can enter mitigation areas or adjacent wetlands or waterways. If necessary to accommodate field conditions and to maximize effectiveness, barrier locations may be shifted with approval from the Engineer. Barriers shall be in place prior to excavation work. No work shall take place outside the barriers.

MATERIALS AND CONSTRUCTION

Prior to initial placement of barriers, the Contractor and the Engineer shall review locations specified on the plans and adjust placement to ensure that the placement will provide maximum effectiveness.

Barriers shall be staked, trenched, and/or wedged as specified herein and according to the Manufacturer’s instructions. Barriers shall be securely in contact with existing soil such that there is no flow beneath the barrier.

ITEM 767.121 (Continued)

Compost Filter Tube

Compost material inside the filter tube shall meet M1.06.0, except for the following: no peat, manure or bio-solids shall be used; no kiln-dried wood or construction debris shall be allowed; material shall pass through a 2-inch sieve; and the C:N ratio shall be disregarded.

Outer tube fabric shall be made of 100% biodegradable materials (i.e., cotton, hemp or jute) and shall have a knitted mesh with openings that allow for sufficient water flow and effective sediment capture.

Tubes shall be tamped, but not trenched, to ensure good contact with soil. When reinforcement is necessary, tubes shall be stacked as shown on the detail plans.

Straw Bales

Straw bales shall be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

Bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. All bales should be either wire-bound or string-tied. Straw bales should be installed so that bindings are oriented around the sides (rather than along the tops and bottoms) of the bales in order to prevent deterioration of the bindings.

The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material which might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.

Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.

The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency. Wedging must be done carefully in order not to separate the bales.

When used in a swale, the barrier should be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.
Sedimentation Fence

ITEM 767.121 (Continued)

Materials and Installation shall be per Section 670.40 and 670.60 of the Standard Specifications and the following:

Sedimentation fence shall only be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

When used with compost filter tubes, the tube shall be placed on a minimum of 8 inches of folded fabric on the upslope side of the fence. Fabric does not need to be trenched.

When used with straw bales, an 8-inch deep and 4-inch wide trench or V-trench shall be dug on the upslope side of the fence line. One foot of fabric shall be placed in the bottom of the trench followed by backfilling with compacted earth or gravel. Stakes shall be on the down slope side of the trench and shall be spaced such that the fence remains vertical and effective.

Width of fabric shall be sufficient to provide a 36-inch high barrier after fabric is folded or trenched. Sagging fabric will require additional staking or other anchoring.

MAINTENANCE

Maintenance of the sediment control barrier shall be per Section 670.60 of the Standard Specifications or per the Stormwater Pollution Prevention Plan (SWPPP), whichever is more restrictive.

The contractor shall inspect the sediment barrier in accordance with relevant permits. At a minimum, barriers shall be inspected at least once every 7 calendar days and after a rain event resulting in 0.25 inches or more of rainfall. Contractor shall be responsible for ensuring that an effective barrier is in place and working effectively for all phases of the Contract.

Barriers that decompose such that they no longer provide the function required shall be repaired or replaced as directed. If the resulting berm of compost within the fabric tube is sufficiently intact (despite fabric decay) and continues to provide effective water and sediment control, barrier does not necessarily require replacement.

DISMANTLING & REMOVING

Barriers shall be dismantled and/or removed, as required, when construction work is complete and upslope areas have been permanently stabilized and after receiving permission to do so from the Engineer.

Regardless of site context, nonbiodegradable material and components of the sediment barriers, including photo-biodegradable fabric, plastic netting, nylon twine, and sedimentation fence, shall be removed and disposed off-site by the Contractor.

ITEM 767.121 (Continued)

For naturalized areas, biodegradable, natural fabric and material may be left in place to decompose on-site. In urban, residential, or other locations where aesthetics is a concern, the following shall apply:

- Compost filter tube fabric shall be cut and removed, and compost shall be raked to blend evenly (as would be done with a soil amendment or mulch). No more than a 2-inch depth shall be left on soil substrate.
- Straw bales shall be removed and disposed off-site by the Contractor. Areas of trenching shall be raked smooth and disturbed soils stabilized with a seed mix matching adjacent seeding or existing grasses (i.e., lawn or native grass mix).
- Sedimentation fence, stakes, and other debris shall be removed and disposed off-site. Site shall be restored to a neat and clean condition.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 767.121 will be measured and paid for at the contract unit price per foot of sediment control barrier which price shall include all labor, equipment, materials, maintenance, dismantling, removal, restoration of soil, and all incidental costs required to complete the work.

Additional barrier, such as double or triple stacking of compost filter tubes, will be paid for per foot of tube installed.

Barriers that have been driven over or otherwise damage by construction activities shall be repaired or replaced as directed by the Engineer at the Contractors expense.

Sedimentation fence used in conjunction with compost filter will be measured and paid for separately under Standard Item 697., Sedimentation Fence.

ITEM 767.91 TIMBER MATTING SQUARE YARD

Work under this item shall conform to the plans and the relevant provisions of Subsection 767 of the Standard Specifications, and the following:

Timber Mats shall be used to support construction equipment when operating in wetlands. This item consists of furnishing, placing, maintaining, and removing Timber Matting as specified herein, as shown on the plans, and as required to protect existing soils during construction. Mats shall be within the area shown on the plans as necessary for construction access and staging. Existing soils shall be protected to the extent feasible.

At a minimum, material and methods shall follow Army Corp of Engineers Best Management Practices:
https://www.nae.usace.army.mil/Portals/74/docs/regulatory/StateGeneralPermits/MA/ConstructionMatBMPs.pdf

Relevant permit conditions and approvals shall also be followed.

MATERIALS & SUBMITTALS

Material and methods shall be submitted to the Engineer for approval. Submittal shall include a plan to show the proposed extent of matting, methods of preventing soil or other material from entering the wetland through gaps in the timber, procedure for inspections, method of removal and cleaning, and location of cleaning.

The timber construction mats shall be composed of heavy timbers joined together to form stable platforms installed over the surface of wetlands. Mats shall have all timber and rods intact.

Depending on site specific field conditions at the time of construction, multiple layers of Timber Mats and stringers may be necessary to support heavy equipment and to protect the underlying wetland.

As necessary, sediment control devices such as compost filter tubes shall be placed along edge of the Timber Mats to protect wetlands from sedimentation caused by construction vehicle traffic.

Mats shall be certified clean by the vendor prior to installation. The vendor shall submit proof of compliance. Clean is defined as being free of plant matter (stems, flowers, roots, etc.), soil, or other deleterious materials prior to being brought to the project site.

METHOD OF WORK

Prior to placement of mats, existing wetland limits and topography shall be assessed. Vegetation shall be cut flush. Care shall be taken to avoid removal of plant roots and to avoid soil disturbance.

ITEM 767.91 (Continued)

Mats shall be spread evenly and smoothly to ensure direct contact with the soil at all points and placed parallel to the drainage flow direction. To the extent possible, mats shall be placed along the travel area so that individual boards are perpendicular to the direction of traffic. There shall be no gaps between the mats. Mats shall be placed on either side of wetland area to rest on firm ground.

For situations where the Contractor determines that stones or boulders shall be removed or relocated within wetland areas in order to install safe and level structure work pads or access roads, the boulders shall be moved in a manner which does not result in significant soil disturbance (i.e., pushing with a bull-dozer is not allowed). When there is a significant number of boulders that shall be removed, the Contractor shall consult with the Engineer prior to undertaking the work.

The stockpiling of stone, drill spoils, and other unconsolidated material on construction mats shall be avoided unless determined necessary due to access and work pad constraints. Under this scenario, composite mats and/or other approved methods and materials shall be placed on top of the timber mats to prevent spoils from migrating through the gaps between timbers or spilling over the sides of the matting. The stockpiled spoil shall be removed from the work zone and properly disposed of in uplands approved by the Engineer or hauled off site for proper disposal. Material that falls into or otherwise enters the wetlands shall be removed by hand following removal of the mats.

Sediment controls and stone or wood chip ramps may be installed to promote a smooth transition to and minimize sediment tracking onto the timber mats. Geotextile may be added beneath stone or wood chip transitions to facilitate removal, as necessitated by site or permit conditions.

Mats shall be placed per the manufacturer's instruction. If requested by the Engineer, method of installation and final placement of mats shall be approved by the Wetland Specialist.

MAINTENANCE

Mats shall be monitored to assure that they are functioning correctly and shall be inspected for any defects or structural problems. Mats covered with soils or construction debris shall be cleaned and the materials removed and disposed of in an upland location. The material should not be scraped and shoveled into the resource area. Mats that become imbedded must be reset or layered to prevent mud from covering them or water passing over them. Worn timber or plywood used as a wearing surface shall be replaced as required and to the satisfaction of the Engineer.

REMOVAL OF MATS

Clean mats after use to remove any invasive plant species seed stock. Cleaning methods may include but are not limited to, shaking or dropping mats in a controlled manner with a piece of machinery to knock off attached soil and debris, spraying with water or air, sweeping, or exposing the mats to high temperatures. The location and method of cleaning shall be approved by the Engineer.

ITEM 767.91 (Continued)

Upon completion of construction, mats shall be removed. Matting should be removed by "backing" out of the site, removing mats one at a time.

If rutting or soil compaction following construction mat removal is observed, the area shall be returned to pre-existing conditions consistent with the surrounding area, by light hand raking or by back-blading with machinery. Deeper ruts shall be graded using available, loose soil from the work area.

Care shall be taken to inspect wetland crossings as each mat is removed to ensure any undesirable materials are properly removed and disposed of off- site.

If determined necessary by the Engineer, to enhance the functions of an altered wetland, a wetland seed mix shall be sown throughout the disturbed areas. In most instances, natural re-vegetation is an appropriate means to re-establish the wetland plant community in lieu of seeding.

Proper snow removal on construction mats shall avoid the formation of ice. To avoid the formation of ice, snow shall be removed from construction mats before applying sand. Prior to their removal from wetlands, sand shall be collected from the construction mats and disposed of in an upland area. A round street sweeping brush mounted on the front of a truck may be an effective way to remove snow from construction mats. Propane heaters may also be suitable solutions for snow removal and/or de-icing of swamp mats. Once construction mats are removed, wetlands shall be inspected for build-up of sand that may have fallen through swamp mats, therefore care shall be taken to inspect wetland crossings carefully as each mat is removed to ensure sand is properly removed and disposed of off-site.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Timber matting will be measured for payment by the square yard, complete in place, maintained and removed. Overlapped matting will not be measured for payment.

Timber matting will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment, sediment barriers specific to matting, geotextile, stone, wood chips, cutting of existing vegetation, and incidental costs required to complete the work of installation, maintenance, removal, and restoration of soil and vegetation, if required.

ITEM 772.035	**ARBORVITAE - EMERALD GREEN 4-5 FEET**	**EACH**
ITEM 772.334	**CEDAR - RED 3-4 FEET**	**EACH**
ITEM 774.239	**SPRUCE - WHITE 4-5 FEET**	**EACH**
ITEM 775.12	**ASPEN - QUAKING 4-5 FEET**	**EACH**
ITEM 776.543	**MAPLE - RED - OCTOBER GLORY 2-2.5 INCH CALIPER**	**EACH**
ITEM 778.18	**BIRCH - GRAY 4-5 FEET**	**EACH**
ITEM 783.043	**SERVICEBERRY - AUTUMN BRILLIANCE 4-5 FEET**	**EACH**
ITEM 794.329	**SUMAC SHRUB - FRAGRANT 2-3/ #2**	**EACH**
ITEM 794.331	**SUMAC SHRUB - FRAGRANT - GRO-LOW 2-3/ #2**	**EACH**
ITEM 794.733	**SUMMERSWEET -'HUMMINGBIRD' 18-24 INCH HT**	**EACH**
ITEM 794.809	**SWEETSPIRE - LITTLE HENRY - 12-18 INCH HT**	**EACH**
ITEM 796.031	**BUTTERFLYWEED - #1 CONT**	**EACH**
ITEM 796.433	**CAREX - ICE DANCE -#1 CONT**	**EACH**
ITEM 796.459	**SWITCH GRASS - SHENANADOAH - #2 CONT**	**EACH**
ITEM 796.753	**DAY LILY - HAPPY RETURNS - #1 CONT**	**EACH**
ITEM 796.757	**DAY LILY - ROSY RETURNS - #1 CONT**	**EACH**

The work under these items shall conform to the applicable requirements of Subsection 771 of the Standard Specifications, and the following:

Plant locations shown on the plans are schematic. Plants shall be located as directed by the MassDOT Landscape Architect or the Landscape Architect for the Designer of Record.

Tree trunk guards shall be supplied and installed at all deciduous trees. Tree trunk guards shall be expandable, made of corrugated plastic, 2 feet in length and a diameter that is a minimum of one-half inch larger than the caliper of the tree. Tree trunk guards shall not be tied or otherwise secured in a manner that does not allow for expanded tree trunk growth.

PLANTING

As shown in the Details, soil shall be carefully removed to expose the root flare of all B&B and container plants. Container plants shall be scored and girdled roots shall be teased out and pruned as necessary.

Plants planted incorrectly (too deep, girdled roots, root balls not scored) shall be deemed unacceptable for payment. The problem shall be remediated, and the plants re-planted to the satisfaction of the Landscape Architect. Plants with root systems that cannot be untangled or that require such severe pruning that the plant is compromised shall be rejected on site and replaced at the contractor’s expense.

Plants shall be watered prior to backfilling of planting pits and again after backfilling.

ITEMS 772.035 through 796.757 (Continued)

WATERING

Watering shall meet the requirements for the MassDOT Standard Specifications. In addition, a Watering Log (available online: Watering Log for MassDOT Plantings) shall be submitted to the Engineer at the end of each week or as requested by the Engineer. Watering and submitting of the weekly Watering Log shall commence immediately following planting and shall continue until the end of the plant warranty. The Engineer shall be notified prior to watering.

Failure to submit the watering log and/or notify the Engineer will result in deductions or non-payment for plants at the Interim and Final Acceptance inspections. This may include rejection of plants that have healthy foliage at the time of inspection but have been compromised (root system loss) due to lack of water during establishment.

ACCEPTANCE OF PLANTING AND PLANT ESTABLISHMENT

Inspections and acceptance of planting and plant establishment shall be as follows:

Conditional Acceptance

Following planting, the Contractor shall request an inspection for Conditional Acceptance of the plants and planting beds. The Engineer, the MassDOT Landscape Architect, and the Contractor shall inspect the plants, planting methods, and planting beds. Approval of plants and planting shall mark the beginning of the Plant Establishment Period and the one-year warranty period. Plants shall be watered and cared for as specified in the MassDOT Standard Specifications.

Interim Acceptance

Following Conditional Acceptance, plants and planting beds shall be cared for as specified in the standard specifications. Plants shall show healthy growth per the Standard Specifications. All weeds shall be removed (including roots) or, if approved by the Landscape Architect, weed-whacked. Watering log submissions shall be submitted and reviewed.

Plants that are dead or that fail to show healthy growth will not be approved for Interim Acceptance. As determined by the Engineer, those plants shall be immediately replaced, or shall be deducted from the contract and there shall be no further payments made.

Inspections for Interim Acceptance shall be conducted by the Contractor, the Engineer, and the MassDOT Landscape Architect and shall be according to the following schedule:

Spring Planting: Plants and planting beds shall be inspected following the first full growing season (June – August) after planting.

Fall Planting: Plants and planting beds shall be inspected the following spring (April– June) for Spring Interim Acceptance. Plants and planting beds shall be inspected again at the end of the growing season for Fall Interim Acceptance. This inspection shall take place between August 15 - September 10 or as otherwise determined by the Engineer, in order to allow for place replacements.

ITEMS 772.035 through 796.757 (Continued)

Final Acceptance: One year following Conditional Acceptance (end of the plant warranty period), plants shall be inspected by the Contractor, MassDOT Landscape Architect and the Engineer. Plants shall show healthy growth meeting the MassDOT Standard Specifications and planting beds shall be free of weeds. Formal planting beds shall be weed-free (no roots) and have a neat appearance.

No payment will be made for plants that are dead or that fail to show healthy growth.

PAYMENT SCHEDULE

Upon approval of plants at each inspection, payment shall be as follows:

Spring Planting:

- 40% upon Conditional Acceptance
- 40% upon Interim Acceptance which will include submission and approval of watering logs
- 20% upon Final Acceptance

Fall Planting:

- 35% upon Conditional Acceptance
- 10% upon Spring Interim Acceptance
- 35% upon Fall Interim Acceptance which will include submission and approval of watering logs
- 20% upon Final Acceptance

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The quantity of trees, shrubs, vines, grasses and ground cover plants measured will be paid for at the contract unit prices per each for planting of the types, species and sizes called for in the bid schedule. The unit price per planting item shall include furnishing and delivering all plants, furnishing and delivering prepared backfill soil, mulch, fertilizer, excavation for plant pits, backfilling, planting, pruning, guying and staking, tree trunk guards, mulching, weeding, watering, cleanup, plant establishment work and care including replacements, and for all labor, equipment, tools and incidentals necessary to complete the work prescribed in this section.

Mulching will be paid for under Item 767.6 Aged Pine Bark Mulch.

ITEM 796.775 LIVE STAKES EACH

The work under this Item shall conform to the relevant provisions of Subsection 771 of the Standard Specifications, and the following:

GENERAL

Live stakes shall be planted as shown on the Plans and shall be planted only during dormancy, prior to any growth or blooms.

Live stakes are placed after rip rap. If schedule doesn't allow for installation immediately following rip rap installation, they shall be installed at the next live stake planting window.

Planting Season

Live stakes shall be planted November 1 to December 15; and February 15 to March 31. Stakes shall not be planted in frozen ground.

MATERIAL

A variety of plant species may be used, depending on availability. Mix shall be determined by the Landscape Architect and/or Wetland Specialist. Species shall be 1) native to Massachusetts; 2) appropriate for conditions; and 3) appropriate for use as a live stake. Species may include, but are not limited to:

Salix discolor (Pussy willow)
Salix nigra (Black willow)
Cornus sericea (Redosier dogwood)
Cornus amomum (Silky dogwood)
Viburnum dentatum (Arrowwood viburnum)
Sambucus canadensis (Elderberry)

Live stakes shall be a minimum of four feet in length and a minimum of three-quarter inch (3/4") in diameter. Stakes shall have been harvested locally, within the same physiographic ecoregion and plant hardiness zone. Stakes shall have side branches removed and bark shall be intact. Bottom ends shall be cut with a sharp blade at a 30 to 45-degree angle for insertion into the soil. Top ends of stakes shall be cut square. Stakes shall have at least two (2) bud scars near the top to facilitate branch development.

Stakes must be fresh when brought to site and shall be planted within two (2) weeks of arriving on site. If stored on site after arrival, the stakes shall be cool, moist, and shaded with the bottoms of the stakes soaked in water. Dried stakes shall be rejected. Stakes that have been stored in water shall have the bottom recut, as described above, prior to planting.

ITEM 796.775 (Continued)

CONSTRUCTION METHODS

Care shall be taken to ensure the correct end of the stake is planted in the ground (buds facing upward). One foot of the live stake should be installed into the ground. Prior to planting, pilot holes should be made with a metal bar or re-bar. A rubber mallet should be used to drive the stakes in the ground. Tops that are damaged during insertion shall be cut. Stakes that split during insertion shall be removed and replaced.

Stakes shall be planted at 90-degrees to the slope.

The layout of species shall be as shown on the plans. If not shown, stakes shall be in groupings of three to five plants of the same species (depending on the species used) or shall be as required by the Landscape Architect or Wetland Specialist. Spacing shall be as directed by the Landscape Architect and/or Wetland Specialist, otherwise spacing shall be no farther than four (4) feet apart, and if planted in double rows, stakes shall be in a staggered pattern.

All stakes shall be watered as required for healthy growth.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment shall be at the Contract unit price for each stake planted. At a minimum, stakes shall have firmly established roots for acceptance at the time of the one-year warranty period.

ITEM 797.2 INFORMATIONAL SIGN EACH

The work to be done under this item includes furnishing and installing of a double pedestal informational sign as detailed on the plans at the locations shown on the plans or as directed by the Engineer.

MATERIALS

Double pedestal informational sign shall have a frame dimension of 38"x 26" for exhibits size of 36"x 24" and shall be made of corten weathering steel and shall have powder coat with black texture finish.

Grout shall be pourable exterior anchoring hydraulic cement per item on MassDOT QCML.

Gravel Borrow	M1.03.0 (Type B)
Cement Concrete (Air-Entrained 4000 psi, ¾", 610)	M4.02.00

CONSTRUCTION METHODS

The Contractor shall consult the manufacturer's recommendations in order to install the informational sign properly. The Contractor shall install the informational sign level, plumb and true.

Engineer shall approve the locations of the informational sign prior to installation of the footings.

The Contractor shall protect informational sign finishes on exposed surfaces from damage by applying a temporary protective covering or wrapping before shipping. Materials shall be stored in compliance with the manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other causes.

Each post of the informational sign shall be installed on a concrete footing as shown on the drawings as per manufacturer's recommendations. Top of footing shall be set below the finished paving course.

The Contractor shall inspect the informational sign after installation is completed and remove spots, dirt, and debris from all components. The Contractor shall repair damaged finishes to match the original finish or replace the damaged component.

METHOD OF MEASUREMENT

Item 797.2 will be measured for payment by the Each informational sign furnished and installed, complete in place.

BASIS OF PAYMENT

Item 797.2 will be paid for at the Contract unit price per Each which price shall include furnishing, installation, all labor, materials equipment, tools, and incidental costs required to complete the work.

ITEM 811.36 ELECTRIC MANHOLE ADJUSTED EACH

The work under this Item shall conform to the relevant provisions of Subsections 201, and 801 of the Standard Specifications, and the following:

The work to be done under this item is the adjustment of electric manholes on Essex Center Drive.

The Contractor shall coordinate the adjustment of these manholes with Sports Medicine North before commencing any work. The structures shall be adjusted to line and grade, with masonry removal and reconstruction conducted in conformity with the applicable requirements of Subsection 201: Basins, Manholes, and Inlets.

METHOD OF MEASUREMENT

Item 811.36 will be measured for payment according to the provisions of Subsection 801.80 of the Standard Specifications.

BASIS OF PAYMENT

Item 811.36 will be paid for according to the provisions of Subsection 801.81 of the Standard Specifications.

ITEM 815.13 RECTANGULAR RAPID FLASHING BEACON SYSTEM (SOLAR) EACH

The work under this Item shall conform to the relevant provisions of Section 800 of the Standard Specifications, the Plans, and the following:

Rectangular rapid flashing beacons (RRFBs) are intended to provide supplemental warning to approaching vehicles of the potential for pedestrians to be crossing in an adjacent crosswalk. The work shall include furnishing and installing a pair of solar-powered, pedestrian actuated, rectangular RRFB system at the locations indicated in the Plans. The final location for each assembly shall be determined and field verified by the City of Peabody and the engineer prior to installation.

MATERIALS

Each RRFB system shall, at a minimum, consist of the following items, which shall be included in the bid for each crossing depicted in the plans:

- (2) concrete foundations;
- (2) 15' traffic signal posts and pedestals
- (2) APS pushbutton systems;
- (4) dual rectangular yellow LED beacons in NEMA enclosures;
- (2) 9"x12" R10-25 (PUSH BUTTON TO TURN ON WARNING LIGHTS) signs;
- (4) 30"x30" W11-15 (BICYCLIST/PEDESTRIAN X-ING) signs;
- (2) 24"x12" W16-7PR and (2) 24"x12" W16-7PL (Diagonal Downward Arrow) signs;
- (2) solar panel arrays;
- (2) NEMA Type 3R or higher enclosures to house:
    - Electrical components, including wiring and solid-state circuit boards;
    - On-board user interface;
    - Battery and solar panels (at the solar-powered location indicated in the plan); and
    - Frequency hopping spread spectrum (or other alternate FCC approved) wireless activation unit with a minimum 150' range; and
- All mounting and supporting hardware and wiring necessary to complete a working system.

RRFB controller and LED beacons, APS pushbutton systems, and traffic signal posts and pedestals shall be listed on the Qualified Traffic Control Equipment List.

The light intensity of the LED beacons during daytime conditions shall meet the minimum specifications for Class 1 yellow peak luminous intensity in the Society of Automotive Engineers (SAE) Standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January, 2005. An automatic signal dimming device shall be included to reduce the brilliance of the LED beacons during nighttime conditions.

All signs shall be MUTCD-compliant. R10-25 signs shall have a black border and legend on a white background. W11-15, W16-7PR, and W16-7PL signs shall have a black border and legend on a fluorescent yellow-green background. All sign sheeting materials shall be per Subsection 828.41.

ITEM 815.13 (Continued)

R10-25 signs may be integrated into the APS pushbutton system as a single unit or mounted separately on Type A aluminum.

W11-15, W16-7PR, and W16-7PL signs shall be Type A aluminum per Subsection 828.42.

Any proprietary software required for the programming and/or operation of the system shall be included at no additional cost.

Where necessary, the Contractor shall provide extension bracket mounted on the signal poles at no additional cost such that the pedestrian pushbutton detector shall be located within 10 inches from the wheelchair ramp level landing. The extension bracket including pushbutton and signs shall not encroach into level landing resulting level landing area smaller than 4 feet by 4 feet. The bracket extension shall provide the provision of mounting pushbutton and 9 inch by 12 inch sign required per ADA and MUTCD guidelines. The bracket extension shall be installed per manufacturer's recommendation and the length of the extension shall be field verified and adjusted as needed.

Solar Panels:

The solar panels shall be affixed to an aluminum plate and bracket, adjustable at an angle of 45° to 60° and each assembly shall be mounted on a 360° rotatable pole cap mount to facilitate adjustment for maximum solar collection and optimal battery strength. The solar panel assemblies shall be rated for 90 mph wind conditions.

The batteries shall conform to Battery Council International specifications and have a capacity allowing up to 30 days of autonomy without sunlight and varying with ambient temperature and number of activations. The batteries shall be rated for a minimum lifespan of 3 years. Batteries shall be replaceable independently of other components. The contractor is responsible for designing the solar panel and battery assembly for each post to provide the stated level of autonomy.

The solar panels and battery shall have a minimum operating temperature range of -40° to 122°F (-40° to 50°C).

The Contractor shall provide shop drawings and calculations to confirm solar panel sizing and battery/solar energy storage will meet the functional requirements of the system.

Functional Requirements:

The RRFB system shall remain dark until pedestrian actuation.

ITEM 815.13 (Continued)

Upon actuation, all LED beacons shall activate and flash in a rapidly flashing sequence. Each sequence shall last 800 milliseconds and there shall be 75 sequences per minute. The sequence shall be the same for each pair of LED beacons in an enclosure and shall be as follows:

1. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.
2. Both RRFB indications shall be dark for approximately 50 milliseconds.
3. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.
4. Both RRFB indications shall be dark for approximately 50 milliseconds.
5. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.
6. Both RRFB indications shall be dark for approximately 50 milliseconds.
7. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.
8. Both RRFB indications shall be dark for approximately 50 milliseconds.
9. Both RRFB indications shall be illuminated for approximately 50 milliseconds.
10. Both RRFB indications shall be dark for approximately 50 milliseconds.
11. Both RRFB indications shall be illuminated for approximately 50 milliseconds.
12. Both RRFB indications shall be dark for approximately 250 milliseconds.

The flash rate of each individual RRFB indication, as applied over the full flashing sequence, shall not be between 5 and 30 flashes per second.

The RRFB units shall operate in flashing sequence after pushbutton activation for the following locations and intervals:

- Crossing of Northshore Road: 11 seconds (for a 24-foot crossing at 3.5 feet per second plus 4 seconds).
- Crossing of Endicott Street: 13 seconds (for a 31-foot crossing at 3.5 feet per second plus 4 seconds).

All RRFBs within a system shall commence and cease operation simultaneously.

These settings shall be user-programmable through the on-board user interface. No-fee wireless (Wi-Fi, Bluetooth®, etc.) may be used as an alternative programming method.

Each APS pushbutton shall have a tactile arrow and locator tone. The tactile arrow shall be oriented to point in the direction of the crosswalk. The locator tone shall have a duration of 0.15 seconds or less and shall repeat at 1-second intervals. The locator tone shall be set 2 to 5 dBA above ambient sound, shall automatically adjust intensity, but cap at a maximum volume of 100 dBA. The tone shall be audible whenever the LED modules are not active.

Upon activation of the LED modules, a speech message shall state, "Yellow lights are flashing." This message shall be stated twice. No vibrotactile or percussive indications shall be used.

ITEM 815.13 (Continued)

CONSTRUCTION METHODS

No work shall commence until the shop drawings are approved.

The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the area affected by the proposed conduit and posts. The cost of the test pits and utility survey shall be considered incidental to the lump sum cost.

Both poles and both signal post pole bases (if applicable) shall be painted black

Foundation installations (where applicable) shall be per Subsection 801.62 and SD3-030 with foundation depth as indicated in the plans. The top of the foundation shall be ¼" to 1" proud of the sidewalk and chamfered at 45 degrees. Gaps between the sidewalk and foundation shall be no larger than ¼" and grouted with preformed joint filler. Foundations shall be cast in place.

Equipment grounding shall be per Subsections 813.61 and 813.62.

The Contractor shall diagnose and replace any part of the pedestrian activated warning system that is found to be defective in workmanship, material, or manner of functioning within six months of final acceptance by the Engineer. This requirement does not supersede the one-year warranty period on materials specified in Subsection 815.20.

Systems shall have a warranty of three (3) years with the warranty period beginning on the date the RRFB units are accepted by the City.

The Contractor shall furnish three (3) sets of maintenance and operation manuals. The equipment manuals shall contain schematic diagrams, complete installation/operation procedures, maintenance/troubleshooting procedures, and a list of replacement parts including names of vendors.

METHOD OF MEASUREMENT

Item 815.13 will be measured for payment by the Each rectangular rapid flashing beacon, as measured by the 2-Post Assembly System, furnished and installed, complete in place.

BASIS OF PAYMENT

Item 815.13 will be paid for at the Contract unit price per Each, which price shall include furnishing, installation, wiring, mounting equipment, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 820.11 HIGHWAY LIGHTING - UNDERPASS LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsection 820 of the Standard Specifications, and the following:

The Lighting Assemblies shall be as generally described on the Drawings and as detailed in these Special Provisions. This work shall be done in accordance with the Standard Specifications and these Special Provisions, as detailed in the Drawings. The contractor shall furnish all supervision, materials, equipment, accessories, handling, shipping, and delivery to provide the specified Lighting Assemblies as detailed herein, complete with all appurtenances. All transportation, handling, shipping costs, manufacturer's storage, and other necessary costs shall be included.

This work shall include providing all labor, equipment, and materials to install the Lighting Assemblies, complete with lamps, drivers, wiring, grounding connections, and all other items necessary to provide a complete and operational system. This work shall be done in accordance with the Standard Specifications and these Special Provisions and as detailed on the Drawings.

SUBMITTALS

Submit detailed shop drawing submittals with all aspects and dimensions, as well as equipment and material specifications of the proposed pole, Luminaire, and appurtenances clearly detailed. Shop drawing submittal shall include point-by-point photometric calculations. Calculations shall be in maintained fc. Include light loss factors in the report. Point-by-point calculations shall utilize an IES standard grid. The manufacturer may contact the engineer to receive an Auto Cad .dwg file of the project area and pole layout to facilitate these calculations.

MATERIALS

Luminaire: Proposed Lighting shall be approved by the Engineer and in accordance with the following requirements:

1. Drawing Designation: SW-1
2. Qty: 4
3. Height: 6 1/2”
4. Width: 15 11/16”
5. Length: 14 17/64”
6. Weight: 17 lbs.
7. EPA Rating: N/A
8. Material: Die Cast Aluminum Housing and Heatsinks.
9. Vibration Rating: 1.5G.
10. Driver Enclosure: Thermally isolated from optics to allow for optimal thermal performance.
11. Optics: High efficiency injection-molded AccuLED Optics to be fully sealed to maintain IP rating.
12. BUG Rating: Luminaire to produce 0% total lumens above 90º (BUG Rating, U=0).
13. Fixture Connection: Gasketed and zinc plated rigid steel mounting attachment.

ITEM 820.11 (Continued)

14. Finish:
    a. Provide in TGIC polyester powder coat paint, 2.5mil nominal thickness, in Gray finish.
    b. Finish to be confirmed with owner prior to ordering.
15. Lamping: 44 watt LED
16. LEDs: ROHS compliant, 100% mercury and lead free.
17. Lumens: 4,851 lm
18. Minimum Efficacy: 110 (lm/w)
19. System Drive Current: 800 mA
20. Voltage: Universal Electronic, wired at 120v to 277v
21. CCT: 3,000K
22. CRI: Minimum of 80
23. Distribution: Type 3
24. BUG Rating: B1-U0-G1
25. Power Supply / Driver: Class 2 0-10V dimmable driver w/ IP66 minimum rating.
    a. Temp Range: -40deg Celsius to 40deg Celsius
    b. Surge Protection: 20kV UL Surge Protection Device integral to fixture.
26. Driver Location: Integral to fixture, mounted to heavy duty fabricated bracket to allow for ease of maintenance.
27. Life: Minimum L90 of 60,000 hours minimum with projected L70 at 205,000 hours.
28. Listing & Rating:
    a. Minimum IP66
    b. UL Wet Location (US/Canada)
    c. Vandal Rating: IK10
    d. Tested and in conformance w/ IESNA LM-79 & LM-80 test standards at 25-degree Celsius
    e. DesignLights Consortium™ Premium Classification qualified product.
    f. International Dark Sky Association listed.
29. Warranty: 5 Year
30. Wiring: Exterior and underground wiring in conduit and grounding conductors: 98% conductivity copper 600 volt insulation, XHHW, THHN/THWN, or THWN-2. Streetlight pole internal wiring: 98% conductivity copper 600 volt insulation, MTW, XHHW, THWN-2 or THHN/THWN.
31. Color code: All conductors shall have color-coded insulation to designate ground, neutral conductor and phases. Colored tape alone is not acceptable. Phases shall be black and red, receptacle branch circuit shall be black, neutral shall be white and ground shall be green.
32. Wire markers: Shall be plastic cable wrap type with marking tag for permanent tagging. Plastic tag shall have controller and circuit number written on it with permanent ink marking pen per tag manufacturer's directions. Panduit PLF1MA-C Marker Tie, or equivalent.
33. Splices and Junctions:
    a. All splices and junctions shall be made waterproof by a UL approved method. Conductor splice shall be made by UL listed compression type butt splice kit. Waterproofing method shall be by heat shrink, by sealant in waterproof splice cap, or by sealant in cold shrink.

ITEM 820.11 (Continued)

b. #10 AWG or Smaller, above grade: UL listed compression type connectors.
c. #8 A WG or Larger, above grade: UL listed mechanical compression connector.
d. Splices and junctions shall not be buried or installed in conduit.
e. Splices in junction boxes shall be UL listed hydraulic compression (12 tons minimum) type butt or two-wire stub splice with UL listed heat shrink waterproof splice cover.
f. End caps shall be used to seal and insulate the ends of 1/C wires. End caps shall be waterproof of thermally stabilized, modified polyolefin heat shrink material with mastic sealant inside UL listed 600 Volt, 90 degrees C.
g. Wet location splices and junctions shall be accomplished with UL listed heat shrink 600 Volt, 90 degrees C, waterproof splice kits. Raychem Series MCK, Type V or L or equivalent.

CONSTRUCTION METHODS

Install fixtures in strict accordance with the manufacturer's instructions.

Electrical conduit, junction boxes, and boxes to be installed in accordance with Section 800 of the MassDOT standard specifications.

Handle lighting fixtures carefully to prevent breakage, denting or scoring of fixtures' finishes. Do not install damaged lighting fixtures. Replace with undamaged units and return damaged units to equipment manufacturer. Install fixture, drivers and wiring complete.

Splices and junctions shall be made only in junction boxes. Perform no more splices than needed.

Install a tie wrap type permanent wire marker on each and every pair of conductors passing through every junction box (bundle circuit pairs together). Mark controller number, circuit letter and pole number on each tie wrap and designate home runs as encountered.

BASIS OF PAYMENT

Item 820.11 will be paid for at the Contract Lump Sum price, which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

Furnishing and installing all required wiring is included in the unit price of this item.

ITEM 832.91 EAST COAST GREENWAY STANDARD ROUTE SIGN EACH
ITEM 832.92 EAST COAST GREENWAY ARROW SIGN EACH

The work under these Items shall conform to the relevant provisions of Subsection 828 of the Standard Specifications, and the following:

The work under these Items shall include furnishing and installing East Coast Greenway signs at the locations designated on the plans and as required by the Engineer.

Signage for the East Coast Greenway must be ordered from the East Coast Greenway Alliance using the attached order form and map or plan of proposed sign locations per the Pavement Marking & Signing Plans.

METHOD OF MEASUREMENT

Items 832.91 and 832.92 will be measured for payment by the Each respective East Coast Greenway sign furnished and installed, complete in place.

BASIS OF PAYMENT

Items 832.91 and 832.92 will be paid for at the respective Contract unit prices per Each, which prices shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

Posts shall be paid under Item 847.1.

ITEM 847.1 SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY – STEEL EACH

The work under this Item shall conform to the relevant provisions of Subsection 840 of the Standard Specifications, and the following:

Where new signs and posts are installed in cement concrete surfaces, coring post holes, filling hole, and repairing/restoring sidewalk shall be considered incidental to this item.

METHOD OF MEASUREMENT

Item 847.1 will be measured for payment according to Subsection 840.80 of the Standard Specifications.

BASIS OF PAYMENT

Item 847.7 will be paid for according to Subsection 840.81 of the Standard Specifications and shall also include coring post holes, filling hole, and repairing/restoring the sidewalk.

ITEM 851.11 TEMPORARY PEDESTRIAN BARRICADE FOOT
ITEM 851.12 TEMPORARY PEDESTRIAN CURB RAMP EACH

Work under these items consist of furnishing, deploying, maintaining in proper operating conditions, and removing temporary pedestrian barricades and temporary pedestrian ramps as part of a Temporary Pedestrian Access Route (TPAR) in order to guide pedestrians around a fully- or partially-closed sidewalk. These devices are intended to prevent pedestrians from entering the work area and to prevent pedestrians from inadvertently entering the vehicle travel lane by providing visual and physical separation between each space.

MATERIALS

The Temporary Pedestrian Barricade shall have a continuous bottom rail or edge no more than two (2) inches above the ground and eight (8) inches in height (minimum) to accommodate cane users, have a smooth and continuous hand railing along the top edge no less than 32 inches above the ground and not obstruct or project into the pedestrian path of travel. Barricade walls shall be nearly vertical and generally within the same plane.

If exposed to traffic, Temporary Pedestrian Barricades shall be crashworthy.

The Temporary Pedestrian Curb Ramp shall provide a 48 inch minimum width, with a firm, stable, and non-slip surface. Protective edging with a two (2) inch minimum height shall be installed when the curb ramp or landing platform has a vertical drop of six (6) inches or greater.

The Temporary Pedestrian Curb Ramp walkway and landing area surface shall be of a solid, continuous, contrasting color abutting up to the existing sidewalk.

If a Temporary Pedestrian Curb Ramp leads to a crosswalk, a detectable warning pad must be used at the base of the ramp; if it leads to a protected path that does not conflict with vehicular traffic then a detectable pad shall not be used.

CONSTRUCTION METHODS

The Temporary Pedestrian Barricade shall be placed in an area that will provide pedestrians with a TPAR on a smooth, continuous hard surface for its entirety. The geometry and alignment of the facility shall meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities" and the Massachusetts Architectural Access Board.

The recommended width of the TPAR is 60 inches, but if constraints exist a minimum clear width of 48 inches shall be provided along its entirety. If a 60 inch width cannot be accommodated in full, a 60 inch by 60 inch passing space shall be provided every 200 feet or less along the TPAR.

Turning areas shall be 60 inches by 60 inches minimum.

Lateral joints between any surfaces shall not exceed 0.5 inches. Lateral edges may be vertical up to 0.25 inches high and shall be beveled at 1V:2H between 0.25 inches and 0.5 inches.

ITEMS 851.11 and 851.12 (Continued)

The TPAR shall be kept clear of debris, snow, and ice and the Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall not obstruct drainage.

Removal and/or resetting of Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall be considered incidental.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for Temporary Pedestrian Barricades will be made at the contract price per foot installed in place, including all incidental items. This price shall include the cost of furnishing, installing, resetting, removal, and maintaining in good working condition.

Payment for Temporary Pedestrian Curb Ramps will be made at the contract price per each unit installed in place, including all incidental items. This price shall include the cost of furnishing, installing, resetting, removal, and maintaining in good working condition.

ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET EACH

The work under this Item shall conform to the relevant provisions of Subsection 840 of the Standard Specifications and the following:

The work to be done consists of removing and resetting the existing street, warning, regulatory and miscellaneous signs and their supports to new locations as shown on the Plans or as required by the Engineer.

The Contractor shall replace at his own expense, all sign panels and supports that are damaged or lost either directly or indirectly as a result of his actions.

MATERIALS

Materials for traffic signs and miscellaneous signs removed and reset shall be the existing signs. If in the opinion of the Engineer, the existing sign panel is unsuitable for reuse, a new sign panel of a size and composition equal to the existing sign panel, shall be furnished, as required by the Engineer.

CONSTRUCTION METHOD

The sign shall be mounted in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the 1990 Standard Drawings for Signs and Supports.

When the visibility of the relocated sign panels is obstructed by trees and other vegetation, the Contractor shall clear the obstruction for proper sight distance. All clearing shall be done within the roadway layout, as approved by the Engineer.

Sign panels to be removed and reset shall be cleaned before being reset.

Damage during removal or resetting to any sign panel designated for reuse by the Engineer shall be repaired or replaced by the Contractor at his own expense.

Any excavation made for removal of the existing sign or foundation and any resulting depression shall be backfilled with selected excavated material and the surface restored to match the adjacent materials.

The Contractor shall furnish and install all necessary mounting fixtures (nuts, bolts and other miscellaneous items) required to complete the work.

ITEM 874.2 (Continued)

METHOD OF MEASUREMENT

Item 874.2 will be measured for payment by the Each traffic sign removed and reset, complete in place.

BASIS OF PAYMENT

Item 874.2 will be paid for at the Contract unit price per Each, which price shall include removing, resetting, excavation, backfilling, mounting fixtures, all labor, materials, tools, equipment, and incidental costs required to complete the work.

If required by the Engineer, new sign posts for Traffic Signs shall be paid for separately under Item 847.1.

If required by the Engineer, new Traffic Sign panels shall be furnished, installed and paid for under Item 832.

The cost of any work or materials required, due to the Contractor's negligence, shall be borne by the Contractor.

ITEM 874.4 TRAFFIC SIGN REMOVED AND STACKED EACH

The work to be done under this item consists of dismantling, removing, and stacking existing warning and regulatory sign panels, guide signs, and posts (whether signs are present or not); including their supports and all mounting hardware, designated to be removed on the plans or as required by the Engineer.

CONSTRUCTION METHODS

Signs and attached hardware shall be carefully removed from their supports. The supports and existing foundations shall be completely removed and the holes backfilled with gravel borrow. The surface shall be patched with a material to match the existing ground or as required by the Engineer.

The Contractor shall backfill all holes resulting from removal of existing signs and their foundations with compacted gravel and restore the area to match the existing conditions of adjacent areas.

Sign panels, posts and foundations shall be disposed of offsite in a manner that meets all applicable local, state and federal requirements.

If signs are attached to existing light poles, utility poles or traffic poles, only the sign and attached hardware shall be removed and stacked.

Signs shall be stockpiled at the City of Peabody DPW at 50 Farm Avenue, Peabody 01960.

The existing signs shall not be removed and stacked without the prior approval of the Engineer.

METHOD OF MEASUREMENT

Item 874.4 will be measured for payment by the Each traffic sign removed and stacked, complete in place.

One unit shall include the sign panel, sign post(s), appurtenances, and foundation(s).

BASIS OF PAYMENT

Item 874.4 shall be paid for at the Contract unit price per Each which price shall include removing, stacking, backfilling, restoration of the removed sign area, all labor, materials, equipment and all incidental costs required to complete the work.

ITEM 916.01 PRECAST CONCRETE CULVERT NO. 1 (8' SPAN, 4' RISE) EACH
ITEM 916.02 PRECAST CONCRETE CULVERT NO. 2 (8' SPAN, 4' RISE) EACH

The work performed under this Item shall conform to the applicable provisions of Subsection 901 of the Standard Specifications and the following:

Work under this item shall include all materials, equipment and labor needed to construct the following:

- Precast concrete box culvert, cutoff walls, and headwalls;
- Precast concrete wingwalls and footings;
- Damproofing and weep holes;
- All items included hereinafter under Basis for Partial Payments.

PRECAST CONCRETE CULVERTS, CUTOFF WALLS, HEADWALLS AND WINGWALLS

A. General.

The work under this Heading consists of fabricating, transporting and installing precast concrete box culverts, and includes all necessary labor, materials, and equipment to complete the work as shown on the Plans. The work shall conform with the MassDOT Standard, Supplemental, and Interim Specifications and the requirements of the current AASHTO LRFD Bridge Construction Specifications, supplemented by the current relevant provisions of the latest edition of PCI MNL-116 (The Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products), except as noted herein.

The manufacturer shall submit evidence at the request of the Engineer showing that he or she has successfully completed work of similar magnitude prior to being approved as the source of the material for this work. The manufacturing process shall be closely supervised by experienced plant personnel and records of plastic and concrete strength shall be kept and submitted to the Engineer for control.

QUALITY ASSURANCE

A. General.

Quality Assurance includes all the planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service. It is an all-encompassing term that includes Quality Control (performed by the Fabricator) and Acceptance (performed by MassDOT). Quality Control is the system used by the Contractor and Fabricator to monitor and assess their production processes at the plant facility and installation activities at the project site to ensure that the final product will meet the specified level of quality. Acceptance includes all factors used by MassDOT to determine the corresponding value for the product. MassDOT Acceptance inspection at the plant facility is intended as a means of evaluation of compliance with contract requirements. Contractor and Fabricator Quality Control activities and MassDOT Acceptance activities shall remain independent from one another. MassDOT Acceptance activities shall not replace Fabricator Quality Control activities.

ITEMS 916.01 and 916.02 (Continued)

B. Fabricator Quality Control.

Quality Control shall be performed by the Fabricator to ensure that the product is fabricated in conformance with the specifications herein. The Fabricator shall maintain a Quality Control system to monitor, assess, and adjust placement and fabrication processes to ensure the Precast Concrete Bridge Element(s) meet the specified level of quality, through sufficient Quality Control sampling, testing, inspection, and corrective action (where required). The Fabricator's Quality Control system shall address all key activities during the placement and fabrication and shall be performed in conformance with the Fabricator's NPCA or PCI Certification. Quality Control documentation shall meet the requirements of the *Fabricator Quality Control – Documentation* section below. Upon request, Fabricator Quality Control documentation shall be provided to the MassDOT Plant Inspector.

1. Plant.

Prior to the fabrication of Precast Concrete Bridge Elements, the Fabricator's precast concrete plant shall obtain the following:

(a) Certification by the National Precast Concrete Association (NPCA) Plant Certification Program or Precast/Prestressed Concrete Institute (PCI) Plant Certification Program, for the applicable types of Precast Concrete Bridge Element(s) being fabricated
(b) MassDOT Prequalification
(c) MassDOT Mix Design Approval

All concrete for a given Precast Concrete Bridge Element shall be produced by a single company and plant, unless otherwise approved by the Engineer.

2. Personnel.

The Fabricator shall provide adequate training for all QC personnel in accordance with NPCA or PCI certification. There shall be sufficient personnel trained and certified to perform the tests listed under Subsection M4.02.13, Part D. At a minimum, the Fabricator's Quality Control Personnel shall maintain the following qualifications and certifications:

(a) QC Manager with an active NETTCP Field Technician or ACI Concrete Field Testing Technician – Grade I certification or higher, and a minimum of 4 years continuous experience in the manufacture of Precast Concrete Bridge Elements for state transportation departments. The QC Manager shall be on site while the batch plant is producing and placing concrete for MassDOT projects.
(b) A Technician/Inspector having the Precast/Prestressed Concrete Institute (PCI) Technician/Inspector Level I or NorthEast Transportation Training and Certification Program (NETTCP) Precast Concrete Inspector, or higher.

The Contractor shall submit to the Engineer a copy of the Fabricator's Quality Control Personnel required qualifications, as specified above.

ITEMS 916.01 and 916.02 (Continued)

3. Laboratory.

The Fabricator shall provide a room of sufficient size to house all equipment and to adequately perform all testing. The room shall have either a separate moisture storage room or curing box for concrete cylinders, and it shall be thermostatically controlled to maintain temperatures consistent with AASHTO T 23. It shall include a desk and file cabinet for proper record keeping, and have good lighting and ventilation. This room shall be kept for testing and quality control and not used for any other purpose. An additional desk and file cabinet shall be provided for exclusive use of the Engineer. No exception from these requirements will be allowed without the express written permission of the Engineer.

4. Testing Equipment.

At a minimum, the Fabricator's plant facility shall have the following testing equipment:

(a) Air Content Meter Type A or B: AASHTO T 152
(b) Air Content Meter Volumetric Method: AASHTO T 196 (Required for Lightweight Concrete)
(c) Slump Cone: AASHTO T 119
(d) Cylinder Molds AASHTO M 205
(e) Concrete Testing Machine: AASHTO T 22
(f) Screening Sieve: AASHTO T 27, AASHTO T 11
(g) Curing Box: AASHTO T 23
(h) Spread Test Base Plate for Self-Consolidating Concrete (SCC): ASTM C1611
(i) All other equipment prescribed by AASHTO and ASTM standards for the tests to be performed by the Fabricator as specified

5. Inspection.

Quality Control personnel shall monitor and inspect the fabrication of each Precast Concrete Bridge Element. Quality Control personnel shall report all inspection activities on Quality Control Inspection Reports and non-conformances on Non-Conformance Reports (NCRs) throughout the entire fabrication process, as speciefied herein.

6. Temperature Monitoring.

At a minimum, the Fabricator shall monitor, record, and report the temperatures of the form, ambient temperatures surrounding the concrete, and temperatures of the concrete continuously, without interruption as specified below:

(a) Prior to placement of concrete to verify that $T_i \geq 50°F$.
(b) Immediately after placement to verify that $T_i \geq 50°F$ is maintained.
(c) Throughout the entire duration of the curing cycle, at regular intervals not to exceed one hour until 100% Design Strength (f'_c) is attained and concrete has cooled to within 40°F of the ambient temperature surrounding the Precast Concrete Bridge Element.

ITEMS 916.01 and 916.02 (Continued)

At a minimum, the temperature measuring devices shall record and report the temperature of the concrete to the nearest 2°F. At least two temperature sensors (thermocouples) shall be positioned to record the maximum and minimum anticipated concrete temperatures. The anticipated minimum temperature shall be measured with one or more thermocouples at a distance no greater than 2 inches from the surface of the thinnest section. The anticipated maximum temperature shall be measured with one or more thermocouples at the center of the thickest section. Proposed temperature measurement locations shall be submitted to the Engineer for approval. Temperature recording devices shall be located within the curing enclosure and calibrated as required by PCI MNL-116 Section 4.18.4. Maximum heat increase and cool down rates shall comply with PCI MNL-116, Section 4.19. The Contractor shall furnish temperature logs recorded at a minimum frequency of once per hour to the Inspector as required, with each post-pour QC inspection report.

7. Sampling and Testing.

At a minimum, the Fabricator shall perform random Quality Control sampling and testing as specified in *Table 1: Quality Control Sampling and Testing*. The Fabricator shall perform additional Quality Control sampling and testing on concrete that has been retempered with admixtures or hold-back water during fabrication. Test Specimens shall conform to the requirements of Section M4.02.13 of the MassDOT Standard and Supplemental Specifications and AASHTO R 60, with the exception of the Stripping (80% f'_c) set of cylinders. Stripping (80 % f'_c) cylinders shall be cured in the same location and environment as the Precast Bridge Elements they represent. If approved by the Engineer, compressive strength cylinder match curing equipment, that maintains the same concrete conditions that the corresponding Precast Bridge Element is exposed to, may be utilized in lieu of Stripping (80 % f'_c) field cured cylinders, with the use of thermocouples, controllers, and heaters

ITEMS 916.01 and 916.02 (Continued)

Table 1: Quality Control Sampling and Testing

Quality Characteristic	Test Method	Sample Size	Specification Limit	Lot Size [c]	Sublot Size [d]	Frequency	Point of Sampling
Slump (in.) [a]	AASHTO T 119	Per AASHTO	≤ 8 in. or as approved by the Engineer	Total Quantity of Concrete (cy) produced on a Contract, per Type of Element fabricated, per Mix Design	20 cy	One (1) per Sublot or fraction thereof	Point of Discharge
Air Content (%)	AASHTO T 152	Per AASHTO	5% ≤ % ≤ 8%				
Temperature (°F)	AASHTO T 309	Per AASHTO	50°F ≤ °F ≤ 90°F				
Compressive Strength (psi)	AASHTO T 22 AASHTO T 23	Stripping Cylinders: One (1) set of Three (3) 4 x 8 in.	≥ 80% f'c at Stripping				
		7-day Cylinders: One (1) set of Three (3) 4 x 8 in.	For Information at 7 days				
		28-day Cylinders: One (1) set of Three (3) 4 x 8 in.	≥ 100% f'c at 28 days				
		56-day Cylinders: One (1) set of Three (3) 4 x 8 in.	≥ 100% f'c at 56 days [b]				

Notes:

(a) Self-consolidating concrete (SCC) shall meet the requirements of M4.02.17.

(b) 56-day Compressive Strength test specimens shall require testing only when 28-day Compressive Strength test specimens have failed to meet Design Strength (f'_c).

(c) Lot shall be defined as a specific quantity of material from a single source, produced or placed by the same controlled process.

(d) Sublot shall be defined as an equal division or part of a Lot from which a sample of material is obtained in order to assess the Quality Characteristics of the Lot.

8. Certificate of Compliance.

The Fabricator shall provide a Certificate of Compliance in accordance with Standard Specifications, Division I, Section 6.01, stating that QC test cylinders have achieved the design strength, f'_c. A Certificate of Compliance shall accompany each shipment and shall be presented to the MassDOT Resident Engineer or designee upon delivery to the site.

ITEMS 916.01 and 916.02 (Continued)

9. Documentation.

At a minimum, the Fabricator shall maintain a filing system for the following QC records and documentation. All QC records and documentation shall be made available to MassDOT upon the request of the Department.

(a) Current MassDOT Approved Mix Design Sheet(s) and Approval Letter(s)
(b) PCI or NPCA Certification
(c) Current Qualifications and Certifications for QC Manager(s) and QC Technician(s)
(d) Most current set of Approved Shop Drawings
(e) Approved Placement, Finishing and Curing Plan
(f) Approved Dunnage Plan
(g) Fabricator Certificate of Compliance for each fabricated Precast Concrete Bridge Element
(h) Admixture Manufacturer's Certification of Compliance for each approved Admixture
(i) Completed QC Inspection Report for each fabricated Precast Concrete Bridge Element
(j) Identification Number for each fabricated Precast Concrete Bridge Element
(k) Time and date of casting of each fabricated Precast Concrete Bridge Element
(l) Date of stripping of each fabricated Precast Concrete Bridge Element
(m) Batch Ticket Printout reporting the quantity of concrete produced for each batch of concrete produced
(n) Concrete temperature records for each Precast Concrete Bridge Element fabricated
(o) QC Test Report Forms for each sublot of concrete produced
(p) Non-Conformance Reports (NCRs)
(q) Documentation of Repairs (if applicable)

C. Acceptance.

MassDOT will perform Acceptance inspection, sampling, and testing during fabrication and installation, to evaluate the quality and degree of compliance of the fabricated Precast Concrete Bridge Element to MassDOT specifications. Additionally, MassDOT Inspectors will monitor the Fabricator's Quality Control activities to ensure the Fabricator is properly administering Quality Control in conformance with the Fabricator's NPCA or PCI Certification. Acceptance inspection and test results not meeting MassDOT specifications will result in Non-conformance Reports (NCR) being issued by MassDOT to the Fabricator or Contractor for corrective action. Final Acceptance for the fabricated Precast Concrete Bridge Elements shall be determined by MassDOT.

1. Inspection.

A MassDOT MassDOT Inspector will be assigned to perform Acceptance activities during fabrication, which includes the inspection of the materials, work procedures, and Precast Concrete Bridge Elements. At least seven (7) days prior to the scheduled start of fabrication, the Fabricator shall contact the MassDOT Research and Materials Section (RMS) to provide notice of the scheduled fabrication start date. The Fabricator shall complete the following activites prior to notifying MassDOT RMS of the scheduled start date:

(a) Receive approval for all submitted Fabricator cement concrete mix designs from the MassDOT Research and Materials Section for the current year, as specified under the *Mix Design* section and *Table 3: Trial Batch Sampling Testing for New Mix Designs*. Self-consolidating concrete shall meet the requirements of M4.02.17.

ITEMS 916.01 and 916.02 (Continued)

(b) Receive approval for the submitted Fabricator Placement, Finishing, and Curing Plan from the MassDOT Research and Materials Section, as specified under the *Placement, Finishing, and Curing Plan* section.
(c) Receive Engineer of Record approved shop drawings from the MassDOT Research and Materials Section as specified under the *Shop Drawings* section.
(d) Participate in the pre-production meeting, as described under the *Pre-Production Meeting* section (if required).

Prior to the start of fabrication, the Fabricator shall review the fabrication schedule with the MassDOT Inspector. Fabrication shall only proceed when:

(a) The QC Inspector and MassDOT Inspector are present to inspect the Precast Concrete Bridge Element(s) being fabricated.
(b) The QC Manager is present at the Fabricator's plant.

The Fabricator shall grant access to all required areas of the Fabricator's plant to the MassDOT Inspector, during the hours of fabrication. Fabrication without MassDOT Inspector access to required areas is prohibited, and will result in the rejection of the fabricated Precast Concrete Bridge Element(s).

Additionally, the MassDOT Inspector will monitor the adequacy of the Fabricator's Quality Control activities. MassDOT Inspector Acceptance activities performed at the Fabricator's plant shall remain independent from the Fabricator, and does not replace the Fabricator's required Quality Control activities.

2. Sampling and Testing.

At a minimum, the MassDOT Inspector will perform random Acceptance sampling and testing for each Sublot of concrete produced as specified in *Table 2: Acceptance Sampling and Testing.* The MassDOT Inspector will also perform Acceptance sampling and testing on concrete that has been retempered with admixtures or hold-back water during production. Test Specimens will conform to the requirements of Section M4.02.13 of the MassDOT Standard and Supplemental Specifications and AASHTO R 60

ITEMS 916.01 and 916.02 (Continued)

Table 2: Acceptance Sampling and Testing

Quality Characteristic	Test Method	Sample Size	Specification Limit	Lot Size [c]	Sublot Size [d]	Frequency	Point of Sampling
Slump (in.) [a]	AASHTO T 119	Per AASHTO	≤ 8 in. or as approved by the Engineer	Total Quantity of Concrete (cy) produced on a Contract, per Type of Element fabricated, per Mix Design	20 cy	One (1) per Sublot or fraction thereof	Point of Discharge
Air Content (%)	AASHTO T 152	Per AASHTO	5% ≤ % ≤ 8%				
Temperature (°F)	AASHTO T 309	Per AASHTO	50°F ≤ °F ≤ 90°F				
Compressive Strength (psi)	AASHTO T 22 AASHTO T 23	7-day Cylinders: One (1) set of Three (3) 4 x 8 in.	For Information at 7 days				
		28-day Cylinders: One (1) set of Three (3) 4 x 8 in.	≥ 100% f'$_c$ at 28 days				
		56-day Cylinders: One (1) set of Three (3) 4 x 8 in.	≥ 100% f'$_c$ at 56 days [b]				

Notes:

(a) Self-consolidating concrete (SCC) shall meet the requirements of M4.02.17.

(b) 56-day Compressive Strength test specimens shall require testing only when 28-day Compressive Strength test specimens have failed to meet Design Strength (f'$_c$).

(c) Lot shall be defined as a specific quantity of material from a single source, produced or placed by the same controlled process.

(d) Sublot shall be defined as an equal division or part of a Lot from which a sample of material is obtained in order to assess the Quality Characteristics of the Lot.

ITEMS 916.01 and 916.02 (Continued)

MATERIALS

A. Materials.
Materials shall meet the following specifications (if applicable):

Stone for Pipe Ends	M2.02.3
Crushed Stone	M2.01.3
General	M4.00.00
Portland Cement	M4.01.0
Blended Hydraulic Cements	M4.01.1
Fly Ash	M4.01.2
Cement Concrete	M4.02.00
Cement	M4.02.01
Cement Mortar	M4.02.15
Aggregates	M4.02.02
Lightweight Aggregates	M4.02.03
Water	M4.02.04
Cement Concrete Additives	M4.02.05
Proportioning	M4.02.06
Mixing and Delivery	M4.02.10
Test Specimens	M4.02.13
Mortar for Filling Keyways	M4.04.0
Slag	AASHTO M 302
High Performance Cement Concrete	M4.06.1
Self-Consolidating Concrete (SCC)	M4.02.17
Controlled Density Fill – Non-Excavatable	M4.08.0
Reinforcing Bars	M8.01.0
Epoxy Coated Reinforcing Bars	M8.01.7
Galvanized Reinforcing Bars	M8.01.8
Welded Wire Reinforcement	M8.01.2
Mechanical Reinforcing Bar Splicer	M8.01.9
Lifting Devices	PCI MNL-116
Corrugated Metal Pipe	AASHTO M 36
Geotextile Fabric	M9.50.0

The payment for Natural Streambed Material, Stone for Pipe Ends, Crushed Stone and Geotextile Fabric shall be paid under their respective items.

The precast box culverts shall be reinforced concrete and shall be manufactured in accordance with ASTM C76 standard specifications for reinforced concrete culvert. The culvert shall be designed to support an HS-20 (32,000 lbs.) truck axle load and dead load from earth cover over the top of the culvert as shown on the plans, and shall conform to all applicable 2017 AASHTO LRFD Bridge Design Specifications with current interim Specifications .

ITEMS 916.01 and 916.02 (Continued)

The Contractor shall submit shop drawings and structural calculations stamped by an Engineer registered in the Commonwealth of Massachusetts for approval as specified in Section 5.02 of the Standard Specifications. The shop drawings shall show the size and location of all inserts and openings as shown on the Plans.
Existing utility locations shall be verified in the field prior to starting this work. The Contractor shall provide the Engineer with a plan showing existing utility locations and elevations prior to undertaking this work.

The Contractor shall dig test pits to verify the dimensions of the existing culvert prior to ordering the material. All costs shall be incidental and be paid for under the EACH price.

1. Cement Concrete Mix Design.

The cement concrete shall be comprised of specified proportions of water and MassDOT approved aggregates, cement, supplementary cementitious materials (SCMs), and admixtures to form a homogenous composition. Cement concrete for Precast Concrete Bridge Elements shall meet the requirements of M4.06.1 High Performance Cement Concrete, with the exception that the "Total Cementitious Content" specified shall be considered the "Maximum Allowable Cementitious Content". When used, self-consolidating concrete (SCC) shall meet the requirements of M4.02.17.

Prior to production of cement concrete, the Fabricator shall report and submit all proposed mix design formulations and its constituent materials onto the MassDOT Cement Concrete Mix Design Sheet to the MassDOT Research and Materials Section for review and approval. All mix design yields shall be designed for 1.0 cubic yards of concrete, with an allowable tolerance of +/- 1.0 %. All liquids incorporated into the proposed mix design(s) shall include both water and admixtures in the liquid mass calculation.

During production of cement concrete, the Fabricator shall not alter the previously approved mix design formulation or its constituent materials. Proposed alterations in source, type, batch quantity, or gradation to any of the constituent materials of the previously approved mix design formulation shall require a new MassDOT Mix Design Sheet submission to the MassDOT Research and materials Section for review and approval. Fabrication shall not occur without prior MassDOT mix design approval.

The Fabricator shall notify MassDOT RMS to schedule trial batch testing for the new mix design(s). Trial batch testing shall meet the following requirements:

(a) Performed by a qualified laboratory and/or AASHTO accredited laboratory.
(b) Performed and/or sampled in the presence of a MassDOT Inspector.
(c) Meet the requirements as specified in *Table 3: Trial Batch Sampling Testing for New Mix Designs*. Self-consolidating concrete (SCC) shall meet M4.02.17.

Failure to perform all of the required trial batch testing or provide MassDOT RMS trial batch test results within the Specification Limits (as specified in Table 3) will result in the disqualification of the Fabricator's proposed mix design(s).

ITEMS 916.01 and 916.02 (Continued)

Table 3: Trial Batch Sampling and Testing for New Mix Designs

Quality Characteristic	Test Method	Sample Size	Specification Limit	Performed By
Slump [(a)]	AASHTO T 119	Per AASHTO	Max. 8 inches or as approved by the Engineer	Quality Control
Air Content (AC)	AASHTO T 152	Per AASHTO	$5\% \leq AC \leq 8\%$	Quality Control
Temperature (°F)	AASHTO T 309	Per AASHTO	$50°F \leq °F \leq 90°F$	Quality Control
Compressive Strength [(b)]	AASHTO T 22 AASHTO T 23	28-day Cylinders: One (1) set of Three (3) 4 x 8 in.	Lab Mixed $f'_{cr} = 1.3\ f'_c$ at 28 days	MassDOT
			Batch Mixed $f'_{cr} = 1.2\ f'_c$ at 28 days	
Alkali-Silica Reaction (ASR) [(d)]	ASTM C 1567	Per ASTM	M4.02.00	Quality Control
Resistance to Chloride Ion Penetration Chloride Ion Penetration [(e)]	AASHTO T 358 [(f)]	28-day Cylinders: One (1) set of Three (3) 4 x 8 in.	Resistivity ≥ 21 kΩ-cm at 28 days	MassDOT
Freeze/Thaw Durability [(c)]	AASHTO T 161 (Procedure A)	Per AASHTO	Relative Dynamic Modulus of Elasticity after 300 cycles ≥ 80%	Quality Control

Notes:

(a) Self-consolidating concrete (SCC) shall meet the requirements of M4.02.17.
(b) Trial batch compressive strength testing shall be performed by MassDOT. Laboratory mixed trial batch compressive strength results shall achieve 130% Design Strength (f'_c). Batch-mixed trial batch compressive results shall achieve 120% f'_c. Acceptance will be based on compressive strength testing performed by MassDOT.
(c) If an AASHTO accredited laboratory is preparing the trial batch test specimens, MassDOT Acceptance presence is not required. If the Fabricator is preparing the trial batch test specimens, MassDOT Acceptance presence is required during trial batch test specimen preparation.
(d) Alkali Silica Reaction (ASR) testing shall meet the requirements of M4.02.00. Independent laboratories performing ASR testing shall be listed on the MassDOT Quality Construction Materials List (QCML).
(e) Calcium nitrite shall be removed from mix designs containing the admixture and replaced by an equivalent quantity of water when preparing Chloride Ion Penetration resistance trial batch test specimens.
(f) The Wenner probe tip spacing "a" shall be 1.5.

ITEMS 916.01 and 916.02 (Continued)

2. Vertical Adjustment Assembly.

Vertical Adjustment Assembly details and material requirements shall be as shown on the plans. Alternate devices may be used provided that they are adjustable and can support the anticipated loads. The design of the leveling devices, with necessary calculations, shall be submitted to the Engineer of Record for approval.

3. Grout.

Grout used for shear keys, vertical adjustment assembly voids, and hand holes shall be in accordance with M4.04.0.

4. Reinforcement.

All reinforcing steel shall be coated Grade 60 unless otherwise noted on the plans. Mechanical reinforcing bar splicers shall be epoxy coated.

5. Threaded Inserts.

Threaded inserts are permissible to facilitate forming the keyway pours. Threaded inserts shall be hot dip galvanized or made of stainless steel. The number of threaded inserts shall be minimized, and the inserts shall not come in contact with the reinforcing steel.

6. Corrugated Metal Pipe.

Corrugated Metal Pipe to be used for forming voids as specified on the plans shall be fabricated from steel and shall have a protective metallic coating of zinc (galvanizing).

CONSTRUCTION METHODS – PLANT FABRICATION

A. Shop Drawings.

Prior to performing any work under this Section, the Contractor shall receive approval for all shop drawings for the Precast Concrete Bridge Element being worked on and any special Contract requirements, provided that a complete shop drawing package is provided. The Contractor shall not order materials or begin work before receiving approved shop drawings. MassDOT will reject Precast Concrete Bridge Elements that deviate from the approved drawings or are fabricated prior to receiving written approval of the shop drawings. The Contractor shall bear full responsibility and costs for all materials ordered or work performed prior to the approval of the shop drawings or written authorization from MassDOT.

Contractor shall submit scaled shop drawings to the Engineer of Record for review and approval. Upon approval, the Engineer of Record will forward two (2) sets of scaled, full size (minimum 24x36") paper copies of the Approved (or Approved As Noted) shop drawings to the MassDOT Director of Research and Materials. Calculations are not to be included in any submittal to the Research and Materials Section. An approval stamp shall appear on every shop drawing sheet. Wet-stamping or wet-signing is not required, provided that the stamp and reviewer name are legible. The Fabricator's name and address shall appear on each sheet.

Resubmittal of "Approved as Noted" shop drawings is not necessary for minor revisions, provided that the correction can be clearly understood and is unambiguous without possibility of misinterpretation. Shop drawings with questions or comments that require a response and/or additional information from the Fabricator must be resubmitted.

ITEMS 916.01 and 916.02 (Continued)

Detailed shop drawings shall be prepared in accordance with the relevant provisions of Subsection 5.02 and shall, at a minimum, contain the following:

(a) Number and type and/or piece mark of the precast concrete bridge element including overall length, width and height.
(b) Skew angle.
(c) Location, size and geometry of all steel reinforcement, including mechanical reinforcing bar splicers to be used for connecting Precast Concrete Bridge Elements together in the field.
(d) Location and details of all inserts, anchors, Vertical Adjustment Assemblies, and any other items required to be cast into the Precast Concrete Bridge Elements (whether detailed on the plans by the Engineer of Record or provided for the Contractor's convenience). Precast Concrete Bridge Elements shall not be fired or drilled into for attachment purposes. All hardware shall be galvanized except as noted.
(e) Locations and details of the lifting devices, including supporting calculations, type and amount of any additional reinforcing required for lifting. The Fabricator shall design all lifting devices based on the no cracking criteria in Chapter 8 of the PCI Design Handbook (7^{th} edition).
(f) The minimum compressive strength required prior to handling the precast concrete bridge element.

The shop drawings shall not include procedures for placement, finishing, and curing of concrete. These details shall be included in the Placement, Finishing and Curing Plan that is to be submitted to MassDOT Research and Materials Section as described under *Placement, Finishing, and Curing Plan*.

B. Fabrication.

All Precast Concrete Bridge Elements shall be fabricated in accordance with the latest edition of PCI MNL-116 as modified herein.

C. Placement, Finishing and Curing Plan.

At least 30 days prior to start of fabrication, the Contractor shall submit the Fabricator's proposed Placement, Finishing and Curing Plan to the Engineer for approval by MassDOT Research and Materials Section. This shall be an independent submittal, separate from the fabrication shop drawings. The Placement, Finishing and Curing Plan shall include the following:

(a) Method of Mixing
(b) Method of Placement
(c) Method of Consolidation
(d) Method of Finishing
(e) Method of Initial Curing
(f) Method of Intermediate Curing
(g) Method of Final Curing
(h) Moisture Retention Materials and Equipment (water spray equipment, saturated covers, sheet materials, liquid membrane-forming compounds, accelerated curing equipment, etc.)

ITEMS 916.01 and 916.02 (Continued)

(i) Cylinder Curing Methods, Location, and Environmental Control (temperature, humidity, etc.)
(j) Temperature Monitoring, Recording, and Reporting

D. Dunnage Plan Shop Drawings.

At least 30 days prior to the start of fabrication, the Contractor shall submit proposed Dunnage Plan Shop Drawings to the Engineer of Record for review and approval. This shall be an independent submittal, separate from the fabrication shop drawings. Upon approval, the Engineer of Record will forward two (2) sets of scaled, full size (minimum 24"x36") paper copies of the Approved (or Approved As Noted) Dunnage Plan to the MassDOT Director of Research and Materials. Calculations are not to be included in any submittal to the Research and Materials Section. The Dunnage Plan shall include the following:

(a) Proposed layout of the Precast Concrete Bridge Elements for storage in yard and during shipping
(b) Support and blocking point locations
(c) Support and blocking materials

E. Box Culverts.

The Contractor shall submit design computations for the box culvert, rigid frame or arch bridge elements to the Engineer for review and approval. The computations shall be prepared in accordance with the latest AASHTO LRFD Bridge Design Specifications, the 2013 Part 2 & 2020 Interim Update Part 1 MassDOT LRFD Bridge Design Manual, and the Plans using English units and HS-20 live loading. The design computations shall consider all Strength, Extreme Event and Service Limit States as are appropriate for each stage of fabrication, shipment, construction, and for the final in-service condition. Design computations and shop drawings shall be prepared and stamped by a Professional Engineer licensed to practice in the Commonwealth of Massachusetts. The shop drawings shall be prepared and submitted in accordance with the section, Drawings, above.

The culvert dimensions provided on the plans are shown to establish the size of the proposed opening. The width and thickness of each culvert unit may vary depending upon the manufacturer's specifications provided that the opening size is maintained. The Contractor shall be responsible for modifying the dimensions of the culvert elements to compensate for elastic shortening, shrinkage, grade corrections, and other phenomena that make in-process fabricating dimensions different from those shown on the drawings. Approval of the shop drawings shall not relieve the Contractor from responsibility for the correctness of the dimensions shown.

1. Joints.

The precast reinforced concrete box culvert shall be produced with grout-filled keyways per the details on the plans, the manufacturer's recommendations, and as approved by the Engineer. The ends shall be manufactured such that when the sections are laid together they will make a continuous line of culverts with a smooth interior surface free of appreciable irregularities, and in compliance with the permissible variations.

ITEMS 916.01 and 916.02 (Continued)

2. Marking.

The following information shall be clearly marked on the interior of each culvert by indentation, waterproof paint, or other approved means:

(a) Culvert span and rise
(b) Date of manufacture and lot number
(c) Name and trademark of the manufacturer

F. Pre-Production Meeting.

The Contractor shall notify the MassDOT Research and Materials Section to determine if a pre-production meeting will be required to review the specification, shop drawings, curing plan, schedule, and discuss any specific requirements. The meeting shall be held prior to scheduling a MassDOT Inspector (refer to Section *Quality Assurance – Precast Concrete, C. Acceptance, A. Inspection*), and at least seven (7) days prior to the scheduled casting of any Precast Concrete Bridge Element or control section. The Contractor shall schedule the meeting, which shall include representatives of the Fabricator and MassDOT.

G. Reinforcement.

The reinforcing bars shall be installed in accordance with Section 901.62 of the Supplemental Specifications, including tolerances for cover and horizontal spacing of bars. Components of mechanical reinforcing bar splicers shall be set with the tolerances shown on the plans. The reinforcing bars and mechanical reinforcing bar splicers shall be assembled into a rigid cage that will maintain its shape in the form and which will not allow individual reinforcing bars to move during the placement of concrete. This cage shall be secured in the form so that the clearances to all faces of the concrete, as shown on the plans, shall be maintained.

Where reinforcing bars are to protrude from one Precast Concrete Bridge Element in order to mate with reinforcing bar splicers in a second precast concrete element, the fabricator shall set the reinforcing bars and the reinforcing bar splicers with a template in order to ensure proper fit up within the tolerances specified on the plans.

H. Tolerances.

Fabrication shall comply with tolerances specified on the plans. Tolerances for steel reinforcement placement shall be in accordance with 901.62. In the absence of specifications on the plans, tolerances shall comply with the latest version of the PCI MNL 135, Precast Tolerance Manual.

ITEMS 916.01 and 916.02 (Continued)

I. Forms.

Concrete shall be cast in rigidly constructed forms, which will maintain the Precast Concrete Bridge Elements within specified tolerances to the shapes, lines and dimensions shown on the approved fabrication drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of the plastic concrete. When wood forms are used, all faces in contact with the concrete shall be laminated or coated with a non-absorbent material. All worn or damaged forms, which cause irregularities on the concrete surface or damage to the concrete during form removal, shall be repaired or replaced before being reused. Any defects or damage of more than "Category 2, Minor Defects" made to the concrete, due to form work, stripping or handling, shall be subject to repair or rejection, as defined in the *Repairs and Replacement* section. If threaded inserts are cast into the elements for support of formwork, the inserts shall be recessed a minimum of 1 inch and shall be plugged after use with a grout of the same color as that of the precast cement concrete.

J. Mixing of Concrete.

The concrete shall be proportioned and mixed in conformance with the Fabricator's MassDOT approved mix design and M4.02.10 Mixing and Delivery Fabrication shall not occur without prior MassDOT mix design approval. The Fabricator shall provide copies of batch tickets to the MassDOT Plant Inspector. The MassDOT Plant Inspector will verify if the batch ticket quantities are within the tolerances of the Fabricator's MassDOT approved mix design.

K. Placement of Concrete.

Prior to the placement of concrete, the temperature of the forms shall be greater than or equal to 50°F. Quality Control inspection shall be performed by the Fabricator as specified in the *Fabricator Quality Control* section. Placement of the concrete shall not proceed until the MassDOT Plant Inspector is present to perform inspection and begin monitoring Fabricator Quality Control inspection activities, and is in compliance with specifications. The MassDOT Plant Inspector shall inspect and accept the placement of the reinforcing steel prior to the placement of concrete into the forms. The Fabricator shall verify all materials and equipment required for protecting and curing the concrete are readily available and meet the requirements of the *Final Curing Methods* section below. All items encased in the concrete shall be accurately placed in the position shown on the Plans and firmly held during the placing and setting of the concrete. Clearance from the forms shall be maintained by supports, spacers, or hangers and shall be of approved shape and dimension.

During placement, the concrete shall maintain a concrete temperature range between 50°F and 90°F. The Fabricator shall minimize the time to concrete placement (measured from start of mixing to completion of placement). In no event shall time to placement exceed 90 minutes. The Fabricator shall perform additional Quality Control sampling and testing on concrete that has been retempered with admixtures or hold-back water during the placement of the concrete as specified in the *Fabricator Quality Control* section above. Delays or shutdowns of over 30 minutes shall not be allowed during the continuous filling of individual forms.

ITEMS 916.01 and 916.02 (Continued)

L. Consolidation of Concrete.

Suitable means shall be used for placing concrete to prevent segregation or displacement of reinforcing steel or forms. The concrete shall be thoroughly consolidated by external or internal vibrators or a combination of both. Vibrators shall not be used to move concrete within the forms. Vibrators shall be used as specified in 901.63C and as directed by the Engineer. Concrete shall be placed and consolidated in a way that minimizes the presence of surface voids or bug holes on the formed surfaces. When used, self-consolidating concrete (SCC) shall meet the requirements of M4.02.17.

M. Finishing of Concrete.

The finish of the Precast Concrete Bridge Elements shall be as indicated on the plans. Where Precast Concrete Bridge Elements have keyways for grout or closure pours, the surfaces of these shear keys shall be abrasive blasted prior to shipment. The Fabricator may utilize a surface retarder with water blast, sandblast, or a combination of both to achieve the desired keyway finish. At a minimum, the profile of the keyway surfaces shall be similar to that of 60 grit sand paper. The exposed reinforcing steel in the precast slab shall be protected from damage during the cleaning of the keyways. Damaged epoxy coating of steel reinforcement shall be repaired, and the reinforcing steel shall be cleaned as directed by the Engineer.

The Fabricator shall permanently mark each precast concrete bridge element with its type and/or piece mark, date of casting, and supplier identification either by stamp markings in fresh concrete, waterproof paint, or other approved means on a surface that will not be exposed after assembly.

N. Exposed Surfaces of Precast Concrete Bridge Elements.

As soon as conditions permit, before the concrete has fully hardened, all dirt, laitance, and loose aggregate shall be removed from the exposed concrete surfaces. Contractor shall not allow foot traffic on the uncured concrete until it has reached sufficient strength to prevent damage.

O. Exposed Surfaces of Closure Pour Shear Keys.

The closure pour shear key cast in the sides of the beam flanges shall have an exposed aggregate finish. The closure pour reinforcing steel and its coating shall not be damaged by the process for creating the exposed aggregate surface. Fabricator may utilize a surface retarder with water blast, abrasive blast, or a combination of both to achieve the desired shear key finish. The abrasive blast shall use oil free compressed air. The profile of the shear key surfaces shall be similar to that of 60 grit sand paper.

P. Initial Curing Methods.

After the placement of concrete and prior to concrete finishing, the Fabricator shall initiate initial curing methods when the concrete surface begins to dry, to reduce moisture loss from the surface. Application of one or more of the following initial curing methods shall occur immediately after the bleed water sheen has disappeared.

ITEMS 916.01 and 916.02 (Continued)

1. Fogging.

Fogging nozzles shall atomize water into a fog-like mist. The fog spray shall be directed and remain visibly suspended above the concrete surface, to increase the humidity of the air and reduce the rate of evaporation. Water from fogging shall not be worked into the surface during finishing operations and shall be removed or allowed to evaporate prior to finishing.

2. Liquid-applied Evaporation Reducers

Evaporation reducers shall be sprayed onto the freshly placed concrete surface to produce an effective monomolecular film that reduces the risk of plastic-shrinkage cracking and rate of evaporation of the bleed water from the concrete surface. Evaporation reducers shall be applied in accordance with manufacturer's recommendations.

Q. Intermediate Curing Methods.

The Fabricator shall initiate intermediate curing methods if concrete finishing has taken place prior to the concrete reaching final set. The freshly finished concrete surface shall be protected from moisture loss, by the continuation of initial curing methods (fogging and evaporation reducers) until final curing methods are applied or by the use of liquid membrane-forming curing compounds (see *Liquid Membrane-Forming Compounds for Curing* section).

R. Final Curing Methods.

The Fabricator shall initiate and apply final curing methods to the concrete immediately after the following conditions are met:

(a) Completion of concrete finishing
(b) Final set of concrete
(c) Concrete has hardened sufficiently enough to prevent surface damage

During fabrication of Precast Concrete Bridge Elements, the Fabricator shall maintain the required concrete temperature ranges throughout the entire duration of the final curing method cycle as specified herein. Controlled and gradual termination of the final curing method shall occur after all specified conditions are met. The concrete temperature shall be reduced at a rate not to exceed 36°F per hour until the concrete temperature is within 20°F of the ambient temperature outside of the final curing method enclosure. The Fabricator shall maintain a minimum concrete temperature of 40°F until 100% f'c is attained (see *Handling and Storage* section below).

1. Water Spray Curing.

All exposed concrete surfaces shall remain moist with a continuous fine spray of water throughout the entire duration of the final curing method cycle (see *Table 4: Final Curing Method Cycle for Water Spray*).

ITEMS 916.01 and 916.02 (Continued)

Table 4: Final Curing Method Cycle for Water Spray

Sustained Concrete Temperature	Final Curing Method Cycle Duration	Compressive Strength
50°F ≤ °F ≤ 90°F	≥ Five (5) days	≥ 80% f'_c

2. Saturated Covers for Curing.

All exposed concrete surfaces shall remain moist with a continuous application of saturated covers throughout the entire duration of the final curing method cycle (see *Table 5: Final Curing Method Cycle for Saturated Covers*). Saturated covers shall be allowed to dry thoroughly before removal to provide uniform, slow drying of the concrete surface.

Table 5: Final Curing Method Cycle for Saturated Covers

Sustained Concrete Temperature	Final Curing Method Cycle Duration	Compressive Strength
50°F ≤ °F ≤ 90°F	≥ Three (3) days	≥ 80% f'_c

Saturated covers, such as burlap, cotton mats, and other coverings of absorbent materials shall meet the requirements of AASHTO M 182, Class 3. Saturated covers shall be in good condition, free from holes, tears, or other defects that would render it unsuitable for curing concrete. Saturated covers shall be dried to prevent mildew when storing. Prior to application, saturated covers shall be thoroughly rinsed in water and free of harmful substances that are deleterious or cause discoloration to the concrete. Saturated covers shall have sufficient thickness and proper positioning onto the concrete surface to maximize moisture retention.

Saturated covers shall contain a sufficient amount of moisture to prevent moisture loss from the surface of the concrete. Saturated covers shall be kept continuously moist so that a film of water remains on the concrete surface throughout the entire duration of the final curing method cycle. The Fabricator shall not permit the saturated covers to dry and absorb water from the concrete. Use of polyethylene film (see *Polyethylene Film* section) may be applied over the saturated cover to potentially decrease the need for continuous watering.

3. Sheet Materials for Curing.

All exposed concrete surfaces shall remain moist with a continuous application of curing sheet materials throughout the entire duration of the final curing method cycle (see *Table 6: Final Curing Method Cycle for Curing Sheet Materials*).

ITEMS 916.01 and 916.02 (Continued)

Table 6: Final Curing Method Cycle for Sheet Materials

Sustained Concrete Temperature	Final Curing Method Cycle Duration	Compressive Strength
50°F ≤ °F ≤ 90°F	≥ Three (3) days	≥ 80% f'_c

Sheet Materials used for curing, such as polyethylene film, white burlap-polyethylene sheeting, and reinforced paper shall meet the requirements of ASTM C171 and the specifications herein. Sheet materials shall inhibit moisture loss and reduce temperature rise in concrete exposed to radiation from the sun during the final curing method cycle. Adjoining covers shall overlap not less than 12 inches. All edges of the covers shall be secured to maintain a moist environment.

(a) Polyethylene Film.

Polyethylene film shall meet the requirements of ASTM C171, consist of a single sheet manufactured from polyethylene resins, be free of visible defects, and have a uniform appearance. Careful considerations shall be taken by the Fabricator to prevent the film from tearing during storage and application, so as to not disrupt the continuity of the film (polyethylene film reinforced with glass or other fibers is more durable and less likely to be torn). The Fabricator shall monitor the application of the film to prevent uneven spots from appearing (mottling) on the concrete surface, due to variations in temperature, moisture content, or both. The Fabricator shall prevent mottling from occurring on the concrete surface by applying additional water under the film or applying a combination of polyethylene film bonded to absorbent fabric to the concrete surface to retain and evenly distribute the moisture.

Immediately following final finishing, polyethylene film shall be placed over the surface of the fresh concrete surface, so as to not damage the surface of the concrete and shall be placed and weighted so that it remains in contact with the concrete throughout the entire duration of the final curing method cycle. The film shall extend beyond the edges of the concrete surface. The film shall be placed flat on the concrete surface, avoiding wrinkles, to minimize mottling. Edges of adjacent polyethylene film shall overlap a minimum of 6 inches and be tightly sealed with the use of sand, wood planks, pressure-sensitive tape, mastic, or glue to maintain close contact with the concrete surface, retain moisture, and prevent the formation of air pockets throughout the entire duration of the final curing method cycle.

(b) White Burlap-Polyethylene Sheeting

White burlap-polyethylene sheeting shall meet the requirements of ASTM C171, be securely bonded to the burlap so to avoid separation of the materials during handling and curing of the concrete, and be applied in the same manner as the polyethylene film.

ITEMS 916.01 and 916.02 (Continued)

(c) Reinforced Impervious Paper.

Reinforced impervious paper shall meet the requirements of ASTM C171, consist of two sheets of kraft paper cemented together with a bituminous adhesive and reinforced with embedded cords or strands of fiber running in both directions, and be white in color. Reinforced impervious paper shall be treated to prevent tearing when wetted and dried.

Reinforced impervious paper can be reused so long as it is effective in retaining moisture on the concrete surface. The Fabricator shall visually inspect the reinforced impervious paper for all holes, tears, and pin holes from deterioration of the paper through repeated use by holding the paper up to the light. The paper shall be discarded and prohibited from use when the moisture is no longer retained.

After the concrete has hardened sufficiently to prevent surface damage, the concrete surface shall be thoroughly wetted prior to the application of the reinforced impervious paper, and be applied in the same manner as the polyethylene film.

4. Liquid Membrane-Forming Compounds for Curing.

All exposed concrete surfaces shall remain moist with a continuous application of liquid membrane-forming compounds throughout the entire duration of the final curing method cycle (see *Table 7: Final Curing Method Cycle for Liquid Membrane-Forming Compounds*).

Table 7: Final Curing Method Cycle for Liquid Membrane-Forming Compounds

Sustained Concrete Temperature	Final Curing Method Cycle Duration	Compressive Strength
50°F ≤ °F ≤ 90°F	≥ Seven (7) days	≥ 80% f'_c

Liquid membrane-forming compounds shall meet the requirements of ASTM C 1315, Type I, Class A and shall exhibit specific properties, such as alkali resistance, acid resistance, adhesion-promoting quality, and resistance to degradation by ultraviolet light, in addition to moisture-retention capabilities. Liquid membrane-forming compounds shall consist of waxes, resins, chlorinated rubber, or other materials to reduce evaporation of moisture from concrete. Liquid membrane-forming compounds shall be applied in accordance with the manufacturer's recommendations.

Liquid membrane-forming compounds shall be applied immediately after the disappearance of the surface water sheen following final finishing. All exposed surfaces shall be wetted immediately after form removal and kept moist to prevent absorption of the compound, allowing the curing membrane to remain on the concrete surface for proper membrane moisture retention. The concrete shall reach a uniformly damp appearance with no free water on the surface prior to the application of the compound.

ITEMS 916.01 and 916.02 (Continued)

If patching or finishing repairs are to be performed prior to the application of the compound, the Precast Concrete Bridge Element shall be covered temporarily with saturated covers until the repairs are completed and the compound is applied. Only areas being repaired shall be uncovered during this period. While the saturated covers are removed to facilitate the patching process, the work shall continue uninterrupted. If for any reason the work is interrupted, saturated covers shall be placed onto the uncovered concrete surface, until the work continues and is completed, at which time the curing compound shall be applied to the repaired area.

Careful considerations shall be made by the Fabricator to determine if the evaporation rate is exceeding the rate of bleeding, thus causing the surface to appear dry even though bleeding is still occurring. Under such conditions, the application of liquid membrane-forming compounds to the concrete surface shall be delayed, in order to prevent bleed water from being sealed below the concrete surface and avert map cracking of the membrane films, reduction in moisture-retention capability, and reapplication of the compound. To diagnose and prevent this condition, the Fabricator shall place a transparent plastic sheet over a test area of the uncured and unfinished concrete surface and shall determine if any bleed water accumulates under the plastic.

The compound shall be applied in two applications at right angles to each other to ensure uniform and more complete coverage. On very deeply textured surfaces, the surface area to be treated shall be at least twice the surface area of a troweled or floated surface. In such cases, two separate applications may be needed, each at 200 ft^2/gal., with the first being allowed to become tacky before the second is applied.

The curing compound shall be applied by power sprayer, using appropriate wands and nozzles with pressures between 25 and 100 psi. For very small areas such as repairs, the compound shall be applied with a wide, soft-bristled brush or paint roller. The compound shall be stirred or agitated before use and applied uniformly in accordance with the manufacturer's recommended rate. The Fabricator shall verify the application rates are in accordance with the manufacturer's recommended rate.

When the concrete surface is to receive paint, finishes, or toppings that require positive bond to the concrete, it is critical that the curing procedures and subsequent coatings, finishes, or toppings be compatible to achieve the necessary bond.

After the termination of the final curing method cycle has occurred, liquid membrane-forming compounds shall be removed by blast-cleaning from any concrete surface that is to receive paint, finishes, plastic concrete from secondary pour, grout, or any other toppings that require bonding to the concrete surface. These surfaces shall be further blast-cleaned to remove the cement matrix down to exposed aggregate to ensure proper bonding to the material. The method used to remove the curing compound shall not damage the reinforcement and coating. Compounds are prohibited on any concrete surface that will have a penetrating or coating type treatment such as a sealer, stain, or waterproofing membrane applied to it.

ITEMS 916.01 and 916.02 (Continued)

5. Accelerated Curing.

Accelerated curing shall use live steam or radiant heat with moisture in accordance with PCI MNL-116 as modified herein. The concrete temperature shall meet the maximum heat increase and cool down rates as specified herein. Concrete temperature monitoring shall meet the requirements of the *Temperature Monitoring* section. Excessive and fluctuating rates of heating and cooling shall be prohibited. The concrete temperature shall not exceed 158°F at any time. The Fabricator shall meet the following accelerated curing sequencing and requirements.

(a) Initial Delay Period.

The initial delay period shall be defined as the duration immediately following the placement of the concrete and the attainment of initial set of the concrete. The Fabricator shall determine the time of initial set in accordance with AASHTO T 197 specifications. Throughout the entire duration of the preset period, initial curing shall be implemented. The temperature increase period (see *Temperature Increase Period* section) shall not occur until initial set of the concrete is attained. During the initial delay period, the concrete temperature shall meet the following requirements:

i. Concrete temperature rate of increase shall not exceed 10°F per hour.
ii. Total concrete temperature increase shall not exceed 40°F higher than the placement concrete temperature or 100°F, whichever is less

(b) Temperature Increase Period.

The temperature increase period shall be defined as the duration immediately following the completion of the initial delay period (after initial set) and immediately prior to the start of the constant maximum temperature period. Application of steam to the enclosure shall not occur until the initial delay period is complete. After the initial delay period is complete, all exposed concrete surfaces shall be cured in a moist environment where the concrete temperature increases at a rate not to exceed 36°F per hour.

(c) Constant Maximum Temperature Period.

The constant maximum temperature period shall be defined as the duration immediately following the completion of the temperature increase period and immediately prior to the start of the temperature decrease period. After the temperature increase period is complete, all exposed concrete surfaces shall be cured in a moist environment at a controlled and constant elevated temperature throughout the entire duration of the constant maximum temperature period. Termination of the constant maximum temperature period and the start of the termination decrease period shall occur after all specified conditions are met (see *Table 8: Constant Maximum Temperature Period*).

ITEMS 916.01 and 916.02 (Continued)

Table 8: Constant Maximum Temperature Period

Sustained Concrete Temperature	Constant Maximum Temperature Period	Compressive Strength
120°F ≤ °F ≤ 158°F	6 hrs ≤ Time ≤ 48 hrs	≥ 80% f'_c

(d) Temperature Decrease Period.

After the constant maximum temperature period is complete, the concrete temperature shall be cured in a moist environment at a controlled and reduced rate not to exceed 36°F per hour until the concrete temperature is within 20°F of the ambient temperature outside of the curing enclosure.

S. Stripping.

The Fabricator shall not strip forms or handle the Precast Concrete Bridge Element until Quality Control compressive strength cylinders attain a minimum compressive strength of 80% Design Strength (f'_c) or the value indicated on the approved drawings has been achieved. After removal from the form, all exposed concrete surfaces shall continue to be cured in conformance with the *Final Curing Methods* sections until completion.

T. Handling and Storage of Precast Concrete Bridge Elements.

Precast Concrete Bridge Elements may be exposed to temperatures below freezing (32°F) when the chosen curing cycle has been completed, provided that the following conditions are met:

(a) Precast Concrete Bridge Elements are protected from precipitation with polyethylene curing covers until 100% f'_c is attained
(b) Precast Concrete Bridge Elements maintain a minimum concrete temperature of 40°F until 100% f'_c is attained

Precast Concrete Bridge Elements damaged during handling and storage will be repaired or replaced at MassDOT's direction at no cost to MassDOT. Precast Concrete Bridge Elements shall be lifted at the designated points by approved lifting devices embedded in the concrete and in accordance with proper lifting and handling procedures. Storage areas shall be smooth and well compacted to prevent damage due to differential settlement. Precast Concrete Bridge Elements shall be supported on the ground by means of continuous blocking, in accordance with the approved dunnage plan.

Precast Concrete Bridge Elements shall be loaded on a trailer with blocking as described above, in accordance with the approved dunnage plan. Shock-absorbing cushioning material shall be used at all bearing points during transportation of the Precast Concrete Bridge Elements. Blocking shall be provided at all locations of tie-down straps. Precast Concrete Bridge Elements stored prior to shipment shall be inspected by the Contractor prior to being delivered to the site to identify damage that would be cause for repair or rejection.

ITEMS 916.01 and 916.02 (Continued)

U. Repairs and Replacement.

In the event defects are identified, they shall be classified in the following categories and a non-conformance report (NCR) shall be filed if required. The NCR shall be submitted to MassDOT for review. Defects in all categories shall be documented by plant Quality Control personnel and made available to MassDOT upon request. Any required repairs shall utilize materials listed on the MassDOT QCML.

Where noted, defects shall be repaired according to the PCI Northeast Region Guidelines for Resolution of Non-Conformances in Precast Concrete Bridge Elements, Report Number PCINE-18-RNPCBE. Please note that reference to PCINE-18-RNPCBE is made for repair details only. In the case of conflicts with this Special Provision, this Special Provision shall govern.

1. Category 1, Surface Defects.

Category 1 defects do not need to be repaired, and an NCR does not need to be filed. Surface defects are defined as the following:

(a) Surface voids or bug holes that are less than 5/8-inch in diameter and less than ¼-inch deep, except when classified as Category 4
(b) Cracks less than or equal to 0.006 inches wide
(c) Cracks less than or equal to 0.125 inches wide on surfaces that will receive a field-cast concrete overlay

2. Category 2, Minor Defects.

Category 2 defects shall be repaired, but an NCR does not need to be filed. Minor defects are defined as the following:

(a) Spalls, honeycombing, surface voids that are less than 2 inches deep and have no dimension greater than 12 inches
(b) Cracks less than or equal to 0.016 inches that will not receive a concrete overlay
(c) Broken or spalled corners that will be covered by field-cast concrete

Minor defects shall be repaired according to PCINE-18-RNPCBE. Cracks shall be sealed according to the PCI Repair Procedure #14 in PCINE-18-RNPCBE.

3. Category 3, Major Defects.

For Category 3 defects, the Fabricator shall prepare an NCR that documents the defect and describes the proposed repair procedure. The NCR shall be submitted to MassDOT for approval prior to performing the repair. Major defects are defined as the following:

(a) Spalls, honeycombing and surface voids that are deeper than 2 inches or have any dimension greater than 12 inches, when measured along a straight line
(b) Concentrated area of defects consisting of four or more Category 2 Defects within a 4-square foot area.
(c) Exposed reinforcing steel
(d) Cracks greater than 0.016 inches and less than or equal to 0.060 inches in width that will not receive a concrete overlay
(e) Bearing area spalls with dimensions not exceeding 3 inches

ITEMS 916.01 and 916.02 (Continued)

(f) Cracks, spalls and honeycombing that will be encased in cast in place concrete need not be repaired, but the limits and location of the defects shall be documented with an NCR

Upon MassDOT approval, defects and cracks shall be repaired according to PCINE-18-RNPCBE and this specification. All repairs shall be completed at the expense of the Contractor.

4. Category 4, Rejectable Defects.

Rejectable defects as determined by the MassDOT Inspector, RMS, and Engineer may be cause for rejection. Fabricator may submit an NCR with a proposed repair procedure, requesting approval. Some rejectable defects are defined as the following:

(a) Surface defects on more than 5% of the surface area which will be exposed to view after installation
(b) Minor defects that in total make up more than 5% of the surface area of the unit
(c) Cracks greater than 0.060 inches in width except as noted in Category 1
(d) Elements fabricated outside of the specified tolerances
(e) MassDOT compressive strength testing that does not meet the specified Design Strength, f'_c

V. Loading.

Prior to the Fabricator loading the Precast Bridge Element on to the truck for shipping, the Fabricator shall provide the MassDOT Plant Inspector and RMS a minimum seven (7) days' notice of the Fabricator's intent to load the Precast Bridge Element. Inspection by the MassDOT Plant Inspector shall take place while the element is still on dunnage in the yard. The element shall not be loaded onto the truck until the MassDOT Plant Inspector has performed the inspection.

W. Shipping.

Prior to shipment, the Fabricator shall perform the following actions and provide the required documentation to the MassDOT Plant Inspector:

(a) Precast Concrete Bridge Elements shall remain at the Fabricator's plant for a minimum of 7 days after cast date.
(b) QC Inspection Reports shall be signed by the Quality Control Manager and provided to the MassDOT Plant Inspector.
(c) QC Compressive Strength Test Report Forms attaining Design Strength, f'c for the Precast Concrete Bridge Element's representative Sublot shall be generated by the Fabricator and provided to the MassDOT Plant Inspector.
(d) Certificate of Compliance shall be generated by the Fabricator as described under the Fabricator Quality Control section and provided to the MassDOT Plant Inspector.
(e) All MassDOT RMS approved Corrective Actions submitted on the Non-Conformance Reports (NCR), shall be verified to have been completed by the MassDOT Plant Inspector and Quality Control Manager.
(f) All NCRs shall be signed off by the Quality Control Manager, MassDOT Inspector and MassDOT RMS.

ITEMS 916.01 and 916.02 (Continued)

X. Delivery.

Upon Delivery, the following documentation shall be provided to the MassDOT Resident Engineer or designee:

(a) QC Compressive Strength Test Report Forms attaining Design Strength, f'c for the Precast Concrete Bridge Element's representative sublot.
(b) Certificate of Compliance generated by the Fabricator as described under the Fabricator Quality Control section.
(c) QC Inspection Reports signed by the Quality Control Manager.

The Contractor shall inspect Precast Concrete Bridge Elements upon receipt at the site. Precast Concrete Bridge Elements damaged during delivery shall be repaired or replaced at MassDOT's direction at no cost to MassDOT.

CONSTRUCTION METHODS – FIELD CONSTRUCTION

A. General.

All of the Contractor's field personnel involved in the erection and assembly of the Precast Concrete Bridge Elements shall have knowledge of and follow the approved Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly.

Prior to installation, the following documentation shall be reviewed and confirmed by the MassDOT Resident Engineer or designee:

(a) QC Compressive Strength Test Report Forms attaining Design Strength, f'c for the Precast Concrete Bridge Element's representative sublot.
(b) Certificate of Compliance generated by the Fabricator as described under the Fabricator Quality Control section.
(c) QC Inspection Reports signed by the Quality Control Manager.

Field construction staff shall verify that the Resident Engineer has accepted all Precast Concrete Bridge Elements prior to installation.

B. Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly.

Prior to the erection, the Contractor shall submit an Erection Procedure and a Quality Control Plan for Precast Concrete Bridge Element Assembly for approval by the Engineer. This submittal shall include computations and drawings for the transport, hoisting, erection and handling of the Precast Concrete Bridge Elements. The Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts with working knowledge of the Contractor's equipment, approved shop drawings, and materials to build the bridge. The Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly shall, at a minimum, include the following:

ITEMS 916.01 and 916.02 (Continued)

1. Erection Procedure

The Erection Procedure shall be prepared to conform to the requirements of 960.61, Erection and the applicable sections in Chapter 8 of the PCI Design Handbook (seventh edition) for handling, erection, and bracing requirements. At a minimum, the Erection Procedure shall provide:

(a) Minimum concrete compressive strength for handling the Precast Concrete Bridge Elements.
(b) Concrete stresses during handling, transport, and erection.
(c) Crane capacities, pick radii, sling geometry, and lifting hardware.
(d) Verification that the equipment can handle all pick loads and weights with the required factor of safety.
(e) Evaluation of construction sequence and evaluation of any geometric conflicts in the lifting of the Precast Concrete Bridge Elements and setting them as shown on the plans.
(f) Design of crane supports including verification of subgrade for support.
(g) Location and design of all temporary bracing that will be required during erection.

Non-shrink grout and concrete materials, approved by the Engineer, shall be placed as shown on the plans. Fill joints, keyways, and voids, in strict accordance with the specifications and manufacturer's recommendations and instructions.

For footings, approach slabs and highway guardrail transitions, once these Precast Concrete Bridge Elements have been set to the correct horizontal and vertical alignment, the void between them and the supporting soil shall be filled with Controlled Density Fill – Non-Excavatable to the limits as shown on the plans. Add additional grout ports in the footings to facilitate the bedding process if required.

Joints shall be filled flush to the top with non-shrink grout, and any vertical misalignment between adjacent elements shall be feathered out on a slope of 1 to 12.

Curing of grout or concrete shall be performed in strict accordance with the specifications and manufacturer's recommendations. Filling shall not be completed in cold weather when either the ambient temperature or the precast member's temperature is below the manufacturer's recommendation. No localized heating of either the precast members or of the air surrounding the element will be permitted in an attempt to reach application temperatures.

If the joints or voids are not filled within five days after the Precast Bridge Elements are erected, the Contractor shall cover and protect the openings from weather and debris until they are filled.

ITEMS 916.01 and 916.02 (Continued)

2. Quality Control Plan for Precast Concrete Bridge Element Assembly

The Quality Control Plan for Precast Concrete Bridge Element Assembly is a document prepared and submitted by the Contractor prior to the start of work which requires the Contractor to identify and detail the sequence of construction in accordance with the project schedule and which clearly identifies all stages of field construction. The assembly procedures for the Precast Concrete Bridge Elements shall be submitted on full size 24"x36" sheets. This document will be treated as a Construction Procedure and will be reviewed by both the Designer and the District Construction Office. The approval of this document will serve as a guideline for setting interim concrete and grout strengths and curing procedures to allow construction to proceed without waiting for the final in-service strengths to be achieved.

The following list details the minimum criteria that should be included in the Quality Control Plan for Precast Concrete Bridge Element Assembly:

(a) A detailed schedule showing the sequence of operations that the Contractor will follow. The schedule shall include a timeline for installation of all major elements of the bridge accounting for the installation of temporary works and cure times of grouts or closure pour concrete and other selected materials.

(b) Calculations that support the schedule outlined above should be included verifying that the selected materials have adequate interim strength to proceed from one step to another. Final material strengths are not normally required until the bridge is opened to vehicular traffic. The minimum factor of safety of two (2) will be required for the interim strength of grouts and closure pour concrete before construction is allowed to proceed to subsequent steps. The factor of safety is applied to the service loads that are supported by the elements and materials during various stages of construction. For example, if the Contractor calculates that the grout between the precast pier cap and pier wall requires a strength of 100 psi to support the dead load of the beams in the next step, a cylinder break of 200 psi will be required prior to allowing the pier cap to be loaded with the beams. The required strength of materials for subsequent construction stages shall also be calculated and the material strength verified.

(c) The Contractor is responsible for determining the center of gravity for all elements. Special care shall be used for unusual elements that are not symmetric. These elements may require special lifting hardware to allow for installation in a plumb or flat position.

(d) Plan of the work area, depicting items such as temporary earth support, utilities within the immediate vicinity of the work, drainage structures, etc. The Contractor shall coordinate the various subcontractors that will need to occupy the same area and shall ensure that there are no conflicts. For example, if the Contractor is having different Subcontractors prepare and submit plans for temporary earth support and demolition, and the earth support is required to be installed prior to the demolition, it shall be the Contractor's responsibility to ensure that the Quality Control Plan for Precast Concrete Bridge Element Assembly submission allows both operations to be performed without field modification.

(e) Details of all equipment that shall be employed for the construction of the bridge.

(f) Methods of providing temporary support of the elements. Include methods of adjusting and securing the element after placement.

(g) Vertical Adjustment Assemblies to be used as a means of setting precast concrete footings to the correct elevations.

ITEMS 916.01 and 916.02 (Continued)

(h) Procedures for controlling the overall horizontal dimensions and the vertical elevations as each precast concrete bridge element is erected by using the tolerance limits of the joints as detailed on the plans.
(i) Methods for curing grout.
(j) Proposed methods for installing non-shrink grout and the sequence and equipment for the grouting operation.
(k) Methods for sealing the keyways in preparation for filling with non-shrink grout, including the use of backer rods. The Contractor shall not assume that the backer rods will restrain the pressure from the grout in vertical grout joints. Provide additional forming to retain the backer rod.

C. Survey and Layout.

Working points, working lines, and benchmark elevations shall be established prior to placement of all elements. The Contractor is responsible for field survey as necessary to complete the work. MassDOT reserves the right to perform additional independent survey. If discrepancies are found, the Contractor may be required to verify previous survey data.

D. Preparation of Closure Pour Keyways.

Immediately prior to erecting the Precast Concrete Bridge Elements, the closure pour shear keys shall be cleaned at the job site of all dust, dirt, carbonation, laitance, and other potentially detrimental materials which may interfere with the bonding of the closure pour concrete and precast concrete using a high-pressure water blast. The exposed reinforcing steel in the precast concrete shall be protected from damage during the cleaning of the keyways. Damaged epoxy coating of steel reinforcement shall be repaired, and the reinforcing steel shall be cleaned as directed by the Engineer. The surfaces of the shear keys shall be wetted so that the surfaces shall have a Saturated Surface Dry (SSD) condition for at least 24 hours prior to the placement of the closure pour concrete.

E. Erection.

The elements shall be placed in the sequence and according to the methods outlined in the Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly. As the erection proceeds, the Contractor shall constantly monitor the assembly to ensure that the precast concrete bridge element is within proper horizontal and vertical location and tolerances prior to releasing it from the crane and setting the next unit. The Contractor may use shims to maintain proper setting tolerances.

The concrete elements shall be lifted only by the lifting devices, and the utmost care shall be taken to prevent distortion of the elements during handling, transportation or storage.

ITEMS 916.01 and 916.02 (Continued)

Suitable spreaders shall be used during lifting so that only a vertical pull will be made on the lifting device. A non-vertical lifting force may be permitted if prior written approval is given by the Engineer. This approval will be contingent on the Contractor demonstrating by calculations, prepared by a Professional Engineer registered in Massachusetts, that the elements will not be damaged by the non-vertical lifting force and by documentation that the capacity of the lifting devices is adequate for the non-vertical lifting force.

Precast components shall be pre-bed with non-shrink grout thicker than shim stacks prior to placing other precast elements on top of them.

After all Precast Concrete Bridge Elements have been placed, the actual overall dimensions of the structure both horizontal and vertical, as laid out shall not deviate from the nominal dimensions shown on the plans beyond a tolerance of +0 inches and -1 inches. Once the layout of Precast Concrete Bridge Elements has been accepted by the Engineer, the Contractor shall cut all lifting devices off below the surfaces of the elements.

F. Box Culverts.

Backfilling operations shall not begin until the following checks have been made:

(a) The culvert to footing key joints are grouted as shown on the plans;
(b) The joints between exterior culvert elements and wingwall stems are complete as shown on the plans;
(c) All joint seals are properly placed.

Backfill shall be paid for under separate items. The backfilling procedures shall be in accordance with Sections 120, 150, and 170 of the Standard Specifications and Supplemental Specifications modified as follows:

(a) Fill shall be placed and compacted in layers not exceeding one foot in depth;
(b) Dumping of fill shall not be allowed any nearer to the structure than 3.25 feet from a vertical plane extending from the back of the footing;
(c) Backfill shall be placed as symmetrically as possible around the structure with differential depths of backfill on each side of the structure not exceeding 1.5 feet with respect to each other;
(d) Compaction shall be achieved using hand compaction equipment for all fill within one foot of the structure;
(e) The bare structure shall not be crossed by any equipment heavier than that specified by the frame manufacturer. All damage resulting from equipment damage shall be rectified to the satisfaction of the Engineer at no cost to the Department;
(f) Construction equipment will not be permitted atop an uncompleted structure;
(g) Construction equipment whose weight exceeds the design capacity shall not be permitted atop the completed structure under any circumstances;
(h) The use of vibratory rollers for compaction purposes will not be permitted.

ITEMS 916.01 and 916.02 (Continued)

A representative of the manufacturer shall be on site at the commencement of the installation, at no cost to the Department, to assist the Contractor. The representative shall offer advisory assistance only and shall not supplant the Contractor's representative, or the Engineer.

G. Filling of Blockouts for Lifting Devices and Threaded inserts.

If the blockouts in the Precast Concrete Bridge Elements where the lifting devices were located will be exposed and visible after assembly is complete, the Contractor shall fill these blockouts with Cement Mortar (M4.02.15) or grout.

After the formwork has been removed, all threaded inserts that have been cast into the precast concrete bridge deck for support of the formwork shall be filled with a grout of the same color as that of the precast concrete.

BASIS OF PAYMENT

The furnishing, fabricating, and erecting of all Precast Concrete box culverts, headwalls, cutoff walls, and wingwalls shall be paid for at the contract unit price EACH, complete in place.

ITEM 943.2	**HELICAL PILE AND BRACKET ASSEMBLY**	**FOOT**
ITEM 948.6	**PRE-DRILLING FOR PILE OBSTRUCTIONS**	**FOOT**
ITEM 948.7	**HELICAL PILE VERIFICATION LOAD TEST**	**EACH**

This item shall conform to the requirements of all relevant Sections of the Standard Specifications and Supplemental Specifications.

This work shall include design, furnishing, installing, and testing helical piles (i.e. helical anchors) to support the loads as shown on the Plans, and as specified herein. The Contractor is responsible for furnishing all materials, equipment, labor, services, and supervision, and for selecting the means and methods for the installation and testing of helical piles for this project. The helical piles shall be designed (overall pile length, helix configuration, and minimum effective torsional resistance) to support the factored loads specified on the Plans or in these Specifications.

Each helical pile shall be installed with the top most helix installed within the bearing stratum, as defined in the Geotechnical Report, boring logs, and shown on the Plans, and to the minimum length determined by the Contractor, subject to verification by static load testing, and using installation torque indicative of the design factored resistance. Install helical piles through whatever material is encountered to the bearing stratum and minimum length to achieve design factored resistance. Helical piles shall be cut-off, as needed, at the elevations required to enable connection of bracket assemblies to the boardwalk decking or pile top to pile cap as shown on the Plans.

The Contractor is responsible to provide qualified personnel for design, and onsite installation, inspection, and record keeping as specified herein.

The helical pile resistance shall be confirmed by pre-production verification load testing. Testing must meet the test acceptance criteria specified herein. The helical pile design may be modified by the Engineer, pending results of verification load testing performed as an initial part of the work.

Pre-drilling may be required to penetrate cobbles or boulders encountered during helical pile installation. Prior to pre-drilling, the Engineer will consider the equipment, techniques, and level of effort by the Contractor and shall be the sole judge of the need for pre-drilling. This work shall be outlined in the submitted construction procedures.

Prior to the installation of helical piles, the Contractor shall perform additional site exploration to verify the location of the existing sewer. If the location of the existing sewer is closer to the proposed helical pile locations shown on the Contract Plans, the Contractor shall notify the Engineer.

RELATED WORK

Additional related items specified elsewhere include:

Item 995.01 BRIDGE STRUCTURE, BRIDGE P-03-020 (CAK)

ITEMS 943.2 through 948.7 (Continued)

MATERIALS

A. General

The Helical Pile Contractor shall be responsible for the selection, purchase, or manufacture of the appropriate size and type of helical piles and bracket assemblies, and all other necessary components to support the factored loads stated in these Specifications or on the Plans. These specifications provide minimum requirements to aid the Helical Pile Contractor in making appropriate materials selections. The size and number of helical blades (helices) must be such that the helical piles achieve the appropriate torque and resistance in the soils at this site. Failure to achieve proper torque and resistance shall result in the Contractor replacing helical piles as appropriate to support the required factored loads. All installation procedures, materials, and replacements shall be acceptable to the Engineer.

Helical pile components as specified herein and on the Drawings shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements. Certificates of Registration denoting ISO Standards Number shall be submitted to the Engineer for review and acceptance. Acceptance will be at the sole discretion of the Engineer and Department.

Materials not conforming to this section of the specifications or from sources not listed in the Contract Documents shall not be used without written consent from the Engineer.

Contractor's design of the helical piles shall conform to the minimum material requirements stated below:

1. Central Steel Shaft

    a) Steel shaft consisting of lead helical segments, steel shaft helical extensions, steel couplers to connect extension shafts to mounting brackets, and adjustable steel mounting brackets.
    b) Steel shafts shall have minimum yield strength of 50 ksi and a minimum torque strength rating of 5,500 ft-lb.
    c) Hot rolled solid steel bars shall meet dimensional and workmanship requirements of ASTM A29. The bars shall be modified medium carbon steel grade with improved strength due to fine grain size and shall be at least 1.5 inches square.
    d) Structural steel pipe shall be seamless or straight-seam welded, per ASTM A500 or A513, 3.5 inch O.D. minimum. Wall thickness shall be 0.300 inch (Schedule 80) minimum.

Helical Bearing Plate

Helix bearing plate shall be hot rolled carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape and uniform pitch. Bearing plate material shall meet or exceed the properties of ASTM A572, ASTM A1018, or ASTM A656 as applicable, with minimum yield strength of 50 ksi. Plate thickness shall be minimum 3/8 inch.

ITEMS 943.2 through 948.7 (Continued)

Bolts

Bolts used to connect anchor shaft sections together, anchor shafts to bracket assembly plates, and pile shaft to the pile cap shall be minimum ¾-inch diameter and shall conform to ASTM A325, ASTM A193 Grade B7, ASTM A320 Grade L7 or SAE J429 Grade 5 or 8.

Couplings

a) Couplings for square shafts shall be formed as an integral part of the helical extension segment and riser segment as hot upset forged sockets.

b) Couplings for structural steel pipe sections shall either be formed as an integral part of the riser as hot forge expanded sockets, or as internal sleeve wrought steel connectors. The steel connectors can be either tubing or solid steel bar with holes for connecting shaft sections together.

Plates, Shapes, or Pile Caps

Vertical and angled bracket assembly plates shall be rated for the design loads specified herein and the strength of the structure they support. The bracket assembly shall be bolted to the riser section to resist tension loading. Threaded bars shall be used to form the connection between the riser section and angled brackets for the helical piles. Bolts for the bracket assembly are specified on the Plans. Structural steel plates and shapes for pile top attachments shall conform to ASTM A36 or ASTM A572 Grade 50.

Corrosion Protection

Corrosion protection requirements for the various helical pile elements shall be provided by hot dip galvanization in conformance with ASTM A123.

QUALIFICATIONS

Due to the special requirements for installation of helical piles and the requirements for proper performance of the structural system helical pile systems, devices, and bracket assemblies shall be installed by a specialized Helical Pile Contractor. The Helical Pile Contractor shall have experience in the design, construction, and load testing of helical piles and have successfully constructed minimum of five (5) projects in the last five (5) years totaling at least 100 helical piles with similar design, loads, and requirements specified in these Plans and Specifications. The Helical Pile Contractor shall have previous helical pile installation experience with similar subsurface materials, groundwater conditions, helical pile sizes, and be thoroughly familiar with the specialized type of equipment needed to perform work of this type.

The Helical Pile Contractor shall be trained and certified by the helical pile manufacturer in the proper methods of design and installation of helical piles. The Helical Pile Contractor shall provide names of on-site personnel materially involved with the work, including those who carry documented certification from the manufacturer. At a minimum, these personnel shall include foreman, machine operator, and project engineer/manager.

ITEMS 943.2 through 948.7 (Continued)

The on-site foremen shall have minimum experience of at least 3 years installing helical piles of equal or greater resistance than required in these Plans and Specifications. The machine operators and tester shall have minimum experience of 2 years installing and testing helical piles of equal or greater resistance than required in these Plans and Specifications.

Prior to the Pre-construction Meeting, the Helical Pile Contractor shall submit the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the helical pile design and construction:

1. Submit a list of at least five helical pile projects successfully completed in the last five years. Include construction details, structural details, load test reports, and client contact for each project listed.
2. Submit a list of the equipment and resources the Helical Pile Contractor plans to mobilize and utilize for the performance of the project.
3. Provide the names and detail the experience of the helical pile designer, on-site supervisor, foremen, and drill rig operators for this project.
4. A signed statement that the Helical Pile Contractor has inspected both the project site and all the subsurface information including any subsurface materials samples made available in the Contract Documents.

The Helical Pile Contractor shall employ a registered professional engineer licensed in the Commonwealth of Massachusetts to design the helical piles; load test set-up, and instrumentation for the pile load tests; monitor, record, and evaluate the test results; and prepare the report of the pile load tests. The engineer shall have at least five (5) years' experience in helical anchor design, installation and pile load test setup, monitoring, and analysis.

Work on any helical piles shall not be started, nor materials ordered until the qualifications and submittals have been accepted by the Engineer. The Engineer may suspend the helical pile construction if the Helical Pile Contractor substitutes unapproved personnel during construction. Requests for substitution of field personnel shall be submitted to the Engineer for acceptance. Additional costs resulting from the suspension of work will be the Helical Pile Contractor's responsibility, and no extension in contract completion date resulting from the suspension of work will be allowed.

All helical piles shall be installed in the presence of a designated representative of the Engineer. The designated representative shall have the right of access to any and all field installation records and test reports.

DESIGN REQUIREMENTS

The helical piles shall be designed to support the design loads shown on the Plans with a service life of not less than 75 years.

ITEMS 943.2 through 948.7 (Continued)

Helical pile systems shall be designed and installed in accordance with:

1. The manufacturer's requirements.
2. The requirements as specified herein.
3. The Contract Plans.
4. AASHTO LRFD Bridge Design Specification, current edition. Herein referenced as AASHTO LRFD.
5. AASHTO LRFD Bridge Construction Specifications, current edition.

Where conflicting requirements occur, the more stringent shall govern. Design shall consider Service, Strength, and Extreme Limit States.

Loads on the Plans are factored design loads. A maximum resistance factor of 0.70 shall be used to determine the required ultimate tensile and compressive resistance of the helical piles with regard to their interaction with soil upon successful completion of static load testing. Helical pile resistance in soil depends on the geometric configuration of the helical blades about the lead section and the subsurface conditions. The torque applied during installation provides an indirect verification of axial resistance. Manufacturer's recommendations and ICC-ES-AC358 should be followed regarding the torque and the tensile/bearing resistance relationship for the particular helical pile selected. The number and size of blades shall be determined by the Helical Pile Contractor so as to achieve the required torque and tensile/bearing resistance for the soil conditions at the site. However, the ratio of factored design resistance to the total area of the helical blades shall not exceed the subsurface material factored bearing resistance.

Design of the helical piles shall be based on Load Resistance Factor Design (LRFD) and conform to the following minimum design criteria:

1. Helical anchor manufacturer shall furnish a guarantee for a period of ten (10) years from date of delivery against defects due to manufacturing of helical pile and bracket assemblies. Helical pile manufacturer must carry product liability insurance.

2. Helical piles shall be designed to provide the minimum factored design loads as shown on the Contract Drawings.

3. Vertical and inclined helical piles are specified on the Contract Drawings. Two vertical helical piles and one inclined helical anchor are specified at each bent to resist axial compression and horizontal (transverse direction) deck loads. Two inclined piles are specified at every third bay of the boardwalk decking to resist longitudinal lateral loading. Contractor shall determine the required angle of inclination for inclined piles within the minimum and maximum range of angle of inclination shown on the Contract Drawings.

4. The overall length, helix configuration, and minimum torsional resistance of a helical pile shall be such that the required nominal resistance is developed by the helix plate(s) in the bearing stratum.

ITEMS 943.2 through 948.7 (Continued)

5. Piles shall be designed so that the helices derive support entirely in the inorganic soils underlying the soil strata. Therefore, the top helix for all piles should extend at least 9 feet into the sand and gravel strata below the fill strata.

6. Maximum resistance factor of 0.70 may be utilized upon successful completion of a preproduction verification load test. The design loads shall be confirmed with pile load tests as specified herein.

7. The pile design shall consider pile spacing, soil stratification, corrosion, and strain compatibility issues as are present for the project.

HELICAL PILE PRE-CONSTRUCTION SUBMITTALS

A. General

The Contractor shall prepare and submit to the Engineer: design calculations, shop drawing, helical pile installation plan, construction procedures, load testing procedures, and equipment calibration for review and acceptance. Verify the limits of the helical pile structure before preparing the detailed Working Drawings. The Contractor shall allow the Engineer four (4) weeks to review, comment, and return the submittal package after a complete set has been received. Work shall not begin, nor materials ordered until all submittals have been received, reviewed, and accepted in writing by the Engineer. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

The helical pile submittals shall include:

1. Design

   Design computations demonstrating compliance with the criteria specified herein and shown on the Plans, prepared, and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts and specializing in helical pile design and construction with a minimum of 5 years of design experience.

   The design calculations shall include but not be limited to:

   a) Statement of all assumptions made and copies of all references used in the calculations.
   b) A written summary report describing the overall helical pile design.
   c) A statement of applicable code requirements and design references.
   d) Helical pile structure critical design cross-section(s) geometry, including soil strata and piezometric levels and location, magnitude and direction of applied loadings, including slope or external surcharge loads.
   e) A description of design criteria to be applied to the work, including, soil shear strengths (friction angle and cohesion), unit weights for each soil stratum, and helix plate diameter(s), helix plate pitch, and installation torque to nominal resistance assumptions for the design bearing stratum.

ITEMS 943.2 through 948.7 (Continued)

f) All design calculations performed by hand, spreadsheet, or computer program and references used.
g) Design calculation sheets with the Project number, helical pile structure location, designation, date of preparation, initials of designer and checker, and page number at the top of each page. Provide an index page for the design calculations.
h) Design notes including a list of symbols and computer program used in the design.
i) Pile-to-footing connection calculations.

2. Plans

Working Drawings indicating:

a) Helical pile number, location, and pattern by assigned identification number.
b) Helical pile factored design load.
c) Type and size of central steel shaft for helix segments and riser segments, including transition bars.
d) Helix configuration (number and diameter of helix plates) on lead segment and extension segment(s), if required.
e) Minimum effective installation torque.
f) Minimum overall length.
g) Inclination of helical pile.
h) Cut-off elevation.
i) Helical pile bracket assembly and connection to boardwalk pier cap or pile cap, including thread bars (if used).

3. Construction Procedures

a) A detailed description of the construction procedures and equipment proposed for installation of the helical piles. Include description of methods to maintain alignment of the piles during installation and the required angle for inclined piles. Procedures shall include a description of mitigating measures to be taken if the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required and if the helical pile is refused or deflected by a subsurface obstruction.

b) Shop drawings for all helical pile components, including transition adapters, helical segments, riser segments, thread bar adapters, brackets, and bolt connections. Include identification of manufacturer's catalog numbers.

c) Example field log to be used for recording installation details for each helical pile installation.

ITEMS 943.2 through 948.7 (Continued)

d) Information on space requirements for installation equipment that verify the proposed equipment can perform at the site.

e) If welding is proposed, submit the welding procedure. All welding shall be done in accordance with the current AWS Structural Welding Code.

f) Mill test reports for the central steel shaft for the materials delivered to the site for record purposes. The ultimate strength, yield strength, percent elongation, and chemistry composition shall be provided.

4. Load Testing Procedures

Procedures, equipment, and set up for pre-production static load testing for the helical piles. Locations of the load tests shall be selected by the Contractor and accepted by the Engineer. The purpose of the tests is to determine the load versus displacement response of the helical pile and provide an estimation/confirmation of nominal resistance. Both a tension and a compression load test will be performed on each of the helical piles to be load tested. The load test proposal shall be in general conformance with ASTM D1143 for compression testing and ASTM D3689 for tension testing. The following minimum information shall be provided for review:

a) Type and accuracy of load equipment.
b) Type and accuracy of load measuring equipment.
c) Type and accuracy of helical pile head deflection equipment.
d) Description of load reaction system, including description of reaction piles.
e) Calibration report for complete load test equipment, including hydraulic jack, pump, pressure gage, hoses, and fittings.

5. Equipment Calibration

Copies of calibration reports for each torque indicator or torque motor, and all load test equipment to be used on the project. The calibration tests shall have been performed within forty five (45) working days of the date submitted. Helical pile installation and testing shall not proceed until the Engineer has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:

a) Name of Project and Contractor
b) Name of testing agency
c) Identification (serial number) of device calibrated
d) Description of calibrated testing equipment
e) Date of calibration
f) Calibration data

ITEMS 943.2 through 948.7 (Continued)

6. Qualifications Documents

   Qualifications of the Helical Pile Contractor and qualifications of the Contractor's Engineer, who will design the helical piles and design, monitor, evaluate and prepare report(s) for pile load tests. Qualifications shall satisfy the requirements of the Qualifications Section of these specifications.

7. Materials Documents

   ISO9001 certificate or helical pile manufacturer or complete description of product testing and manufacturing quality assurance programs used to assess and maintain product quality.

   Documentation of ICC ES AC358 acceptance criteria required for the testing and validation of the performance of a manufacturer's helical piles. Test standard involves lab and field testing of the helical pile components and within various soil types.

HELICAL PILE PRE-CONSTRUCTION MEETING

A mandatory pre-construction meeting will be scheduled by the Engineer and held prior to the start of helical pile construction. The Design Consultant, MassDOT Resident Engineer, Prime Contractor, and Helical Pile Contractor, including QC personnel, shall attend the meeting. The preconstruction meeting will be conducted to clarify the construction and QC requirements for the work, to coordinate the construction schedule and activities, specifically those pertaining to excavation for helical pile structures, installation of temporary support of excavation, anticipated subsurface conditions, helical pile installation and testing, and helical pile structure survey control.

SITE DRAINAGE CONTROL

The Contractor shall provide positive control and discharge of all surface water that will affect construction of the helical pile installation. Maintain all pipes or conduits used to control surface water during construction. Repair damage caused by surface water at no additional cost. Upon substantial completion of the work, remove surface water control pipes or conduits from the site.

EXCAVATION

Coordinate the work and the excavation so the helical pile structures are safely constructed and remain stable at all times. Perform the helical pile construction and related excavation in accordance with the Plans and accepted submittals. No excavation deeper than those specified herein or shown on the Plans will be made above or below the helical pile structure locations without written acceptance of the Engineer.

ITEMS 943.2 through 948.7 (Continued)

HELICAL PILE INSTALLATION

A. General

Contractor shall be responsible for selecting installation equipment, tooling, and procedures for installing helical piles. These specifications provide minimum requirements to aid the Contractor in making appropriate selections.

Piles shall be installed only in the presence of the Engineer's or MassDOT's Representative.

B. Site Conditions

The Contractor shall visit the site to review all details of the work and working conditions, to verify dimensions in the field and to advise the Engineer of any discrepancy before performing any work.

The Contractor shall verify that all helical piles may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc. The Contractor shall consult the Contract Drawings and official records of existing utilities, both surface and subsurface, and their connections to be fully informed on all existing conditions and limitations as they apply to this work. Contractor shall repair or replace any construction induced damage to existing active utilities to the satisfaction of the governing utility owner at the Contractor's expense.

Subsurface explorations (drive sample borings) were performed on wide spacing along the elevated boardwalk alignment. Locations and logs of the borings are shown on the Contract Drawings. Contractor shall review logs of these explorations and other pertinent data for the site as described in the Geotechnical Engineering Report.

The Contractor may take whatever explorations deemed as necessary, at no additional cost to the Owner or Engineer, for designing the helical piles.

The aforementioned data is for general information and is accurate only at the particular locations and time the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and draw conclusions on the character of the materials encountered and the impact on this work based on the Contractor's expert knowledge of the area and helical pile installation techniques.

C. Location and Survey

Helical piles shall be located and marked using survey and a template by the Contractor who shall maintain and be responsible for all location and elevation stakes.

ITEMS 943.2 through 948.7 (Continued)

D. Installation Equipment

The Contractor shall verify that site conditions will allow for access of proposed equipment and will support equipment for helical pile installation.

Each helical pile shall be advanced into the ground by application of rotational force using a hydraulic torque converter. Installation equipment shall include a direct means of determining the installation torque being applied to the helical pile. Percussion drilling methods shall not be permitted. The equipment shall be capable of continuous position adjustment to maintain proper helical pile alignment.

Where load testing is required, installation equipment shall include a means for applying and measuring loads and deflections of helical piles. Acceptable methods of load testing include a calibrated hydraulic jack or other means acceptable to the Engineer. Current evidence of calibration of Contractor's load testing and torque monitoring equipment shall be provided as part of the pre-construction submittals, but also upon request of the Engineer during installation.

Equipment shall be re-calibrated during helical pile installation, if in the opinion of the Engineer and/or Contractor, reasonable doubt exists as to the accuracy of the torque measurements. Re-calibrations shall be at the cost of the Contractor.

All drive tools and equipment shall be in accordance with the manufacturer's written installation instructions.

All helical pile installation equipment and materials shall be acceptable to the Engineer prior to delivery to the site. Acceptance will be based upon submission of records and data, as discussed in this specification. Once accepted, changes in installation equipment and materials will not be permitted without additional acceptance and will be considered only after the Contractor has submitted all information requested by the Engineer which must meet all requirements of this special provision.

E. Installation Procedure

Helical piles shall be advanced into the ground until the required minimum overall length criteria and minimum effective torsional resistance criteria are achieved to accommodate the nominal tensile and bearing resistance plus an additional distance to ensure proper embedment. For the helical piles, the embedment length shall be achieved by continuing advancement while maintaining or exceeding the required torsional resistance for the last three (3) feet of penetration.

Constant normal pressure shall be applied while screwing helical piles into the ground. The pressure applied shall be sufficient to ensure that, during each revolution, the helical pile progresses into the ground a distance equal to at least 80% of the blade pitch. Rate of helical pile rotation shall not exceed 20 revolutions per minute.

Inclined helical piles can be positioned perpendicular to the ground to assist in the initial advancement into the soil before the required batter angle is established.

ITEMS 943.2 through 948.7 (Continued)

All helical pile components including the shaft and bracket assembly shall be isolated from making a direct electrical contact with any concrete reinforcing bars or other non-galvanized metal objects since these contacts may alter corrosion rates.

F. Construction Tolerance

Helical piles and bracket assemblies shall be installed at the locations shown on the Plans.

1. Centerline of helical piles shall not be more than 3 inches laterally and longitudinally from indicated Plan location.
2. Piles shall be plumb within 2 degrees of design Plan alignment.
3. The top elevations of helical piles shall be within +1 inch to –2 inches of the design vertical elevation.
4. Bracket assembly placement shall be within 1 inch in both directions perpendicular to the pile shaft and ¼ inch in a direction parallel with the pile shaft.

G. Installation Records

The Contractor shall prepare and provide to the Engineer full-length installation records for each helical pile installed. The records shall be submitted within one work shift after that pile installation is completed. The data shall be recorded on a helical pile installation log. A separate log shall be provided for each helical pile. The log for each helical pile shall contain the following minimum information:

1. Project name, structure name, helical pile number, and contract number.
2. Name of Contractor's supervisor during installation.
3. Date and time of installation.
4. Installation equipment name and model, and operator name.
5. Type of torque indicator used.
6. Plan location of helical pile.
7. Pile reveal.
8. As-built helical pile type and configuration, including manufacturer's catalogue numbers for lead section (number and size of helix plates), number and type of extension sections, and associated hardware used to make shaft connections and bracket connections to deck.
9. Total length of installed helical pile.
10. As-built installation angle of pile.
11. Helical pile installation duration and observations.
12. Cut-off elevation.
13. Installation torque measurements at one-foot intervals for the final 10 feet of installed length, at a minimum.
14. Effective torsional resistance and calculated geotechnical resistance as derived from the pre-production load test program.
15. Comments pertaining to interruptions, obstructions, or other relevant information.
16. Rated load capacities.

ITEMS 943.2 through 948.7 (Continued)

The Contractor shall also submit within 2 weeks after installation of all piles, an as-built plan, certified by a surveyor, showing the as-installed location of all piles to the nearest ½ inch.

CONSTRUCTION QUALITY CONTROL

HELICAL PILE LOAD TESTS

A. General

The Contractor shall perform pre-production verification pile load testing (both compression and tension) on a sacrificial pile per bond zone stratum. The number and location of the verification test(s) shall be as specified on the Plans. In general, the location of the verification test(s) shall be within 10 feet of the footprint of a substructure unit, but at least 5 feet from any production pile as selected by the Contractor and accepted by the Engineer.

Installation methods, procedures, equipment, and overall lengths for the pre-production verification load test helical pile shall be identical to those proposed for use in installing production helical pile to the extent practical.

The load tests shall conform to the requirements of ASTM D1143 (vertical compression load testing) and ASTM D3689 (vertical tension load testing) except as modified herein. The maximum test loads shall be 150% of the Factored Design Load (FDL) for the Helical Pile Verification Test. The Factored Design Load is defined as the Factored Axial Design Load (compression and/or tension) as shown on the Plans. The Alignment Load (AL) should not be more than 0.04 FDL.

Before starting the work, the Contractor shall submit to the Engineer for acceptance, a pile load test plan including a written description of the equipment and methods which are intended to be used. The methods must be of an accepted type and shall be altered as necessary to meet the acceptance of the Engineer. The pile load test plan and description shall be prepared and signed and stamped by a professional engineer registered in the Commonwealth of Massachusetts.

If the load test fails to meet the design requirements, the Contractor shall modify the helical pile design and/or installation methods and retest the modified pile at no additional cost to the Owner.

The Contractor shall provide all personnel and equipment needed to perform the test, measure loads and movements, and record test data. A representative of the Department or the Engineer may observe and witness the test and record data independently. No testing is to be performed unless all the agreed representatives are present.

B. Load Test Equipment

Testing equipment shall include dial gauges, dial gauge support, jack and pressure gauge, electronic load cell, and a reaction frame. The Contractor shall provide a description of test setup and jack, pressure gauge and load cell calibration curves, in accordance with the Submittals Section.

ITEMS 943.2 through 948.7 (Continued)

Design the testing reaction frame to be sufficiently rigid and of adequate dimensions such that excessive deformation of the testing equipment does not occur. Provide a reaction frame capable of safely supporting 125 percent of the maximum test load. Align the jack, bearing plates, and stressing anchorage such that un-loading and repositioning of the equipment will not be required during the test. The direction of the applied load shall be collinear with the helical pile at all times.

Apply and measure the test load with a hydraulic jack and pressure gauge. The pressure gauge shall be graduated in 100 psi increments or less. The jack pressure gauge shall have a pressure range not exceeding twice the anticipated maximum test pressure. The jack shall be positioned at the beginning of the test such that unloading and repositioning during the test will not be required. The jack shall also be positioned co-axial with respect to the helical pile head so as to minimize eccentric loading.

Calibrate the test load jacking system including the hydraulic jack couplings, gas pump, pressure gauge, and hydraulic load cell prior to the test so that the load applied is controlled to within 3 percent of the total applied load. Submit calibration reports prior to the start of the pile load test. Monitor the creep test load hold during verification tests with both the pressure gauge and the electronic load cell. Use the load cell to accurately maintain a constant load hold during the creep test load hold increment of the verification test.

Readings of settlement and rebound shall be referred to a fixed benchmark and shall be made using dial gauges (micrometer dial extensometers) graduated to 0.001 inches and located so its stem is parallel with the axis of the helical pile. The stem may rest on a smooth plate located at the helical pile head and positioned perpendicular to the axis of the helical pile. The gauges shall be mounted on a reference beam supported at each end by reliable supports located at least 10 feet from the center of the test pile and independent from the jack, pile, or reaction frame.

The dial gauges shall have a travel sufficient to allow the test to be done without having to reset the gauges. Readings shall be taken at intervals specified in the Verification Test and Proof Test Section.

Protect the settlement measuring system against rain, wind, frost, and any other disturbances that could affect the reliability of the settlement observations. Provide sun shading for the measuring system for the duration of the test and for a minimum of 1 hour prior to the start of the test.

C. Helical Pile Verification Test

The Contractor shall perform pre-production verification pile load testing on sacrificial piles at a location selected by the Contractor and accepted by the Engineer. The location of the verification tests shall be within 10 feet of footprint of a substructure unit but at least 5 feet away from any production pile. Testing shall be performed in compression or tension in accordance with ASTM D1143 or ASTM D3689, respectively, except as modified herein.

Verification load tests shall be performed to verify that the Contractor installed helical pile will meet the required FDL and load test acceptance criteria and to verify the nominal resistance to the average installing torque of the helical pile for the project site.

ITEMS 943.2 through 948.7 (Continued)

The helical pile verification load test results must verify the helical pile design and installation methods, and be reviewed and accepted by the Engineer prior to beginning installation of production helical piles. The verification test pile and reaction piles shall not be used as production piles.

Test verification pile to a maximum Test Load of 150% of the Factored Design Load (FDL) defined above, as indicated on the Plans. The verification pile load test shall be made by incrementally loading the helical pile in accordance with the following cyclic load schedule:

Step	Loading	Applied Load	Hold Time (min.)
1	Cycle 1	AL	1
		0.15 FDL	4
		0.30 FDL	4
		0.45 FDL	4
		0.60 FDL	4
		0.75 FDL	4
		0.525 FDL	4
		0.375 FDL	4
		0.20 FDL	4
		AL	1.0
2	Cycle 2	AL	1
		0.25 FDL	4
		0.75 FDL	4
		0.90 FDL	4
		1.0 FDL	4
		1.2 FDL	4
		1.35 FDL	4
		1.5 FDL	10
		1.0 FDL	4
		0.75 FDL	4
		0.25 FDL	4
		AL	5

Test Notes: Pile top movement shall be measured at each load increment. The load-hold period shall start as soon as each test load increment is applied. The verification test pile shall be monitored for displacement at the 1.5 FDL increment. Displacement readings shall be recorded at 1, 2, 3, 5, 6, and 10 minutes. Dial gauges shall be reset to zero after the initial AL is applied.

The acceptance criteria for helical pile verification load test are:

1. The helical pile shall sustain the compression and tension design loads (0.75 FDL) with no more than 3/4-inch total vertical movement of the helical pile head as measured relative to the top of the helical pile prior to the start of testing.

ITEMS 943.2 through 948.7 (Continued)

2. Failure does not occur at the 1.50 FDL maximum compression and tension test loads. The failure load shall be defined by one of the following definitions, whichever results in the lesser load:

   - The point at which the movement of the helical pile tip exceeds the elastic compression/tension of the anchor shaft by 0.08 B, where B is defined as the diameter of the largest helix.

   - The point at which the slope of the load versus deflection (at end of increment) curve exceeds 0.05 inches/kip.

Both of the above acceptance criteria shall be met.

At the completion of verification testing, test pile shall be removed down to the elevation specified on the Plans or by the Engineer.

E. Helical Pile Load Test Report

Verification Load Test Report

For the verification load tests, reports must be written and submitted to the Engineer within 3 working days of the load test completion. This report will either confirm the helical piles' resistance as specified on the approved Working Plans or propose changes based upon the results of the pre-production tests. This report shall be reviewed and accepted by the Engineer prior to beginning installation of production helical piles. The contents of the verification load test report shall include:

1. Brief project description.
2. Description of site and subsurface conditions including information on the ground conditions at the location of the load test and a comparison to actual conditions encountered.
3. Key personnel including the installation equipment operator, the superintendent, and any other personnel involved in the installation and testing of the helical pile.
4. Helical pile installation data including information such as length of the helical pile, geology encountered (e.g. soil material, rock material, and water levels) during installation, and all relevant helical test pile information specified for production helical pile installation in Construction Quality Control Section C. Installation Records, above.
5. A scale drawing of helical test piles showing all relevant construction details and subsurface conditions encountered during installation of the helical test piles and helical reaction piles.
6. Results of load test including load-movement curves/figures and filled-out data sheets.
7. Statement of load test requirements and acceptance criteria.
8. Comparison of load test requirements and acceptance criteria.
9. Summary statement on the load test results.
10. Report shall be signed and stamped by the Contractor's Professional Engineer registered in the Commonwealth of Massachusetts.

ITEMS 943.2 through 948.7 (Continued)

If a tested helical pile fails to meet the acceptance criteria, the Contractor shall modify the design, the construction procedure, or both. These modifications may include but not limited to de-rating the helical pile resistance, modifying the installation methods and equipment, increasing the minimum effective installation torque, changing the helix configuration, or changing the helical pile material (for example central steel shaft). Modification shall be submitted as a revision to the Working Drawings and require the Engineer's review and acceptance. Additional load testing may be required until an acceptable pile load test meets the designated load test requirements.

NON CONFORMING PILES

Non-conforming helical piles include piles that are installed out of tolerance, are damaged, are not installed to the minimum required torque, are not installed to the minimum required depth, or the helical pile lead section is not installed in the specified bearing stratum. The Contractor shall submit a written remedial action plan to the Engineer for approval. To mitigate or remediate nonconforming helical piles, the Contractor may be required to provide additional helical piles or supplement helical piles to meet specified requirements at no additional cost to the Owner. Re-use of components of helical piles that had been previously installed and removed shall be at the acceptance of the Engineer.

FIELD MODIFICATIONS

Modification of manufactured helical anchor shaft, helical blades, bracket assemblies, and shaft connections is prohibited and shall not be performed without written approval of product manufacturing company and acceptance by the Engineer.

METHOD OF MEASUREMENT

Helical Pile and Bracket Assembly will be paid for at the contract unit price per Foot. Helical Pile and Bracket Assembly shall be measured between the tip of the pile and the bottom of the timber pile cap, which shall include the pile lead sections with helices, pile shaft materials, couplers, mounting bracket assemblies, bolts, hardware, and any other materials, equipment and labor required for proper installation of one helical pile at the required final installation torque, resistance, location, elevation, and minimum length specified. Installation torque records with depth and pile length shall be the basis for measurement.

Pre-Drilling for Pile Obstructions shall be measured for payment per Foot.

Helical Pile Verification Load Test shall be measured for payment per Each.

ITEMS 943.2 through 948.7 (Continued)

BASIS OF PAYMENT

Helical Pile and Bracket Assembly shall be paid at the contract unit price per Foot, complete in place and accepted. Payment for helical pile and bracket assembly shall be considered complete compensation for providing all design, materials, labor, equipment, services, and incidentals to complete the work. There will be no separate measurement for mobilization and demobilization associated with this item. Payment will only be made for piles that are installed in accordance with the requirements of these specifications, the accepted Contractor's design submittal, and the acceptance of installed piles by the Engineer. No payment shall be made for non-conforming helical piles.

The cost of the Contractor's design professional to design the helical piles and prepare the necessary submittals and respond to comments by the Engineer and the cost of the helical pile manufacturer's representative is incidental to the items listed in this Section.

The Contractor shall anticipate encountering obstructions during helical pile installation and shall utilize equipment and methods necessary to advance through the obstructions. Any cost associated with the pre-drilling for pile obstructions shall be paid for at contract unit price of Pre-Drilling for Pile Obstructions Item.

The cost of the additional site exploration to locate the existing sewer shall be paid under item 141.1 Test Pit for Exploration.

Helical Pile Verification Load Test shall be paid at the contract unit price per each completed and accepted test, for which payment shall be considered complete compensation for providing all design, materials, labor, equipment, load test report, and incidentals to complete the work including the installation and materials of the test pile, reaction piles, if used, and load frame. This payment shall also include full compensation for cutting the pile to the elevation necessary and for mounting bracket assemblies, bolts, hardware, and any other materials, equipment and labor required to properly incorporate the pile in the structure. If a pile is not to be incorporate in the structure, this payment item includes cutting the pile to the grade necessary to avoid its interference with the proposed construction. Payment for Helical Pile Verification Load Tests shall also include full compensation for installing the test pile

ITEM 983.6 NATURAL STREAMBED MATERIAL SQUARE YARD

The work under this heading shall consist of installation of natural streambed material within the channel excavation portion and up to the excavated material to provide a natural streambed for aquatic organisms. The natural streambed construction material is to be placed within the bottom 12” of the channel and on top of rip rap as depicted on the plans. The natural stream bed material shall be installed in dry conditions.

The existing streambed material to be excavated shall be stockpiled in separate locations or be separated by double-stacked straw bales or temporary concrete barriers within the limits of work to prevent mixing and allow for reinstallation of the correct material on the bed and banks.

The intent of this work is to ensure a natural streambed within the channel, to provide fisheries and wildlife habitat enhancement as part of the wetland replication area and natural wetlands. The natural streambed material shall be comprised of the stones 4 inches and under, that shall meet the following gradation:

Sieve opening	Percent by Mass Passing Through
4”	95
2”	55-65
¾”	30-45
#4	0-5

Partially angular rock is preferred over round and shall be able to lock together to prevent movement during high flows. Crushed stone will not be accepted for any components. The top of streambed elevations shall match existing streambed elevations.

METHOD OF MEASUREMENT

Item 983.6 will be measured by the area of natural streambed material, complete in place, 12” deep.

BASIS OF PAYMENT

Item 983.6 will be paid for at the Contract unit price per Square Yard which price shall include furnishing, installation, all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 991.1	**CONTROL OF WATER – STRUCTURE NO. P-03-020 (CAK)**	**LUMP SUM**
ITEM 991.2	**CONTROL OF WATER – STRUCTURE NO. 2 (CULVERT NO. 1)**	**LUMP SUM**
ITEM 991.3	**CONTROL OF WATER – STRUCTURE NO. 3 (CULVERT NO. 2)**	**LUMP SUM**

The work under these Items shall conform to the relevant provisions of Subsection 140.60 of the Standard Specifications, and the following:

The work to be done under these Items shall consist of all work required for the control of water and siltation, if necessary, to ensure that all the proposed precast culverts and bridge abutments are installed in the dry as shown on the plans, or as directed by the Engineer. The work shall include all incidental dewatering, pumping, turbidity barriers, sandbagging, filtration or dewatering basins, or other measures inclusive of sheeting, necessary for sufficient water control to accomplish the construction of the proposed substructure/culvert in the dry.

For demolition purposes, dewatering shall be conducted on an as needed basis as determined by the Contractor. It is the responsibility of the Contractor to assess the site and determine the need and extent of dewatering required and to submit complete working drawings and computations of his/her proposed dewatering scheme to the Engineer for approval in accordance with Subsection 5.02 and these Special Provisions. A Professional Engineer registered in the Commonwealth of Massachusetts shall certify both. The furnishing of such schemes shall not serve to relieve the Contractor of any of his responsibility for the safety of the work or the responsibility for the successful completion of the project. Submittals shall include, but are not limited to, a sequence plan with a timetable and details specific to each of the phases of construction. The submittals shall include working drawings and calculations. Detailing the methods and materials proposed to account for all anticipated loads and construction conditions necessary to permit the work while maintaining a safe work area and protecting property from damage.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of transporting by water any part of the concrete materials being placed. No such pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it is done by a method approved by the Engineer. During dewatering operations, water that is pumped from the interior of any foundation enclosure shall be conveyed into a sedimentation basin or other device or methodology which will cleanse the water before being discharged away from the site or into adjacent wetlands. The locations of any sedimentation basin will be determined by the Contractor based on the selected methods of construction. Placement of the basin shall be in an upland area that is within the existing right of way and temporary easements. At no time shall the Contractor discharge untreated water from the site or into the wetlands. The proposed plan shall include methods and equipment necessary to discharge water from the sedimentation treatment basins.

The Engineer has the right to order the Contractor to stop all excavation operations when in his judgment the Contractor’s water control operations are failing to produce adequate results or are posing a threat to the environment.

ITEMS 991.1 through 991.3 (Continued)

BASIS OF PAYMENT

Items 991.11, 991.12 and 991.13 will be paid the respective Contract Lump Sum prices for Control of Water, which prices shall include full compensation for the design of the water control schemes, all equipment, materials, tools and labor necessary for the installation, maintenance, operation, removal and disposal of the materials used for water control including placement and/or removal of temporary sheeting or other retaining structures all as outlined above, and all incidental costs required to complete the work.

The payment method for Item 991.1 is partial progressive payment of the LUMP SUM Contract Bid Price of this Item. The partial payment schedule will be as follows:

- The first payment of these Items (50% of the Lump Sum bid price) will be made upon complete installation of the water control system to the satisfaction and approval of the Engineer.
- The final payment of these Items (50% of the Lump Sum bid price) will be made upon the satisfactory removal of the water control system after bridge construction is complete. All adjustments and repositioning of water control shall be considered as included under this Item. No separate payment will be made for the removal and disposal of the sediment material collected from the dewatering systems, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 995.01 BRIDGE STRUCTURE, BRIDGE NO. P-03-020 (CAK) LUMP SUM

The work to be done under this Item shall conform to the relevant provisions of Subsection 995 of the Standard Specifications, and the following:

Work under this Item shall include all materials, equipment and labor needed to construct the following:

- Timber railing, decking, stringers, and pile bents;
- GRS-IBS abutments, wingwall, and elastomeric bearing pads;
- All items included hereinafter under Basis for Partial Payments.

It shall be the responsibility of the Contractor to provide all survey control necessary to assure accurate placement of all excavation and substructure work. This responsibility shall further include, but not be limited to; locating of utilities, drainage, copings and railing. The Contractor shall be responsible for making all measurements of angles, bearings, distances, and elevations from the original transverse line to the places of construction, as shown on the Plans and/or furnished by the Engineer within the limits of project. The Contractor shall make all data and reference points established in the course of the control surveys available to the Engineer for review and use by State survey parties.

The work does not include any items listed separately in the proposal. Payment for materials shown on the Plans as being part of this bridge structure or which may be incidental to its construction and are not specifically included for payment under another Item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component of which they are a part.

GRS-IBS ABUTMENTS

General

Work included in this section consists of furnishing all materials and construction of a geosynthetic reinforced soil-integrated bridge system (GRS-IBS) bridge to the lines and grades shown on the contract drawings and approved shop drawings. This will include Geosynthetics for GRS-IBS Abutments, Backfill for GRS-IBS Abutments, and CMU Facing for GRS-IBS Abutments.

Do not start any operation unless all materials and services needed for the work are delivered in such an order that there will be no interruption to the continuous and efficient progress in the completion of the project.

ITEM 995.01 (Continued)

Reference Documents

In the event of conflict between the documents referenced herein and the contents of this specification, the content of this specification shall be the superseding requirement. Various AASHTO and ASTM materials and testing designations are referenced in these specifications. The following FHWA reports are also relevant to the work:

- June 2018 Design and Construction Guidelines for Geosynthetic Reinforced Soil Abutments and Integrated Bridge Systems, Publication No. FHWA-HRT-17-080 (http://www.fhwa.dot.gov/publications/research/infrastructure/structures/11026/index.cfm.)

- Federal Highway Administration. (2012). Acceptance of Non-Structural Precast Elements, Report No. FHWA-HIF-12-045, Federal Highway Administration, Washington, DC.

In addition, Bidders are encouraged to watch an FHWA-produced video of the construction process. It can be seen at: https://www.youtube.com/watch?v=s9R-cznFgZA

Abbreviations

GRS	Geotextile Reinforced Soil
GRS-IBS	Geotextile Reinforced Soil – Integrated Bridge System
QC	Quality Control
RSF	Reinforced Soil Foundation
CMU	Concrete Masonry Unit

Submittals

A. Schedule of Operations

Before starting any work under this Contract, submit a schedule of operations. Coordinate work with the work to be done by public utilities or other agencies.

B. Contractor QC Plan

Before the start of the work, the Contractor shall submit a written QC plan for approval by the Engineer. The QC plan is not intended to be a generic document, but rather, it must be project specific. The plan should sufficiently document the QC processes of all Contractor parties (i.e., prime Contractor, subcontractors, and producers) performing work required under this specification.

1. QC Plan Submittal Requirements:

- The Contractor shall be prepared to discuss the QC plan at pre-construction meetings, including the proposed submittal date, QC organization, and sources of materials.

ITEM 995.01 (Continued)

- The Contractor shall submit one hard copy and one electronic copy of the QC plan for approval by the Engineer no less than 45 days prior to the start of any work activities related to GRS-IBS construction, including excavation. The Contractor shall not start work on the subject work items without an approved QC plan.

2. QC Plan Format and Contents:

- The QC plan shall be structured to follow the format and section headings outlined below. The pages of the QC plan shall be sequentially numbered. The plan shall address, in sufficient detail, the specific information requested under each section and subsection.

Cover Page
Table of Contents
Section 1. Scope and Applicable Specifications
Section 2. Quality Control Organization
- 2.1 QC Organizational Chart
- 2.2 QC Personnel and Applicable Qualifications
- 2.3 QC Self-Checks by Production Personnel

Section 3. Quality Control Laboratories
- 3.1 QC Laboratory Accreditation or MassDOT Qualification

Section 4. Materials Control Procedures
- 4.1 Material Types and Source of Supply
- 4.2 QC of Project Produced Materials Offsite
- 4.3 QC of Standard Manufactured Items
- 4.4 On-site Material Storage and Handling

Section 5. QC Visual Inspection
- 5.1 QC Procedures for Equipment
- 5.2 Definition of Lots and Sublots (for Inspection)
- 5.3 Attributes Inspected for Project Produced Items
- 5.4 Attributes Inspected for Standard Manufactured Items
- 5.5 QC Inspection Report Forms
- 5.6 Evaluation of QC Inspection Results

Section 6. QC Sampling and Testing
- 6.1 Definition of Lots and Sublots
- 6.2 Random and Selective Sampling Procedures
- 6.3 Sample Identification, Storage, and Retention
- 6.4 Quality Characteristics Tested for QC
- 6.5 QC Sampling and Testing Report Forms
- 6.6 Evaluation of QC Testing Data

3. QC Plan Approval and Modifications

- Approval of the QC plan will be based on the inclusion of the information required in the Contractor QC section of this specification. Revisions to the QC plan may be required for any part of the plan that is determined to be insufficient by the Engineer.

ITEM 995.01 (Continued)

- Approval of the QC plan does not imply any warranty by the Engineer that the QC plan will result in completed work that complies with the specifications. It remains the responsibility of the Contractor to demonstrate such compliance.

- The Contractor may modify the QC plan as work progresses when circumstances necessitate changes in QC personnel, laboratories, or procedures. In such case, the Contractor shall submit for approval by the Engineer an amended QC plan identifying changes at least 3 calendar days prior to the proposed changes being implemented.

C. Backfill for GRS-IBS Abutments

1. Materials Source: Submit name and address of imported materials source.
2. Direct shear test results of the GRS backfill material prior to placement of material.
3. Quality Control (QC) Test Results: Submit QC test results within 24 hours of receipt.

D. Geosynthetics for GRS-IBS Abutments

1. Storage Plan: Indicate method of storage as approved by manufacturer.
2. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material proposed for use as geotextile.
3. Mill Certificates or Affidavits: Provide mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical, and manufacturing requirements of this Specification. A mill certificate shall be submitted for each lot of geotextile delivered to the Project site.
4. Results of Interface Friction Tests between geotextile and proposed GRS backfill material and between geotextile and underlying native soil.

E. CMU Facing Blocks

1. Materials Source: Submit name and address of imported materials source.
2. Proof of strength, water absorption, freeze thaw durability, and all other requirements described under Materials Section being met prior to placement of material.

Materials

Materials shall meet the requirements specified below and relevant Subsections of Division III, Materials.

Concrete Masonry Unit (CMU) Facing for GRS-IBS Abutments

Facing elements consisting of split-face CMU block units shall meet ASTM C90-11b requirements, with a minimum required compressive strength of 4,000 psi and a maximum water absorption rate of 5 percent after 24 h. The CMU block units shall be tested for freeze-thaw durability in accordance with ASTM C1262-10. Specimens used for absorption testing shall not subsequently be used for freeze-thaw testing.

ITEM 995.01 (Continued)

CMU blocks shall be furnished within the following tolerances:

- The height of each individual block shall be within 1/16 inches of the specified dimension.
- The length and width of each individual block shall be within 1/8 inches of the specified dimension.
- Hollow CMU block units shall have a minimum face shell thickness of 1-1/4 inches and a minimum web thickness of ¾ inches.

The CMU block units shall be randomly sampled and tested in accordance with ASTM C140-12. Contractor QC testing shall be conducted at a qualified agency or AASHTO-accredited laboratory as described below. Acceptance testing of the CMU blocks by the Engineer will be performed on a lot basis.

Backfill for GRS-IBS Abutments

Furnish sound, crushed durable particles, fragments of stone gravel free from organic matter or other deleterious material for the Geosynthetic Reinforced Soil (GRS) at the abutments and wingwalls, reinforced soil foundations (RSFs), integrated approach, and leveling course conforming to the following:

A. Geosynthetic Reinforced Soil (GRS) Backfill at Abutments and Wingwalls:
GRS backfill material for the abutments and wingwalls shall be crushed stone that meets the requirements of M2.01.0 Crushed Stone, gradation requirements of M2.01.4 (¾-inch), and have a minimum angle of internal friction of 38 degrees as confirmed by a direct shear test.

B. Reinforced Soil Foundation (RSF) Backfill:
The backfill material for the RSF shall meet the requirements of M2.01.4.

C. Integrated Approach Backfill:
The backfill material for the integrated approach shall meet the requirements of M2.01.1, Crushed Stone.

D. Leveling Course Backfill:
The leveling course backfill material shall meet the requirements of M2.01.0 Crushed Stone, and gradation requirements of M2.01.6 (3/8-inch).

Geosynthetics for GRS-IBS Abutments

Furnish geosynthetics consisting of geotextile for the GRS abutment, RSF and integrated approach. The geosynthetics material shall be manufactured from polypropylene, high-density polyethylene, or polyester.

ITEM 995.01 (Continued)

A. GRS Abutment and Wingwalls:

Geotextile shall meet the requirements of AASHTO M-288 Class 1 for stabilization with the additional requirement that the geotextile have a minimum ultimate tensile strength of 4,800 lb/ft according to ASTM D 4595-11 and that Geotextile reinforcement strength at 2 percent strain shall be at least 1320 lb/ft in the cross-direction but does not need to meet the requirements for permittivity. Geotextile machine-direction shall be rolled out parallel to the wall where shown on the plans.

B. RSF:

Geotextile shall meet the requirements of GRS Abutment and Wingwalls.

C. Integrated Approach:

Geotextile shall meet the requirements of AASHTO M-288 Class 1 for stabilization with the additional requirement that the geotextile have a minimum ultimate tensile strength of 2,400 lb/ft according to ASTM D 4595-11 but does not need to meet the requirements for permittivity.

Miscellaneous Materials

A. CMU Block Wall Concrete Fill - 4000 PSI, ¾ IN., 585 HP Cement Concrete.

B. Epoxy Coated Reinforcing steel bar—Deformed #4 (0.5-inch diameter) bars as described in STEEL REINFORCEMENT FOR STRUCTURES of the Standard Specifications, Section 901 and Division III Materials Specifications Section M8.01.0.

Construction Methods

Labor and Equipment

Section 7.2 of the *Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide* may be consulted for information regarding typical labor, tools, equipment requirements proven to efficiently construct the GRS-IBS, and suggestions on how to improve productivity. However, it is the responsibility of the Contractor to choose the construction method, labor, and equipment that is most efficient for this project.

Excavation

A. All excavation shall comply with the Occupational Safety and Health Administration as well as State and local requirements.

B. Excavation shall include provisions for drainage with a sloped cut to facilitate the movement of water away from the work.

C. Any over-excavation that forms a pit shall be backfilled with suitable free draining material and compacted.

ITEM 995.01 (Continued)

RSF

A. The base of the RSF shall be cut smooth and excavated to uniform depth, and all loose, soft, wet, frozen, organic, and unsuitable material shall be removed from the base and sides of the excavation.

B. The base of the RSF shall be graded level for the entire area of the base to the limits shown in the plans. The intention is that bedrock will not be excavated, except that bedrock sloping toward the railroad tracks at an angle of more than 10 degrees from horizontal shall be cut to form nearly horizontal (i.e., less than 10 degrees from horizontal) benches.

C. Excavation shall be backfilled as soon as possible to avoid adverse weather delays. If this cannot be achieved, the excavation shall be graded to one end to facilitate the removal of any water. If excavation is flooded, all water shall be removed along with soft saturated soils.

D. The RSF shall be constructed with backfill material placed from the face to the back to push folds or wrinkles in the geotextile reinforcement to the free end of the reinforcement layer. Backfill shall be compacted in 6-inch-thick lifts.

E. The fill material shall be graded, leveled, and compacted before encapsulating the RSF.

F. The RSF shall be encapsulated in the geotextile reinforcement and placed perpendicular to the abutment face to protect it from possible erosion. The geotextile shall be sized to fully enclose the RSF on the face and the wing walls sides.

G. Overlap geotextile reinforcement a minimum of 3 feet on the top of the preceding layer.

H. The wrapped corners of the RSF need to be tight and without exposed soil within the RSF to complete the encapsulation.

Placement of Backfill and Compaction

A. For RSF and Integrated Approach Backfills, the backfill material shall be compacted to at least 95 percent maximum dry density according to AASHTO T-99-10.

B. For RSF and Integrated Approach Backfills, adjust the moisture content of the compacted backfill materials to within 2 percent of the optimum moisture content.

C. The GRS mass shall be constructed using compacted lifts of approximately 8 inches, equal to the facing block height.

ITEM 995.01 (Continued)

D. For GRS Backfill, compact each layer using a vibratory roller or other suitable compactor capable of compacting 8 inches of fill until there is no visible evidence of further compression. A minimum of four passes shall be applied per lift.

E. Hand-operated compaction equipment, such as lightweight mechanical tampers, plates, or rollers, is required within 3 feet of the front of the wall face so as not to damage or dislocate the facing blocks.

F. The top 5 feet of the abutment (i.e., just below the bridge seat) shall be compacted to 100 percent of the maximum dry density in accordance with AASHTO T-99-10.

G. Compaction equipment shall be selected to achieve the required fill material density.

Placement of Geotextile Reinforcement

A. Geotextile reinforcement shall be installed in accordance with the manufacturer's site-specific wall erection instruction.

B. The geotextile reinforcement shall be placed so that the strongest direction (i.e., cross machine direction) is perpendicular to the abutment or wingwall facing, as indicated on the drawings.

C. Reinforcement coverage shall be as shown on the drawings.

D. Adjacent sections of the geotextile reinforcement do not need to be overlapped except for the geotextile of the RSF, which shall overlap 3 feet.

E. Geotextile reinforcement shall be laid so that it is taut and free of wrinkles prior to backfilling.

F. Geotextile reinforcement shall be placed directly on the compacted horizontal fill surface.

G. The geotextile shall bear uniformly on the compacted reinforced soil from the connection to the wall to the free end of the geotextile layer.

H. The geotextile reinforcement shall extend between the layers of the CMU block.

I. The geotextile reinforcement shall cover a minimum of 85 percent of the top surface of the CMU block. Any excess reinforcement material showing through the face shall be removed in accordance with the manufacturer's directions.

J. A minimum backfill layer of 6 inches shall be placed on the geotextile prior to operating any vehicle or equipment over it.

ITEM 995.01 (Continued)

K. Bearing bed geotextile reinforcement shall be placed behind the CMU block at approximately 4-inch spacing with the main reinforcement layers for five layers of the GRS abutment directly under the bridge seat as shown on the drawings.

Wall Facing

A. Split-Block CMU units shall be used for the GRS wall facing.

B. The CMU block construction shall begin at the lowest portion of the excavation with each layer placed horizontally.

C. Each CMU block shall be placed tightly against the adjoining block without any gaps.

D. Each CMU layer shall be completely constructed and cleaned of any debris and fill material prior to placing the next layer of geosynthetic reinforcement and CMU.

E. A stretcher or running bond shall be maintained between courses of blocks to ensure that the joints between the blocks are offset with each row, with the vertical joints of each course midway between those of adjoining courses.

F. CMU blocks displaced out of required alignment during construction shall be carefully moved back into position by methods that will not cause damage to the CMU blocks or other work.

G. Any damaged CMU blocks shall be replaced to retain the new wall integrity.

H. Abutment wall and wing wall courses shall be staggered to form a tight interlocking stable corner where they are at right angles, as shown on the drawings.

I. Corner details for vertical joints shall be submitted to accommodate corners other than right angles. Suggested details are included in the drawings.

J. The top two courses of CMU blocks shall be filled with grout, pinned with No. 4 steel bar, and embedded within the reinforced concrete cap.

Leveling Course

A. The first course of the facing block shall be set level and to grade.

B. A thin leveling layer of 3/8 inch crushed stone, which shall not exceed 0.5 inches, may be used on the top of the RSF to facilitate construction of the first course of the facing block. If the leveling layer required exceeds 0.5 inches, then mortar or grout shall be placed in the gap between the RSF and the first CMU block course.

ITEM 995.01 (Continued)

Contractor QC

Description

The Contractor shall provide a QC program to ensure all materials and workmanship meet the required quality levels specified. The Contractor shall provide qualified QC personnel, laboratory facilities and perform QC sampling, testing, inspection, data analysis, corrective action (when necessary), and documentation as outlined below.

QC Personnel Requirements

All laboratory QCTs shall have qualifications acceptable to the Engineer.

A. The Contractor's QC program and QC plan shall be administered by a qualified QC manager. The manager shall have full authority to institute any actions necessary for the successful implementation of the QC plan. Principal responsibilities of the QC manager shall include preparation and submittal of the QC plan, managing the activities of all QC personnel, communicating on quality issues, and ensuring that all requirements in the approved QC plan are met. The QC manager shall have relevant QC experience and qualifications acceptable to the Engineer.

B. All QC sampling, testing, and inspecting conducted at the construction site shall be performed by qualified field QC technicians (QCTs). A minimum of one field QCT shall be present during construction of the GRS-IBS. Work will not be accepted by the Engineer unless the field QCT is present at the site during construction operations and performs the required QC inspection, testing, and documentation. All Field QCTs shall have qualifications acceptable to the Engineer.

C. Any QC testing that is performed at QC laboratories shall be performed by qualified laboratory QCTs. The Contractor shall ensure a sufficient number of laboratory QCTs to adequately implement the minimum QC requirements contained in this specification and as outlined in the approved QC plan. All laboratory QCTs shall have qualifications acceptable to the Engineer.

QC Laboratory Facility Requirements

A. All QC testing shall be performed in MassDOT-approved laboratories.

B. Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The QC manager shall have overall responsibility for ensuring that all laboratories utilized for QC are in compliance with the requirements of the LQP or AAP. This includes providing required AASHTO, ASTM, and MassDOT reference documents and ensuring that all required testing equipment and tools are properly functioning and calibrated.

ITEM 995.01 (Continued)

C. The Engineer shall be permitted unrestricted access to inspect and review the Contractor's QC laboratory facilities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, testing personnel, and procedures. Deficiencies shall be grounds for the Engineer to order an immediate stop to incorporating materials into the work until they are corrected.

QC of Standard Manufactured Items

A. All manufacturers of standard manufactured items shall have a QC system in place that meets the requirements established in AASHTO R38-10. Each manufacturer shall maintain a Quality System Manual (QSM) that addresses the format and content of AASHTO R38-10. The manufacturer shall perform QC inspection and testing in accordance with their QSM.

B. All standard manufactured items delivered to the project site shall be accompanied by a manufacturer's certificate of compliance (COC), which includes the QC inspection and testing results for the corresponding manufacturer's lot.

C. The Contractor shall be responsible for reviewing the manufacturer's COC and accompanying QC results for all standard manufactured items delivered to the project, including, but not limited to, the following:

- CMU blocks
- Geosynthetic reinforcement

D. The Contractor shall provide copies of each manufacturer's COC to the Engineer. The Contractor's QC personnel will assist the Engineer in obtaining acceptance samples for any standard manufactured items, as required by the Engineer.

E. The Contractor will perform QC inspection of all standard manufactured items upon delivery to the project site and during storage. Contractor QC personnel will also provide inspection of all standard manufactured items throughout field installation of the GRS-IBS system.

QC Inspection

The Contractor shall perform QC inspection of all work items addressed under this specification. Inspection activities during production and placement may be performed by qualified production personnel (e.g., skilled laborers, foremen, and superintendents). However, the Contractor's QC personnel shall have overall responsibility for QC inspection.

QC inspection activities must address the following primary components: equipment, environmental conditions, materials, and workmanship. The minimum frequency of QC inspection activity shall be in accordance with the requirements below and as outlined in the approved QC plan.

ITEM 995.01 (Continued)

A. QC Inspection of CMU Facing Element, Backfill, and Geosynthetics

The Contractor's personnel will perform QC inspection during installation of the CMU facing element, backfill material, and geosynthetics in accordance with the requirements of this specification. The minimum attributes to be inspected are outlined in Table 1 and Table 2. The Contractor shall identify in the QC plan the specific inspection activities necessary to ensure the quality of the work, including any additional QC inspection attributes not specifically listed in Table 1 and Table 2.

Table 1. Minimum QC Inspection of CMU Facing Element

Inspection Component	Attributes Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC plan	Per QC plan	Per QC pan	Per QC plan
Environmental conditions	Underlying surface soundness and moisture	Per QC plan	Underlying surface	Visual check
	Temperature of air and underlying surface	One per day	At placement location	Check measurement
Materials	CMU blocks (correct type)	Per QC plan	Stockpile on site	Visual check and manufacturer COC
	CMU block dimensions	Per QC plan	Stockpile on site	Check measurement
	Reinforcing steel bar (correct type)	Per QC plan	Stockpile on site	Visual check and manufacturer COC
	Concrete wall fill (correct type)	Per QC plan	At placement location	Check concrete batch ticket
Workmanship	CMU block course (free of debris)	One per CMU course	Each CMU course	Visual check
	CMU block fit (free of gaps)	One per CMU course	Each CMU course	Check measurement or visual check
	CMU block horizontal alignment	One per CMU course	Each CMU course	Check measurement or visual check
	CMU block vertical alignment	One per two CMU courses	Each two CMU courses	Check measurement
	Reinforcing steel bar alignment/cover	One per top of wall or wall parapet	At placement location	Check measurement or visual check
	Concrete wall fill finishing/curing	One per top of wall or wall parapet	At placement location	Visual check
	Concrete coping wall fill finishing/curing	One per top of wall or wall parapet	At placement location	Visual check

ITEM 995.01 (Continued)

Table 2. Minimum QC Inspection of Backfill Material and Geosynthetic Reinforcement

Inspection Component	Attributes Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC plan	Per QC plan	Per QC plan	Per QC plan
Environmental Conditions	Underlying surface soundness and moisture	Per QC plan	Underlying surface	Visual check
	Temperature of air and underlying surface	One per day	At placement location	Check measurement
Materials	Abutment backfill (correct type and free of organics)	One per backfill layer	At placement location	Visual check
	RSF backfill (correct type and free of organics)	One per backfill layer	At placement location	Visual check
	Integrated approach backfill (correct type and free of organics)	One per backfill layer	At placement location	Visual check
	Geosynthetics (correct type and free of tears)	One per backfill layer	At placement location	Visual check and manufacturer COC
Workmanship	Abutment backfill (lift thickness)	One per backfill layer	Post-compaction of each lift	Check measurement
	RSF backfill (lift thickness)	One per backfill layer	Post-compaction of each lift	Check measurement
	Integrated approach backfill (lift thickness)	One per backfill layer	Post-compaction of each lift	Check measurement
	Level of backfill behind CMU facing block	One per backfill layer	Post-compaction of each lift	Visual check
	Geosynthetics (embedment area coverage = 100 percent)	One per backfill layer	Each geosynthetic layer	Visual check
	Geosynthetics (coverage of top surface of CMU blocks > 85 percent)	One per backfill layer	Each geosynthetic layer	Visual check
	Geosynthetics (no excessive construction damage)	One per backfill layer	Each geosynthetic layer	Visual check
	Geosynthetics (splice seams staggered)	Per reinforcement schedule	Each geosynthetic layer	Visual check

ITEM 995.01 (Continued)

QC Sampling and Testing

The Contractor's QC personnel will perform QC sampling at the site of GRS field placement. QC testing will be performed at the field placement site or at the Contractor's QC laboratory depending on the quality characteristic being tested. The Contractor shall furnish approved containers for all material samples. The engineer shall be provided the opportunity to monitor and witness all QC sampling and testing.

A. GRS Lot and Sublot Sizes

Each lot of GRS backfill material will represent material from the same source, be produced or obtained under the same controlled process, and will possess normally distributed specification properties. Each lot will be divided into sublots of equal size to assess the quality characteristics of the lot. The lot size and corresponding sublot size for each GRS backfill material item is listed in Table 3.

Table 3. GRS Backfill Material Lot and Sublot Sizes

Backfill Item	Material Type(s)	Lot Size	Sublot Size
Abutment backfill	GRS Backfill	Total quantity (cubic yard) of backfill material type/ same source/abutment	See Table 4
RSF backfill	RSF Backfill	Total quantity (cubic yard) of backfill material type/ same source/RSF	See Table 4
Integrated approach backfill	Integrated Approach Backfill	Total quantity (cubic yard) of backfill material type/ same source/integrated approach	See Table 4

B. Random QC Sampling

The Contractor's QC system shall utilize stratified random sampling of each lot produced and placed. The Contractor's qualified QC personnel shall obtain random QC samples at the minimum frequencies specified in Table 4. In all cases, the QC sampling frequencies shall result in a minimum of one random sample per sublot.

Random sample locations shall be determined using the random number tables and procedures contained in ASTM D 3665-07 or an electronic random number generator. The determination of all random sample locations shall be documented on standard test report forms (TRFs). The Contractor will provide the engineer with the random QC sampling locations for each sublot prior to production and placement of the relevant sublots.

ITEM 995.01 (Continued)

C. Selective Sampling

The Contractor's QC system will also utilize selective sampling (i.e., non-random samples) as needed to provide supplemental information to assist in maintaining all production and placement processes in control. The Contractor's qualified QC personnel shall obtain selective QC samples from any sublot as determined necessary and in accordance with the guidelines established in the approved QC plan.

D. QC Sample Identification System

The Contractor shall establish a reliable system for the identification of all QC samples obtained. All samples shall be correctly labeled with the following minimum information:

- Contract number
- Date of sample
- Material type
- Lot and sublot number
- Sample number
- Sample type (i.e., random or selective)
- Sample location (e.g., station and offset)

E. Retention of Split Samples

The Contractor will retain split samples from each QC material sample and provide a split sample to the engineer if requested. All split samples shall be properly labeled and stored for a period of 30 days or until tested. These split samples will be utilized, if necessary, in the dispute resolution process. The retained split samples may be discarded prior to the required 30 days if mutually agreed on by the Contractor and the Engineer.

F. QC Testing of GRS Lots

The Contractor's QC personnel will perform QC testing during production and field placement of the backfill material to ensure that the production and placement processes are providing work conforming to the contract requirements. All QC testing shall be in accordance with procedures specified in Table 4. The Engineer shall be provided the opportunity to monitor and witness all QC testing.

ITEM 995.01 (Continued)

Table 4. Minimum QC Sampling and Testing Backfill Material

Quality Characteristic	Test Method	Sublot Size	Minimum Test Frequency	Point of Sampling	Sampling Method
Gradation	AASHTO T 11-05(6) and AASHTO T 27-05[19]	—	One per lot	Source of material (before use)	Random; AASHTO T 2-91[20] and AASHTO T 248-11[21]
PI	AASHTO T 89-10(7) and AASHTO T 90-00[8]	—	One per lot	Source of material (before use)	Random; AASHTO T 2-91[20] and AASHTO T 248-11[21]
Maximum dry density and optimum moisture content	AASHTO T 99-10[16] (method C) and AASHTO T 180-10[22] (method D)	—	One per lot	Source of material (before use)	Random; AASHTO T 2-91[20] and AASHTO T 248-11[21]
In-place density and moisture content (per targets)*	AASHTO T 310-11[23] (method B) and other approved procedures	Minimum two per lift per day	One per sublot	In-place compacted backfill (before placing subsequent layer)	Random; AASHTO T 310-11[23]

— Indicate that the there is no sublot size.

*If density requirements cannot be achieved due to material incapable of being compacted or tested to maximum values as determined by AASHTO T 99-10, compact each layer a minimum of four passes using vibratory compactor until there is no visible evidence of further consolidation.

QC Documentation and Data Evaluation

A. QC Inspection Documentation & Evaluation

The Contractor shall document all QC inspection activity for each GRS lot produced and placed. All inspection results shall be recorded within 24 hours of inspection on current standard inspection report forms (IRFs). The QC manager shall evaluate inspection results in a timely manner to confirm that production and placement processes are in control. The Contractor shall submit hard copies of all IRFs to the engineer at the completion of each lot.

ITEM 995.01 (Continued)

B. QC Sampling and Testing Documentation and Data Analysis

The Contractor shall document all QC sampling and testing data for each GRS lot produced and placed. All sampling and testing data shall be recorded within 24 hours of sampling and testing on current standard TRFs. The QC manager shall evaluate sampling and testing results in a timely manner to confirm that production and placement processes are in control. The Contractor shall submit hard copies of all TRFs to the engineer at the completion of each lot.

QC Records System

A. QC Daily Diary

The QC manager should maintain a QC daily diary to document all major activities or actions related to the Contractor's QC system. The QC daily diary serves as a summary record of key actions taken by QC personnel each day. Recommended information that should be recorded in the QC daily diary includes the following:

- The day's weather or environmental conditions.
- A summary of production or placement activities completed.
- Any non-conforming material or workmanship identified.
- Any corrective actions recommended or taken by QC personnel.
- Discussions held with other Contractor personnel or MassDOT personnel.
- Visitors to the production facility or field placement operation.

B. QC Record Books

The Contractor shall maintain one or more ringed binders referred to as "QC record books" to store all required QC documents. Separate QC record books shall be kept at each backfill material production facility and at the project field site. QC data for each pay item number shall be organized into separate sections by quality characteristic and by lot number. QC documents to be stored in the QC record book(s) include the following:

- A signed copy of the current approved QC plan.
- The original signed copies of all completed IRFs.
- The original signed copies of all completed random sampling location forms.
- The original signed copies of all completed TRFs.
- A current copy or printout of all control charts.
- A current copy or printout of all running QLA performed.
- Current summaries of all individual QC test results to date (by lot and sublot).
- Summary sheets of material quantities produced or placed (by lot and sublot).

Each required record shall be inserted into the corresponding QC record book within 24 hours after the document has been completed. All QC record books shall be maintained in a suitable location. The Engineer shall be provided access to all QC record books as part of the Engineer's monitoring of Contractor QC activity.

ITEM 995.01 (Continued)

C. QC Records Retention

All Contractor QC records identified above shall be retained for a minimum of 3 years. The records shall be protected from damage or alteration. When requested by any State or Federal agency for audit or similar purposes, the Contractor shall provide complete access to all QC records.

ACCEPTANCE

MassDOT is responsible for performing all acceptance activities and making the final acceptance determination for each GRS-IBS lot produced and placed. MassDOT's acceptance system will include monitoring the contractor's QC activity, performing acceptance inspection, sampling, and testing, and determining the quality and corresponding payment for each lot. These activities will be performed for each GRS-IBS lot.

Materials and construction for GRS-IBS shall be pre-approved materials, construction methods and services shall follow the latest MassDOT Standard Specifications requirements.

TREATED TIMBER

The work under this heading shall conform to the relevant provisions of Section 955 of the Standard Specification and shall include the supply, fabrication, and installation of treated timber framing, posts and hand railing as shown on the Plans. All materials under this items shall adhere to the requirements provided in the Plans.
The treated timber bent end faces shall have a sealant applied to them which is incidental to the treated timber item. The sealant shall be a non-toxic, water-based material that only uses natural plant-based polymers and wax for protection.

Please refer to Contract Plans for all requirements and notes on the required steel hardware components needed for the boardwalk assembly.

BLACK LOCUST DECKING

The work under this heading shall conform to the relevant provisions of Section 955 of the Standard Specification and shall include the supply, fabrication, and installation of the Black Locust decking boards and top rail as shown on the Plans.

The Black Locust decking material shall meet the following requirements:

- Janka Hardness: 48 pcf at 11% moisture content
- Modulus of Rupture: 19,400 lbf/in
- Elastic Modulus: 2,050,000 lbf/in2
- Crushing Strength: 10,200 lbf/in2
- Volumetric Shrinkage: 10.2%
- Forest Stewardship Council (FSC) Certified product

The Contractor shall submit shop drawings for the Black Locust decking to the Engineer for approval.

ITEM 995.01 (Continued)

Black Locust decking shall be quantified as the square footage as shown on the Plans, and will be paid for as part of this Lump Sum item.

SCHEDULE OF BASIS FOR PARTIAL PAYMENTS

At the time of bid, the Contractor shall submit on his/her proposal form a schedule of unit prices for the major component Sub-Items that make up Item 995.01 as well as his/her total wall structure Lump Sum cost for the Bridge Structure, Bridge No. P-03-020 (CAK). The wall structure Lump Sum breakdown quantities provided in the proposal form are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the Lump Sum contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual wall components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 995.01 and no further compensation will be allowed.

The schedule on the proposal form applies only to Bridge Structure, Bridge No. P-03-020 (CAK). Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

Sub-Item	Description	Quantity	Unit	Unit Price	Total
151.6	Backfill for GRS-IBS Abutments	40	CY		
698.5	Geosynthetic for GRS-IBS Abutments	200	SY		
906..	5000 psi, 1.5 Inch, 660 Cement Concrete	2	CY		
933.	Elastomeric Bearing Pad	48	EA		
955.	Treated Timber	16	MBF		
955.1	Black Locust Decking	9.5	MBF		
960.1	Structural Steel – Coated Steel	2,900	LB		
987.99	Concrete Masonry Unit Facing for GRS-IBS Abutments	360	SF		
				Total Cost of Item 995.01=	

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00802

DETAIL SHEETS

THIS PAGE INTENTIONALLY LEFT BLANK

TOWN/CITY:	Peabody, MA	YEAR: 2025	
STA.:	289+45 to 359+43	ROAD: Independence Greenway Ext	
DATE:	6/6/2025	CLASS: Local Roadway/ Urban Collector	

Earth Excavation:	7600 CY	Class "A" Rock Excavation:	370 CY
Class "A" Trench Excavation:	250 CY	Class "B" Rock Excavation:	60 CY
Class "B" Trench Excavation:	10 CY	Ordinary Borrow:	550 CY
Gravel Borrow:	3570 CY	Gravel borrow for backfilling	
Bridge Excavation:	40 CY	structures and pipes:	40 CY

PAVEMENT NOTES

FULL DEPTH PAVEMENT (SHARED USE PATH): AREA = 7,172 SY
- 1 1/2" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
- 2 1/2" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER
- 8" GRAVEL BORROW (TYPE B)

FULL DEPTH RECONSTRUCTION (ESSEX CENTER DRIVE): AREA = 1,335 SY
- 1 1/2" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
- 1 3/4" SUPERPAVE INTERMEDIATE COURSE – 12.5 (SIC-12.5) OVER
- 4" SUPERPAVE BASE COURSE – 37.5 (SBC – 37.5) OVER
- 4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER
- 8" GRAVEL BORROW (TYPE B)

FULL DEPTH RECONSTRUCTION LESS THAN 4 FEET WIDE: AREA = 444 SY
- 1 1/2" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
- 1 3/4" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER
- 6" HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE OVER
- 8" GRAVEL BORROW (TYPE B)

MICRO MILLING AND OVERLAY: AREA = 2,221 SY
- 1 1/2" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
- 1 1/2" PAVEMENT MICRO MILLING

CEMENT CONCRETE WALK/ PEDESTRIAN CURB RAMP: AREA = 147 SY
- 4" CEMENT CONCRETE (AIR ENTRAINED – 4000 PSI, 3/4", 610)
- 8" GRAVEL BORROW (TYPE B)

HMA WALK: AREA = 147 SY
- 1 1/4" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
- 1 3/4" SUPERPAVE SURFACE COURSE – 12.5 (SSC-12.5) OVER
- 8" GRAVEL BORROW (TYPE B)

HMA DRIVEWAY: AREA = 27 SY

1 1/2" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
2 1/2" SUPERPAVE SURFACE COURSE – 12.5 (SIC-12.5) OVER
8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE REINFORCED PAVEMENT: AREA = 110 SY

6” CEMENT CONCRETE (AIR ENTRAINED – 400 PSI, ¾”, 610) WITH
WWF 6x6 – W1.4xW1.4 AT MID DEPTH
18" GRAVEL BORROW (TYPE B)

NOTES:

1. ALL HMA FOR PATCHING, ASPHALT EMULSION FOR TACK COAT AND HMA JOINT ADHESIVE SHALL BE INSTALLED PER SECTION 450 AND 700.

2. HMA SIDEWALKS, DRIVEWAYS, AND SHARED USE PATH ARE TO BE PAID FOR UNDER ITEM 702.

ITEM 101. CLEARING AND GRUBBING

STA 305+00 to STA 306+12 RT
STA 311+07 to STA 311+84 RT
STA 312+60 to STA 313+26 RT
STA 314+13 to STA 318+31 RT
STA 318+46 to STA 318+96 LT/RT
STA 318+87 to STA 319+05 RT
STA 319+24 to STA 321+31 RT
STA 322+79 to STA 323+77 LT
STA 324+20 to STA 324+80 LT
STA 325+34 to STA 325+60 LT
STA 325+70 to STA 329+36 RT
STA 327+28 to STA 327+83 LT
STA 328+37 to STA 329+03 LT
STA 331+21 to STA 331+92 LT
STA 333+26 to STA 333+96 RT
STA 333+77 to STA 334+17 LT
STA 334+74 to STA 335+44 RT
STA 335+75 to STA 337+93 LT/RT
STA 338+20 to STA 338+89 RT
STA 339+09 to STA 351+97 LT/RT
STA 356+14 to STA 358+70 RT

ITEM 141. CLASS A TRENCH EXCAVATION

STA 311+40 STA 340+09 STA 342+24
STA 358+51

ITEM 144. CLASS B ROCK EXCAVATION

STA 305+12 STA 311+40

ITEM 146. DRAINAGE STRUCTURE REMOVED

STA 301+67 RT STA 303+18 RT STA 359+04 LT

And as required by the Engineer.

ITEM 151. GRAVEL BORROW

STA 289+23 to STA 290+00 LT/RT
STA 289+45 to STA 302+59 RT
STA 289+83 to STA 359+43 LT/RT
STA 290+00 to STA 290+32
STA 290+32 to STA 292+50 RT
STA 292+65 to STA 302+02 LT/RT
STA 301+70 to STA 304+57 RT
STA 301+74 to STA 302+29 RT
STA 302+02 to STA 318+32 RT
STA 302+18 to STA 302+22 LT
STA 302+18 to STA 304+10 LT/RT
STA 302+38 to STA 302+57 LT
STA 303+76 to STA 318+32 LT/RT
STA 304+11 to STA 304+25 RT

ITEM 151.01 GRAVEL BORROW – TYPE C

STA 291+92 to STA 292+64 LT

ITEM 152.71 PEASTONE DIAPHRAGM

STA 306+57 to STA 314+93 RT

ITEM 170. FINE GRADING AND COMPACTING – SUBGRADE AREA

STA 289+23 to STA 290+00 LT/RT
STA 289+45 to STA 302+59 RT
STA 289+83 to STA 359+43 LT/RT
STA 290+32 to STA 292+50 RT
STA 292+65 to STA 302+02 LT/RT
STA 301+70 to STA 304+57 RT
STA 301+74 to STA 302+29 RT
STA 302+02 to STA 318+32 RT
STA 302+18 to STA 302+22 LT
STA 302+18 to STA 304+10 LT/RT
STA 302+38 to STA 302+57 LT
STA 303+76 to STA 318+32 LT/RT
STA 304+11 to STA 304+25 RT
STA 304+13 to STA 304+16 LT
STA 317+28 to STA 317+45 LT
STA 317+29 to STA 317+46 RT
STA 317+29 to STA 318+55 RT
STA 318+20 to STA 318+41 LT
STA 318+27 to STA 318+32 LT
STA 318+44 to STA 318+48 LT/RT
STA 318+75 to STA 351+09 LT
STA 319+02 to STA 351+09 RT
STA 355+49 to STA 358+95 LT
STA 355+49 to STA 358+95 RT
STA 358+95 to STA 359+03 LT/RT
STA 359+34 to STA 359+43 LT/RT

ITEM 184.1 DISPOSAL OF TREATED WOOD PRODUCTS

STA 318+21 RT to STA 346+58 RT

ITEM 201. CATCH BASIN

STA 359+04 RT STA 301+60 RT STA 303+18 RT
STA 311+49

And as required by the Engineer.

ITEM 201.7 CATCH BASIN – DOUBLE GRATE

STA 311+39 RT

And as required by the Engineer.

ITEM 202. MANHOLE

STA 301+70 RT STA 359+04 LT STA 311+38 RT

And as required by the Engineer.

ITEM 203. SPECIAL MANHOLE

STA 302+21 RT

ITEM 220. DRAINAGE STRUCTURE ADJUSTED

STA 294+37 RT
STA 297+04 RT
STA 297+12 LT (2)
STA 297+33 RT
STA 298+70 RT
STA 298+74 LT
STA 301+67 RT
STA 309+77 RT
STA 311+37 RT
STA 317+90 RT

ITEM 220.3 DRAINAGE STRUCTURE CHANGE IN TYPE

STA 311+38 RT

ITEM 220.7 SANITARY STRUCTURE ADJUSTED

STA 293+56 RT
STA 347+81 LT
STA 293+56 LT
STA 348+35 LT
STA 294+68 LT

ITEM 220.8 SANITARY STRUCTURE REMODELED

STA 291+07 RT
STA 356+35 RT
STA 327+20 RT
STA 344+86 RT

ITEM 222. FRAME AND GRATE – MASSDOT BAR TYPE

STA 311+36 RT (2)

ITEM 222.1 FRAME AND GRATE- MASSDOT CASCADE TYPE

STA 301+60 LT
STA 303+18 RT
STA 359+04 LT

ITEM 223.1 FRAME AND GRATE (OR COVER) REMOVED AND STACKED

STA 301+67 RT
STA 311+38 RT
STA 303+18 RT
STA 359+04 LT

ITEM 234.12 12 INCH DRAINAGE PIPE - OPTION

STA 301+63 RT to STA 301+66 RT
STA 301+69 RT to STA 301+72 RT
STA 302+20 RT to STA 303+18 RT
STA 311+39 RT to STA 311+39 RT
STA 359+26 RT to STA 359+26 LT

ITEM 234.15 15 INCH DRAINAGE PIPE - OPTION

STA 301+76 RT to STA 301+78 RT

ITEM 234.18 18 INCH DRAINAGE PIPE - OPTION

STA 305+10 RT to STA 305+10 RT

ITEM 234.36 36 INCH DRAINAGE PIPE – OPTION

STA 302+17 RT to STA 302+19 RT
STA 302+20 RT to STA 302+22 RT

ITEM 238.10 10 INCH DUCTILE IRON PIPE

STA 359+04 RT to STA 359+05 LT

ITEM 238.12 12 INCH DUCTILE IRON PIPE

STA 311+42 RT to STA 311+46 RT

ITEM 238.16 16 INCH DUCTILE IRON PIPE

STA 358+52 RT to STA 358+47 LT

ITEM 238.24 24 INCH DUCTILE IRON PIPE

STA 342+24 RT to STA 342+26 LT

ITEM 238.36 36 INCH DUCTILE IRON PIPE

STA 340+08 RT to STA 340+12 LT

ITEM 258. STONE FOR PIPE ENDS

STA 340+08 RT to STA 340+21 LT
STA 342+14 RT to STA 342+29 LT
STA 358+45 RT to STA 358+57 LT
STA 289+53 LT to STA 289+64 LT

ITEM 280. HOT MIX ASPHALT WATERWAY

STA 289+62 LT to STA 289+98 LT

ITEM 285. INFILTRATION TRENCH

STA 310+39 LT to STA 314+39 RT

ITEM 358. GATE BOX ADJUSTED

STA 311+67 RT
STA 311+82 RT
STA 294+55 LT
STA 294+10 LT
STA 294+07 LT
STA 293+59 LT
STA 293+49 LT

ITEM 402. DENSE GRADED CRUSHED STONE FOR SUB-BASE

STA 292+65 to STA 302+02 LT/RT
STA 329+53
STA 330+09
STA 346+25

ITEM 415.3 PAVEMENT MICRO MILLING

STA 292+65 to STA 301+74 LT/RT
STA 289+99 to STA 290+32 LT/RT
STA 347+83 to STA 350+00 LT

ITEM 431.1 HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE

STA 302+02 to STA 318+32 RT STA 317+28 to STA 317+45 LT STA 318+20 to STA 318+41 LT

ITEM 440. CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL

STA 292+65 to STA 302+02 LT/RT

ITEM 443. WATER FOR ROADWAY DUST CONTROL

STA 292+65 to STA 302+02 LT/RT

ITEM 450.22 SUPERPAVE SURFACE COURSE – 9.5 (SSC – 9.5)

STA 292+65 to STA 301+74 LT/RT
STA 292+65 to STA 302+02 LT/RT
STA 347+83 to STA 350+00 LT
STA 289+99 to STA 290+32 LT/RT
STA 302+38 to STA 302+57 LT
STA 302+02 to STA 318+32 RT
STA 317+28 to STA 317+45 LT
STA 318+20 to STA 318+41 LT
STA 290+32 to STA 292+50 RT

ITEM 450.31 SUPERPAVE INTERMEDIATE COURSE – 12.5 (SIC – 12.5)

STA 292+65 to STA 302+02 LT/RT
STA 302+02 to STA 318+32 RT
STA 302+38 to STA 302+57 LT
STA 317+28 to STA 317+45 LT
STA 318+20 to STA 318+41 LT
STA 290+32 to STA 292+50 RT

ITEM 450.42 SUPERPAVE BASE COURSE – 37.5 (SBC – 37.5)

STA 292+65 to STA 302+02 LT/RT

ITEM 452. ASPHALT EMULSION FOR TACK COAT

STA 292+65 to STA 301+74 LT/RT
STA 347+83 to STA 350+00 LT
STA 289+99 to STA 290+32 LT/RT
STA 289+83 to STA 359+43 LT/RT
STA 289+23 to STA 290+00 LT/RT
STA 302+38 to STA 302+57 LT
STA 292+65 to STA 302+02 LT/RT
STA 302+02 to STA 318+32 RT
STA 317+28 to STA 317+45 LT
STA 318+20 to STA 318+41 LT
STA 290+32 to STA 292+50 RT

ITEM 470. HOT MIX ASPHALT BERM

STA 290+26 LT

ITEM 506. GRANITE CURB TYPE VB - STRAIGHT

STA 304+53 to STA 318+20 RT
STA 290+20 to STA 301+76 RT
STA 302+49 to STA 303+88 RT
STA 302+63 to STA 302+69 LT
STA 318+44 to STA 318+44 RT
STA 302+63 to STA 302+69 LT

ITEM 506.1 GRANITE CURB TYPE VB - CURVED

STA 302+28 to STA 302+49 RT
STA 303+88 to STA 304+08 RT
STA 304+33 to STA 304+53 RT
STA 292+63 to STA 292+78 LT

ITEM 506.2 GRANITE TRANSITION TYPE VB – SPLAYED END

STA 290+32 to STA 290+38 RT
STA 302+57 to STA 302+63 LT

ITEM 509. GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS – STRAIGHT

STA 292+63 LT
STA 292+65 RT
STA 317+45 RT
STA 318+24 LT
STA 318+24 RT
STA 318+32 RT
STA 318+32 LT
STA 302+21 LT
STA 359+05 RT
STA 359+31 LT
STA 359+05 LT
STA 302+24 LT

ITEM 509.1 GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS – CURVED

STA 301+76 to STA 302+04 RT
STA 302+16 to STA 302+28 RT
STA 304+08 to STA 304+15 RT
STA 302+21 to STA 302+21 LT
STA 304+25 to STA 304+33 RT
STA 302+22 to STA 302+22 LT

ITEM 510. GRANITE EDGING TYPE SA

STA 290+00 to STA 290+20 RT
STA 302+52 to STA 302+57 LT

ITEM 516. GRANITE CURB CORNER TYPE A

STA 302+22 LT
STA 302+23 LT

ITEM 570.3 HOT MIX ASPHALT CURB TYPE 3

STA 290+23 to STA 290+32 LT
STA 318+13 to STA 318+20 LT

ITEM 594. CURB REMOVED AND DISCARDED

STA 301+70 to STA 304+75 RT
STA 292+63 to STA 292+78 LT
STA 358+92 LT/RT
STA 358+94 LT/RT
STA 359+05 LT/RT
STA 359+31 LT/RT

ITEM 620.12 GUARDRAIL, TL-2 (SINGLE FACED)

STA 348+07 LT to STA 348+32 LT
STA 349+11 LT to STA 349+61 LT

ITEM 627.1 TRAILING ANCORAGE

STA 348+32 LT to STA 348+41 LT
STA 349+61 LT to STA 349+70 LT

ITEM 627.82 GUARDRAIL TANGENT END TREATMENT, TL-2

STA 347+72 LT to STA 348+07 LT
STA 348+70 LT to STA 349+11 LT

ITEM 630.2 HIGHWAY GUARD REMOVED AND DISCARDED

STA 318+15 to STA 318+46

ITEM 644.172 72 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) VINYL COATED (LINE POST OPTION)

STA 303+68 RT to STA 318+32 RT
STA 298+72 RT to STA 302+20 RT

ITEM 655. CEDAR RAIL FENCE

STA 329+48 RT to STA 329+73 RT
STA 329+48 LT to STA 329+73 LT
STA 329+94 RT to STA 330+17 RT
STA 329+94 LT to STA 331+50 LT
STA 344+50 LT to STA 346+09 LT
STA 344+50 RT to STA 346+09 RT
STA 346+30 RT to STA 346+54 RT
STA 346+30 LT to STA 346+54 LT
STA 350+01 LT to STA 351+10 LT
STA 350+01 RT to STA 351+10 RT
STA 355+49 RT to STA 356+51 RT
STA 355+49 LT to STA 356+51 LT

ITEM 665.2 CHAIN LINK FENCE REMOVED AND DISCARDED

STA 303+68 RT to STA 318+32 RT
STA 290+12 RT to STA 302+20 RT

ITEM 673. ACCESS ROAD GATE

STA 348+55 LT

ITEM 697.1 SILT SACK

STA 292+82 LT
STA 293+11 LT
STA 293+47 LT
STA 297+13 LT
STA 298+73 RT
STA 298+76 LT
STA 301+69 LT
STA 301+92 LT
STA 302+20 LT
STA 302+35 LT
STA 303+18 LT
STA 302+22 RT
STA 309+50 LT
STA 309+77 RT
STA 316+89 LT
STA 317+25 LT
STA 359+06 LT
STA 359+32 LT

ITEM 697.2 FLOATING SILT FENCE

STA 329+62 to STA 330+86 LT
STA 339+98 to STA 340+12 RT
STA 340+10 to STA 340+24 LT
STA 342+00 to STA 342+31 LT
STA 342+15 to STA 342+32 RT
STA 346+26 to STA 346+39 RT
STA 351+40 to STA 351+77 RT

ITEM 701.2 CEMENT CONCRETE PEDESTRIAN CURB RAMP

STA 301+74 RT to STA 302+29 RT
STA 302+18 LT to STA 302+22 LT
STA 304+11 RT to STA 304+25 RT
STA 304+13 LT to STA 304+16 LT
STA 317+29 RT to STA 317+46 RT
STA 318+27 LT to STA 318+32 LT
STA 318+44 LT/RT to STA 318+48 LT/RT
STA 358+95 LT/RT to STA 359+03 LT/RT
STA 359+34 LT/RT to STA 359+43 LT/RT

ITEM 702. HOT MIX ASPHALT SIDEWALK OR DRIVEWAY

STA 289+23 to STA 290+00 LT/RT
STA 289+83 LT/RT to STA 359+43 LT/RT
STA 290+00 to STA 290+32 LT
STA 301+70 to STA 304+57 RT
STA 317+29 RT to STA 318+55 RT

ITEM 704.2 STONE DUST FOR SHOULDERS

STA 289+45 RT to STA 302+59 RT
STA 302+18 LT/RT to STA 304+10 LT/RT
STA 303+76 LT/RT to STA 318+32 LT/RT
STA 318+75 LT to STA 351+09 LT
STA 319+02 RT to STA 351+09 RT
STA 355+49 LT to STA 358+95 LT
STA 355+49 RT to STA 358+95 RT

ITEM 706.9 TEXTURED DECORATIVE PAVEMENT

STA 319+26 LT/RT to STA 319+65 LT/RT
STA 357+84 LT/RT to STA 358+23 LT/RT

ITEM 707.17 BENCH

STA 319+00 RT (2)
STA 358+79 RT

ITEM 707.2 TRASH RECEPTICAL

STA 318+60 RT

ITEM 707.8 STEEL BOLLARD

STA 302+34 to STA 304+09
STA 351+01
STA 355+58

ITEM 707.9 BICYCLE RACK

STA 318+64 RT (2)

ITEM 765. SEEDING

STA 289+83 RT to STA 302+55 RT
STA 303+68 LT to STA 318+32 LT
STA 317+26 LT to STA 351+09 LT
STA 292+46 to STA 292+72 LT
STA 318+44 RT to STA 351+09 RT
STA 355+51 LT to STA 358+95 LT
STA 355+51 RT to STA 358+95 RT

ITEM 767.121 SEDIMENT CONTROL BARRIER

STA 318+43 RT to STA 350+78 RT
STA 318+43 LT to STA 350+78 LT
STA 351+85 RT to STA 358+93 RT
STA 351+85 LT to STA 358+93 LT

ITEM 767.6 AGED PINE BARK MULCH

STA 318+57.87 LT to STA 318+77.62 LT
STA 318+52.87 RT to STA 318+69.51 RT

ITEM 767.91 TIMBER MATTING

STA 351+77 to STA 354+26

ITEM 769. PAVEMENT MILLING MULCH UNDER GUARD RAIL

STA 347+72 to STA 348+41 LT
STA 348+70 to STA 349+70 LT

ITEM 772.035 ARBORVITAE - EMERALD GREEN 4-5 FEET

STA 338+93 to STA 339+10 RT
STA 339+35 to STA 339+50 RT

ITEM 772.334 CEDAR – RED 3-4 FEET

STA 293+49.75 RT
STA 294+08.00 RT (3)
STA 295+34.80 RT
STA 295+59.89 RT (3)
STA 297+19.67 RT (3)
STA 297+52.56 RT (3)
STA 298+09 RT (2)
STA 298+85.65 RT (2)
STA 299+11.59 RT (2)
STA 299+59.44 RT (2)
STA 301+65.62 RT (3)

ITEM 774.239 SPRUCE - WHITE 4-5 FEET

STA 337+94 to STA 338+08 RT

ITEM 775.12 ASPEN – QUAKING 4-5 FEET

STA 294+21.60 RT
STA 295+82.72 RT (2)
STA 299+37.65 RT (2)
STA 299+73.56 RT

ITEM 778.18 BIRCH – GRAY 4-5 FEET

STA 292+80.70 RT
STA 296+13.20 RT (2)
STA 298+77.93 RT
STA 301+33.58 RT (3)

ITEM 794.329 SUMAC SHRUB – FRAGRANT 2-3/ #2

STA 295+28.53 RT (2)
STA 297+35.18 RT (3)
STA 297+65.50 RT
STA 298+00 RT (2)
STA 298+65.79 RT (3)

ITEM 797.2 INFORMATIONAL SIGN

STA 318+70 RT STA 348+06 RT STA 358+62 RT

ITEM 811.36 ELECTRIC MANHOLE ADJUSTED

STA 292+90 STA 297+70

ITEM 811.6 JUNCTION BOX 12 X 8 X 6 INCHES

STA 304+22 LT

ITEM 815.13 RECTANGULAR RAPID FLASHING BEACON SYSTEM (SOLAR)

STA 318+32 RT & STA 318+51 LT STA 358+90 RT & STA 359+40 LT

ITEM 832.91 EAST COAST GREENWAY STANDARD ROUTE SIGN

STA 289+57 LT STA 300+86 RT STA 304+54 LT
STA 304+43 LT

ITEM 832.92 EAST COAST GREENWAY ARROW SIGN

STA 289+57 LT STA 300+86 RT STA 304+54 LT
STA 304+43 LT

ITEM 847.1 SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY – STEEL

STA 289+95 STA 302+50 (2) STA 306+50 (2)
STA 301+71 STA 302+75 (2)
And as required on the Traffic Sign Summary sheet

ITEM 854.016 TEMPORARY PAVING MARKINGS – 6 INCH (PAINTED)

STA 293+35 to STA 296+27 STA 293+30 to STA 301+26
STA 297+22 to STA 301+76 STA 302+59 to STA 303+94
STA 293+35 to STA 301+77 STA 300+29 to STA 301+27

ITEM 854.036 TEMPORARY PAVING MARKINGS – 6 INCH (TAPE)

STA 293+35 to STA 296+27 STA 293+35 to STA 301+77
STA 297+22 to STA 301+76

ITEM 854.1 PAVEMENT MARKING REMOVAL

STA 302+40 to STA 302+40 STA 359+19 to STA 359+19
STA 304+10 to STA 304+10 STA 303+89 to STA 359+20
STA 304+10 to STA 304+10 STA 302+42 to STA 303+88
STA 318+32 to STA 318+32 STA 303+87 to STA 303+87

ITEM 864.04 PAVEMENT ARROWS AND LEGENDS REFLECTORIZED WHITE (THERMOPLASTIC)

STA 290+51 LT/RT STA 311+63 LT/RT STA 332+75 LT/RT
STA 295+79 LT/RT STA 316+91 LT/RT STA 338+03 LT/RT
STA 301+07 LT/RT STA 317+32 RT STA 343+31 LT/RT
STA 301+54 RT STA 319+70 LT STA 348+59 LT/RT
STA 305+00 RT STA 322+19 LT/RT STA 357+78 RT
STA 306+35 LT/RT STA 327+47 LT/RT STA 358+50 LT/RT

ITEM 866.106 6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)

STA 292+50 to STA 301+77 RT
STA 297+22 to STA 301+00 LT
STA 293+34 to STA 296+24 LT
STA 302+48 to STA 304+05 RT
STA 290+51 to STA 290+51 RT
STA 295+79 to STA 295+79 RT
STA 301+07 to STA 301+07 RT
STA 306+35 to STA 306+35 RT
STA 311+63 to STA 311+63 RT
STA 316+91 to STA 316+91 RT
STA 322+19 to STA 322+19 LT/RT
STA 327+47 to STA 327+47 LT/RT
STA 332+75 to STA 332+75 LT/RT
STA 338+03 to STA 338+03 LT/RT
STA 343+31 to STA 343+31 LT/RT
STA 348+59 to STA 348+59 LT/RT
STA 358+50 to STA 358+50 LT/RT
STA 290+00 to STA 290+17 LT/RT

ITEM 866.112 12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)

STA 292+39 RT
STA 292+43 LT/RT
STA 292+77 LT
STA 293+33 LT
STA 297+21 LT
STA 301+77 RT
STA 302+10 LT/RT
STA 302+00 LT/RT
STA 304+05 RT
STA 304+10 LT/RT
STA 304+30 LT/RT
STA 304+30 RT
STA 318+27 LT/RT
STA 318+27 LT
STA 318+33 RT
STA 358+92 RT
STA 359+03 LT/RT
STA 304+10 LT

ITEM 867.106 6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)

STA 289+45 to STA 291+76
STA 291+76 to STA 300+72
STA 300+72 to STA 301+72
STA 302+53 to STA 304+05
STA 302+32 to STA 304+00
STA 304+50 to STA 305+60
STA 305+60 to STA 317+27
STA 317+27 to STA 318+27
STA 318+50 to STA 319+65
STA 319+65 to STA 351+09
STA 355+50 to STA 358+23
STA 358+23 to STA 359+23
STA 302+30 to STA 302+55
STA 293+35 to STA 296+27
STA 297+22 to STA 301+76

ITEM 867.112 12 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)

STA 302+32 to STA 302+50

ITEM 874. STREET NAME SIGN

STA 292+76 LT (2)

ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET

STA 289+95 LT (3)
STA 301+71 RT (2)
STA 302+50 RT
STA 302+75 LT (2)
STA 303+99 LT (2)
STA 304+01 RT
STA 306+50 RT (2)

ITEM 874.4 TRAFFIC SIGN REMOVED AND STACKED

STA 289+95 LT (3)
STA 289+95 LT (2)
STA 289+95 LT
STA 293+35 LT (2)
STA 303+99 LT (2)
STA 304+00 LT
STA 304+28 LT (2)

ITEM 901. 4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE

STA 340+10
STA 342+24
STA 358+51

ITEM 901.3 4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE FOR POST FOUNDATION

STA 289+71 to 302+20
STA 303+68 to 318+32

ITEM 910. STEEL REINFORCEMENT FOR STRUCTURES

STA 340+10
STA 342+24
STA 358+51

ITEM 983. DUMPED RIPRAP

STA 329+85
STA 346+20

ITEM 983.6 NATURAL STREAMBED MATERIAL

STA 329+85
STA 346+20
STA 351+00

ITEM 986. MODIFIED ROCKFILL

STA 301+25 to STA 301+75 RT

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00805

TRAFFIC MANAGEMENT PLANS

THIS PAGE INTENTIONALLY LEFT BLANK

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

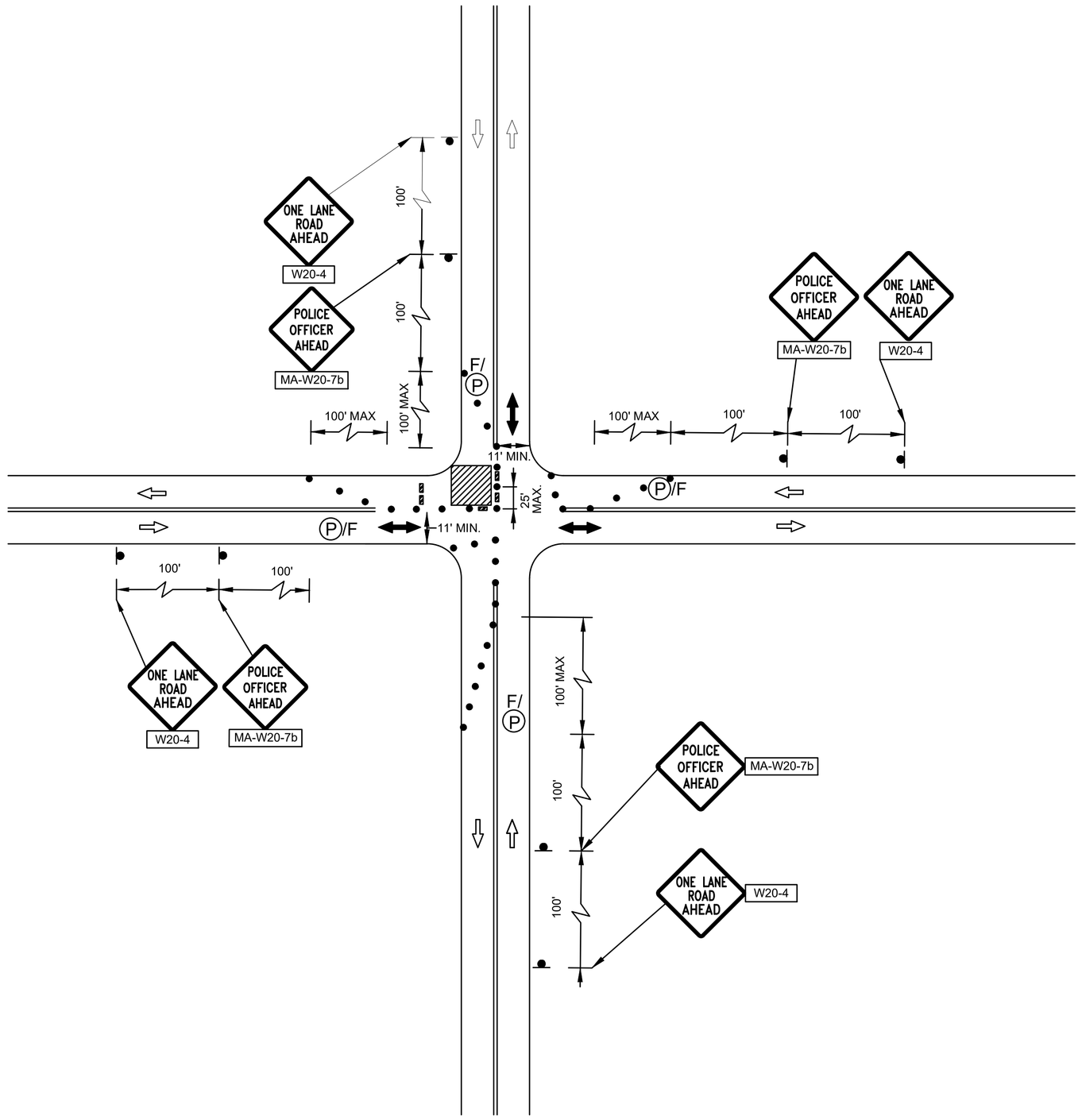
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	55	145
PROJECT FILE NO.	609211		

TRAFFIC MANAGEMENT PLAN - 1

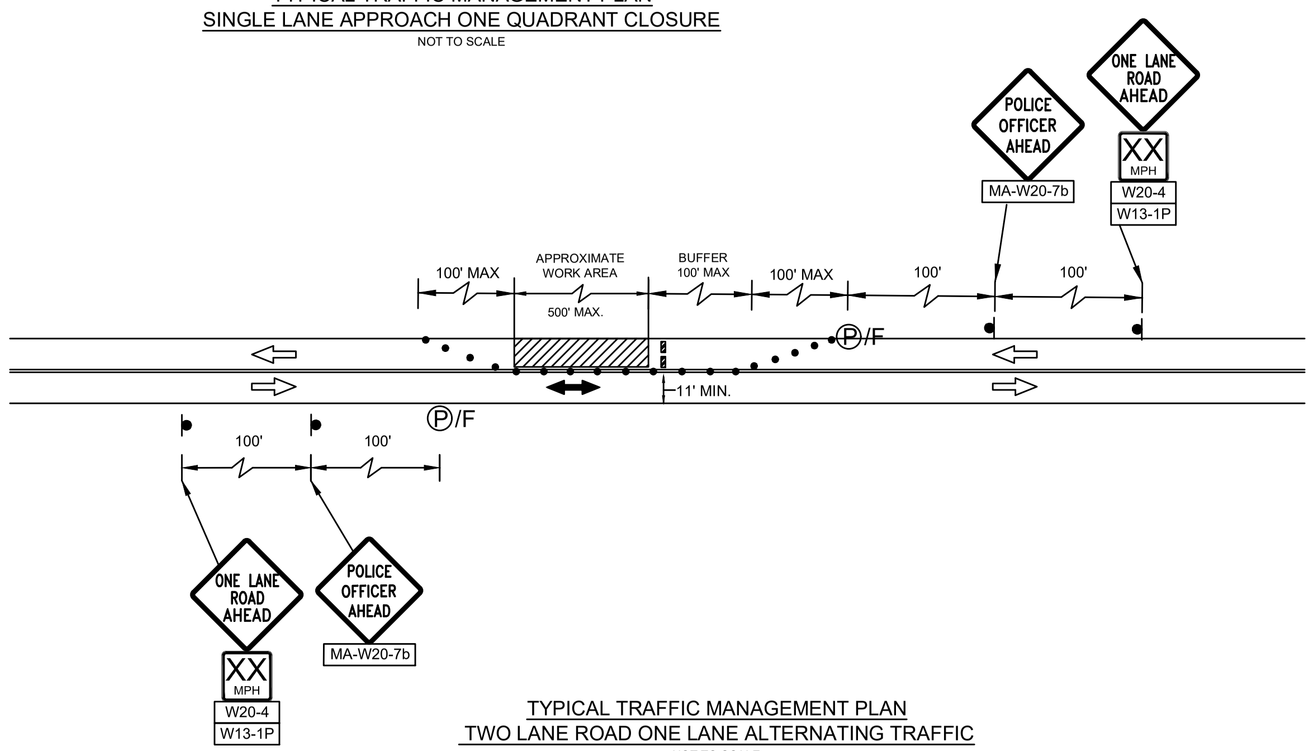
SHT015_HD(TMP).DWG Plotted on 16-Jul-2025 4:51 PM

TEMPORARY TRAFFIC CONTROL NOTES:

1. MINIMUM LANE WIDTH OF 11 FEET SHALL BE MAINTAINED AT ALL TIMES. MINIMUM LANE WIDTHS TO BE MEASURED FROM THE EDGE OF THE DRUMS OR CONES (IF USED).
2. SIGNS AND SIGN SUPPORTS LOCATED ON OR NEAR THE TRAVELED WAY MUST PASS THE CRITERIA SET FORTH IN THE NHCRP 350 REPORT.
3. THE CONTRACTOR SHALL COORDINATE APPROVAL AND IMPLEMENTATION OF THIS TEMPORARY TRAFFIC CONTROL PLAN WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION (MASSDOT) PRIOR TO CONSTRUCTION ACTIVITIES.
4. THE CONTRACTOR SHALL COORDINATE APPROVAL OF ANY CHANGES TO THE TEMPORARY TRAFFIC CONTROL PLAN WITH MASSDOT PRIOR TO CONSTRUCTION ACTIVITES. THE CONTRACTOR SHALL ALSO NOTIFY MASSDOT, THE NORTH SHORE MALL, AND THE CITY OF PEABODY THREE (3) WEEKS IN ADVANCE OF PLACING TEMPORARY TRAFFIC CONTROL SIGNS.
5. ALL CONSTRUCTION SIGNING, DRUMS, BARRICADES, AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM WITH THE 2023 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND "STANDARD HIGHWAY SIGNS" CURRENT EDITION.
6. PLACE ALL SAFETY DEVICES AND CONSTRUCTION SIGNING BEFORE ACTUAL CONSTRUCTION WORK BEGINS.
7. DISTANCES ARE A GUIDE AND MAY BE ADJUSTED BASED ON FIELD CONDITIONS WITH THE DIRECTION AND APPROVAL OF ENGINEER.
8. ALL WARNING SIGNS SHALL BE BLACK LEGEND ON A REFLECTIVE ORANGE BACKGROUND.
9. ALL DRUMS SHALL BE PLACED APPROPRIATELY OR MOVED AS NECESSARY TO MAINTAIN SAFE AND REASONABLE ABUTTER ACCESS AT ALL TIMES.
10. ALL SIGNS NOT APPLICABLE TO THE CURRENT TRAFFIC SETUP SHALL BE REMOVED AND RESET UPON COMPLETION OF CONSTRUCTION OR COVERED.
11. A LONGITUDINAL BUFFER SPACE SHALL BE UTILIZED IN ADVANCE OF WORK AREAS. REFER TO PART VI OF THE 2009 MUTCD FOR GUIDELINES AND DETAILS.
12. AT THE END OF EACH WORKING DAY, EXCAVATED AREA OF TRAVEL LANE SHALL BE RESURFACED OR STEEL PLATED FOR VEHICLE USE.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ACCESS/EGRESS AT ALL CURB CUTS, BUSINESS ENTRANCES, RESIDENTIAL ENTRANCES LOCATED WITHIN THE WORK ZONES.
14. CONTRACTOR SHALL PROVIDE AND MAINTAIN A TEMPORARY ADA AND AAB COMPLIANT ACCESSIBLE PEDESTRIAN ROUTE AROUND BLOCKAGES TO AN EXISTING PEDESTRIAN ROUTE (E.G. SIDEWALKS, CROSSWALKS, PEDESTRIAN CURB RAMPS, ETC.). ALL TEMPORARY WHEELCHAIR RAMPS SHALL MEET MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (AAB) AND AMERICANS WITH DISABILITIES ACT (ADA) STANDARDS. BLOCKAGES INCLUDE, BUT ARE NOT LIMITED TO CONSTRUCTION WORK, EXCAVATIONS, EQUIPMENT AND VEHICLES, TEMPORARY WATER AND UTILITY LINES PLACED ON THE SURFACE, TRAFFIC DIVERTERS, ETC. PROVIDE TEMPORARY FENCING OR BARRIERS AS NECESSARY TO MAINTAIN SAFE PEDESTRIAN PASSAGE AT ALL TIMES.
15. CONTRACTOR SHALL MAINTAIN EMERGENCY PASSAGE AT ALL TIMES TO BUILDINGS WITHIN AND ADJACENT TO THE PROJECT LIMITS AS WELL AS A LARGER AREA IF AFFECTED BY CONSTRUCTION CONDITIONS. CONTRACTOR SHALL MAINTAIN 24 HOUR EMERGENCY VEHICLE ACCESS TO CONSTRUCTION AREAS.
16. CONTRACTOR SHALL COORDINATE WITH ABUTTERS FOR THE PROPOSED WORK AND SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF THE START OF THE WORK THAT WILL REQUIRE TEMPORARY CLOSURE OF ACCESS.
17. SAFETY SIGNS PROPOSED FOR LOCATIONS OTHER THAN ERECTED ON TEMPORARY BARRICADES SHALL BE CONSTRUCTED WITH THEIR OWN SUPPORTS OR SIGN POSTS.
18. TEMPORARY CONSTRUCTION SIGNING, BARRICADES AND ALL OTHER NECESSARY WORK ZONE TRAFFIC DEVICES SHALL BE REMOVED FROM THE ROADWAY WHEN THEY ARE NOT REQUIRED FOR CONTROL OF TRAFFIC.
19. UNLESS OTHERWISE NOTED, ALL PAVEMENT MARKINGS, SIGNS AND OTHER TRAFFIC EQUIPMENT REMOVED OR DAMAGED AS A RESULT OF THE CONTRACTOR'S OPERATIONS SHALL BE REPLACED IN CONFORMANCE WITH THE STANDARDS OF APPLICABLE STATE AND LOCAL AGENCIES.
20. CONTRACTOR SHALL INSTALL, RENEW AND MAINTAIN ALL TRAFFIC CONTROL DEVICES AS SHOWN ON THE DRAWINGS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND AS REQUIRED BY APPLICABLE STATE AND LOCAL AGENCIES.
21. THE CONTRACTOR SHALL NOTIFY APPLICABLE STATE AND LOCAL AGENCIES TWO (2) WEEKS IN ADVANCE OF PLACING TEMPORARY TRAFFIC CONTROL SIGNS.
22. THE CONTRACTOR SHALL LOCATE ALL TEMPORARY BARRIERS (IF USED) SO THERE ARE NO EXPOSED BLUNT ENDS WHICH WILL CAUSE HAZARDOUS CONDITIONS TO TRAFFIC. IN SUCH CASES, THE CONTRACTOR SHALL PROVIDE AND LOCATE BARRIER TAPERED END SECTIONS TO PROTECT VEHICULAR TRAFFIC AND THE WORK AREA.
23. THE FIRST TEN (10) PLASTIC DRUMS OF A TAPER SHALL BE MOUNTED WITH SEQUENTIAL FLASHING LIGHTS.
24. THE CONTRACTOR SHALL COORDINATE WITH ANY ABUTTING PROJECTS.
25. ON-STREET PARKING, IF APPLICABLE, TO BE RESTRICTED PRIOR TO WORK.
26. THESE PLANS ARE NOT INTENDED TO LIMIT THE CONTRACTOR'S APPROACH TO SCHEDULE THE WORK BUT TO OUTLINE ONE WAY OF PROGRESSING. THE CONTRACT IS EXPECTED TO USE KNOWLEDGE AND EXPERIENCE TO PERFORM THE WORK IN THE MOST EFFICIENT AND SAFE MANNER IN COMPLIANCE WITH THE DRAWINGS AND SPECIFICATIONS.
27. THE ADVISORY SPEED LIMIT, IF REQUIRED, SHALL BE DETERMINED BY THE ENGINEER.
28. MAXIMUM SPACING OF TRAFFIC DEVICES IN A TAPER (DRUMS OR CONES) IS EQUAL IN FEET TO THE SPEED LIMIT IN MPH.
29. ALL SIGNS SHALL BE MOUNTED ON THEIR OWN STANDARD SIGN SUPPORTS.
30. MBTA BUS ROUTES 435 AND 436 WILL BE AFFECTED DURING FULL-DEPTH OPERATIONS. WORK ON ESSEX CENTER DRIVE AND NORTHSHORE ROAD SHALL BE COORDINATED WITH MILES TAYLOR (MTAYLOR@MBTA.COM) OF BUS OPERATIONS.
31. WORK REQUIRING LANE CLOSURES SHALL BE PERFORMED BETWEEN 9:30 A.M. AND 3:30 P.M. FOR DAYTIME WORK OR BETWEEN 8:00 P.M. AND 6:00 A.M. FOR NIGHTTIME WORK. REFER TO SUBSECTION 8.02 SCHEDULE OF OPERATIONS LANGUAGE IN THE SPECIAL PROVISIONS.



TYPICAL TRAFFIC MANAGEMENT PLAN
SINGLE LANE APPROACH ONE QUADRANT CLOSURE
NOT TO SCALE



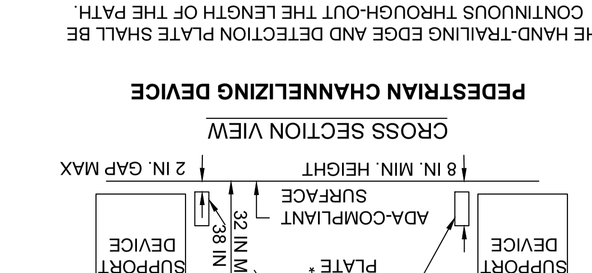
TYPICAL TRAFFIC MANAGEMENT PLAN
TWO LANE ROAD ONE LANE ALTERNATING TRAFFIC
NOT TO SCALE

TRAFFIC DEVICE LEGEND

- WORK ZONE
- DIRECTION OF VEHICULAR TRAFFIC
- DIRECTION OF PROPOSED VEHICULAR TRAFFIC
- SIGN
- TYPE III BARRICADE
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- (P) POLICE OFFICER

NOTES:

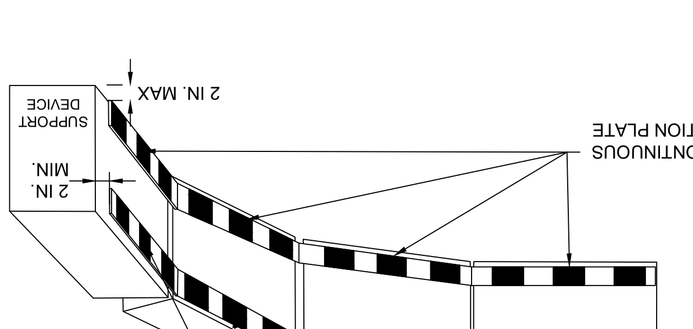
1. CURB RAMPS SHALL BE 60 IN. MINIMUM WIDTH WITH A FIRM, STABLE AND NON-SLIP SURFACE.
2. PROTECTIVE EDGING WITH A 2 IN. MINIMUM HEIGHT SHALL BE INSTALLED WHEN THE CURB RAMP OR LANDING PLATFORM HAS A VERTICAL DROP OF 6 IN. OR GREATER OR HAS A SIDE APRON SLOP STEEPER THAN 1:3 (33%). PROTECTIVE EDGING SHOULD BE CONSIDERED WHEN THE CURB RAMPS OR LANDING PLATFORMS HAVE A VERTICAL DROP OF 3 IN. OR MORE.
3. DETECTABLE EDGING WITH 6 IN. MINIMUM HEIGHT AND CONTRASTING COLOR SHALL BE INSTALLED ON ALL CURB RAMP LANDINGS WHERE THE WALKWAY CHANGES DIRECTION (TURNS).
4. THE CURB RAMP WALKWAY AND LANDING AREA SURFACE SHALL BE OF A SOLID CONTINUOUS CONTRASTING COLOR ABUTTING UP TO THE EXISTING SIDEWALK.
5. CURB RAMPS AND LANDINGS SHOULD HAVE A 1:50 (2%) MAX CROSS-SLOPE.
6. CLEAR SPACE OF 60X60 IN. MINIMUM SHALL BE PROVIDED ABOVE AND BELOW THE CURB RAMP.
7. WATER FLOW IN THE GUTTER SYSTEM SHALL HAVE MINIMAL RESTRICTION.
8. LATERAL JOINTS OR GAPS BETWEEN SURFACES SHALL BE LESS THAN 0.5 IN. WIDTH.
9. CHANGES BETWEEN SURFACE HEIGHTS SHOULD NOT EXCEED 0.5 IN. LATERAL EDGES SHOULD BE VERTICAL UP TO 0.25 IN. HIGH, AND BEVELED AT 1:2 BETWEEN 0.25 IN. AND 0.5 IN. HEIGHT.
10. IF A TEMPORARY PEDESTRIAN RAMP LEADS TO A CROSSWALK, THEN A DETECTABLE WARNING PAD MUST BE ADHERED TO THE BASE OF THE RAMP. IF IT LEADS TO A PROTECTED PEDESTRIAN BYPASS THAT DOES NOT CONFLICT WITH VEHICULAR TRAFFIC, THEN A PAD SHALL NOT BE INSTALLED ON THE RAMP.



CROSS SECTION VIEW

PEDESTRIAN CHANNELIZING DEVICE

* THE HAND-TRAILING EDGE AND DETECTION PLATE SHALL BE CONTINUOUS THROUGH-OUT THE LENGTH OF THE PATH.

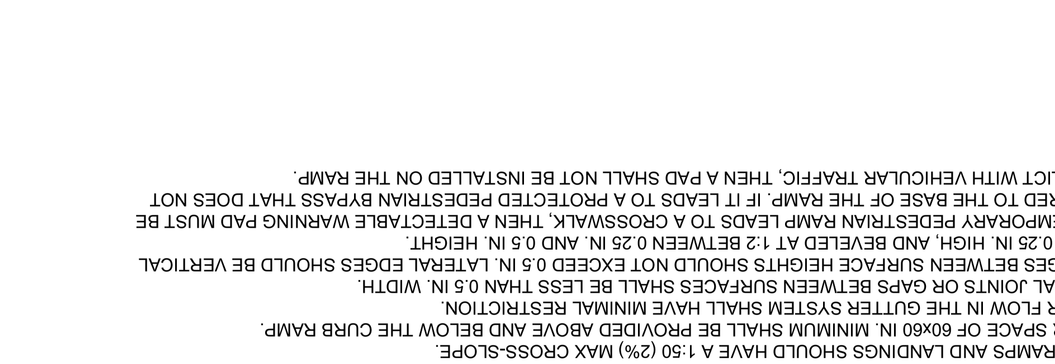


NOTES:

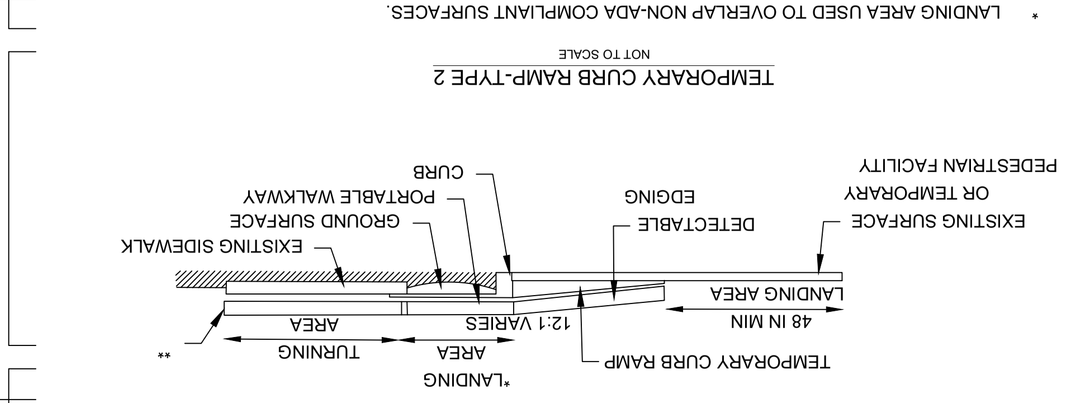
1. THERE SHOULD BE AT LEAST A 2-INCH GAP BETWEEN THE HAND-TRAILING EDGE AND ITS SUPPORT.
2. A MAXIMUM 2-INCH GAP BETWEEN THE BOTTOM OF THE CONTINUOUS DETECTION PLATE AND THE WALKWAY MAY BE USED TO PROVIDE DRAINAGE.
3. SHEETING PANELS MAY BE EITHER VERTICAL OR AT A 45-DEGREE ANGLE.
4. HAND-TRAILING EDGE AND/OR DETECTION PLATES ARE OPTIONAL FOR CONTINUOUS WALLS.

TEMPORARY CURB RAMP - PERPENDICULAR TO CURB

NOT TO SCALE



TEMPORARY CURB RAMP-PARALLEL TO CURB



TEMPORARY CURB RAMP-TYPE 2

NOT TO SCALE

* LANDING AREA USED TO OVERLAP NON-ADA COMPLIANT SURFACES.
** A DETECTABLE EDGE REMOVED IF A CONTINUOUS SIDEWALK.
*** 60 IN. IF AN OBSTRUCTION IS AT BACK OF SIDEWALK.

AUDIBLE DEVICES

FOR LONG TERM SIDEWALK CLOSURES (AT A MINIMUM OVERNIGHT) A FORM OF SPEECH MESSAGING FOR PEDESTRIANS WITH VISUAL DISABILITIES SHALL BE PROVIDED. AUDIBLE INFORMATION DEVICES SUCH AS DETECTABLE BARRIERS OR BARRICADES AND OTHER PASSIVE PEDESTRIAN ACTIVATION (MOTION ACTIVATED) DEVICES SHOULD BE CONSIDERED FOR THESE CASES. THESE AUDIBLE DEVICES CAN BE MOUNTABLE OR STAND ALONE.

10. EXISTING AUDIBLE DEVICES NO LONGER APPLICABLE DUE TO CONSTRUCTION SHALL BE DISABLED.

9. AUDIBLE INFORMATION DEVICES SHOULD BE CONSIDERED WHERE MIDBLOCK CLOSINGS AND CHANGED CROSSWALK AREAS CAUSE INADEQUATE COMMUNICATION TO BE PROVIDED TO PEDESTRIANS WHO HAVE VISUAL DISABILITIES.

8. THE PEDESTRIAN DETAILS SHOW ONLY CONTROLS FOR PEDESTRIAN TRAFFIC; VEHICULAR TRAFFIC SHOULD BE DESIGNED AS SHOWN ELSEWHERE. THESE DETAILS ARE USED IN CONJUNCTION WITH THE PROPOSED LANE CLOSURE DETAILS AND DURING CONSTRUCTIONS STAGING AS DETERMINED BY THE ENGINEER.

7. THE PROTECTIVE REQUIREMENTS OF A WORK ZONE HAVE PRIORITY IN DETERMINING THE NEED FOR TEMPORARY TRAFFIC BARRIERS OR BARRICADES AND THEIR USE IN THIS SITUATION SHOULD BE BASED ON ENGINEERING JUDGEMENT.

6. THE TEMPORARY SIDEWALK SHOULD BE A MINIMUM OF 5 FEET WIDE.

5. THE ALTERNATIVE PATHWAY SHOULD HAVE A SMOOTH CONTINUOUS HARD SURFACE FOR THE ENTIRE LENGTH OF THE TEMPORARY PEDESTRIAN FACILITY.

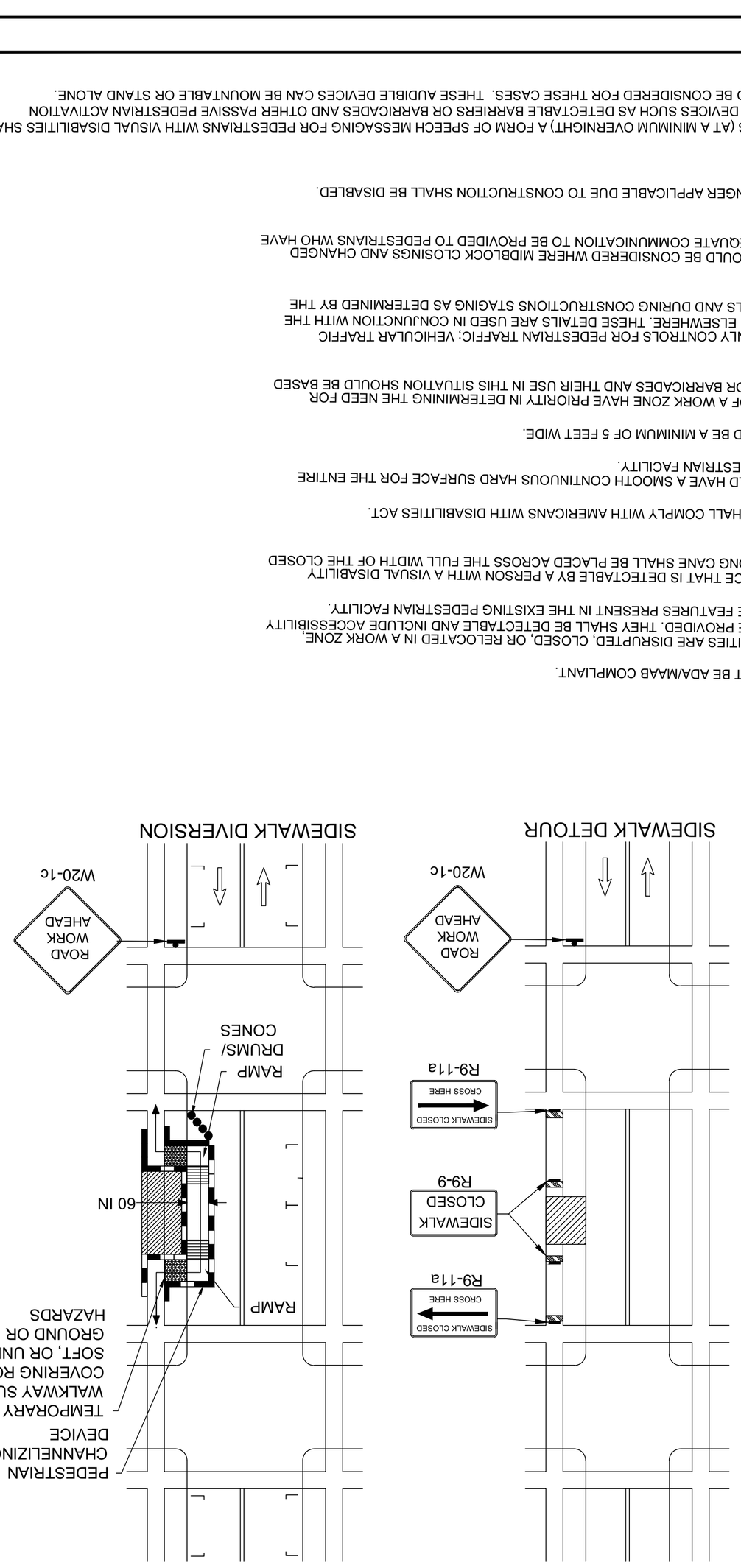
4. WHEN USED, TEMPORARY RAMPS SHALL COMPLY WITH AMERICANS WITH DISABILITIES ACT.

3. A PEDESTRIAN CHANNELIZING DEVICE THAT IS DETECTABLE BY A PERSON WITH A VISUAL DISABILITY TRAVELING WITH THE AID OF A LONG CANE SHALL BE PLACED ACROSS THE FULL WIDTH OF THE CLOSED SIDEWALK.

2. WHEN EXISTING PEDESTRIAN FACILITIES ARE DISRUPTED, CLOSED, OR RELOCATED IN A WORK ZONE, TEMPORARY FACILITIES SHALL BE PROVIDED. THEY SHALL BE DETECTABLE AND INCLUDE ACCESSIBILITY FEATURES CONSISTENT WITH THE FEATURES PRESENT IN THE EXISTING PEDESTRIAN FACILITY.

1. PEDESTRIAN DETOUR ROUTES MUST BE ADA/MAAB COMPLIANT.

NOTES:



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

TRAFFIC MANAGEMENT PLAN - 2

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	56	145
	PROJECT FILE NO. 609211		

SHT015_HDTMPJ.DWG Plotted on 16-Jul-2025 4:51 PM

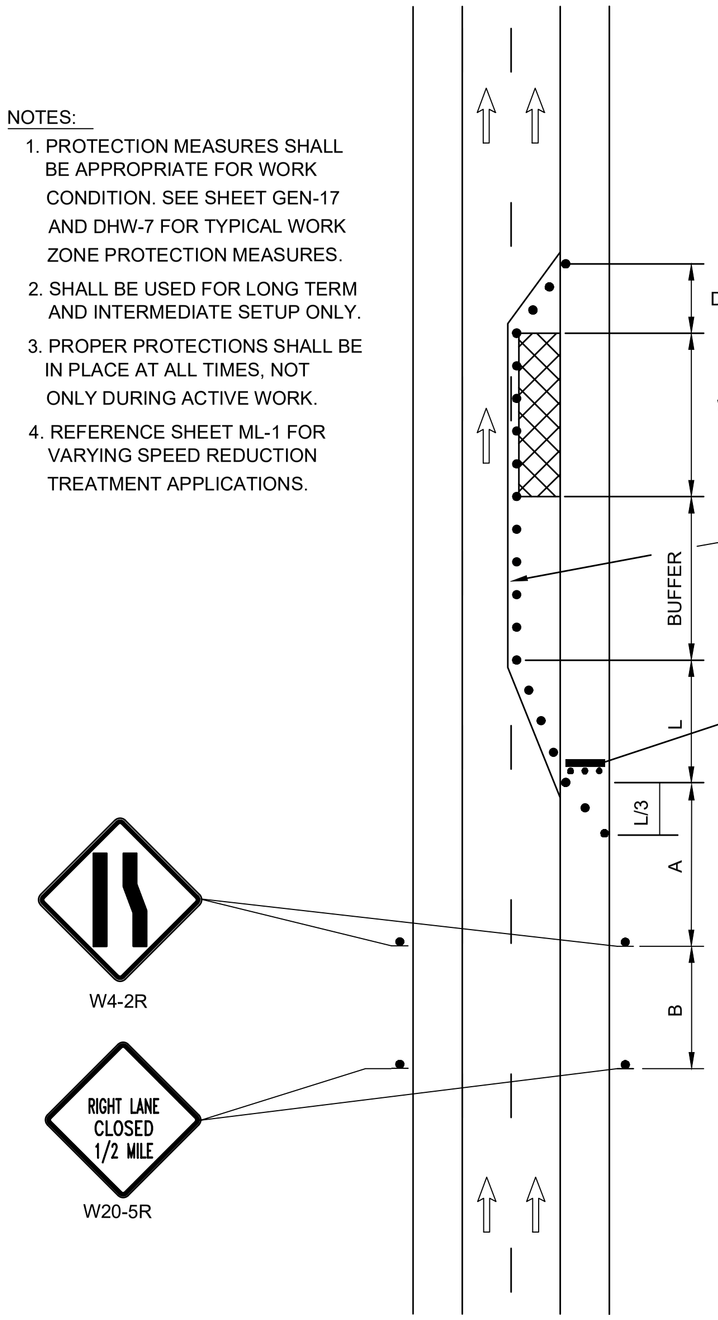
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	57	145
PROJECT FILE NO.	609211		

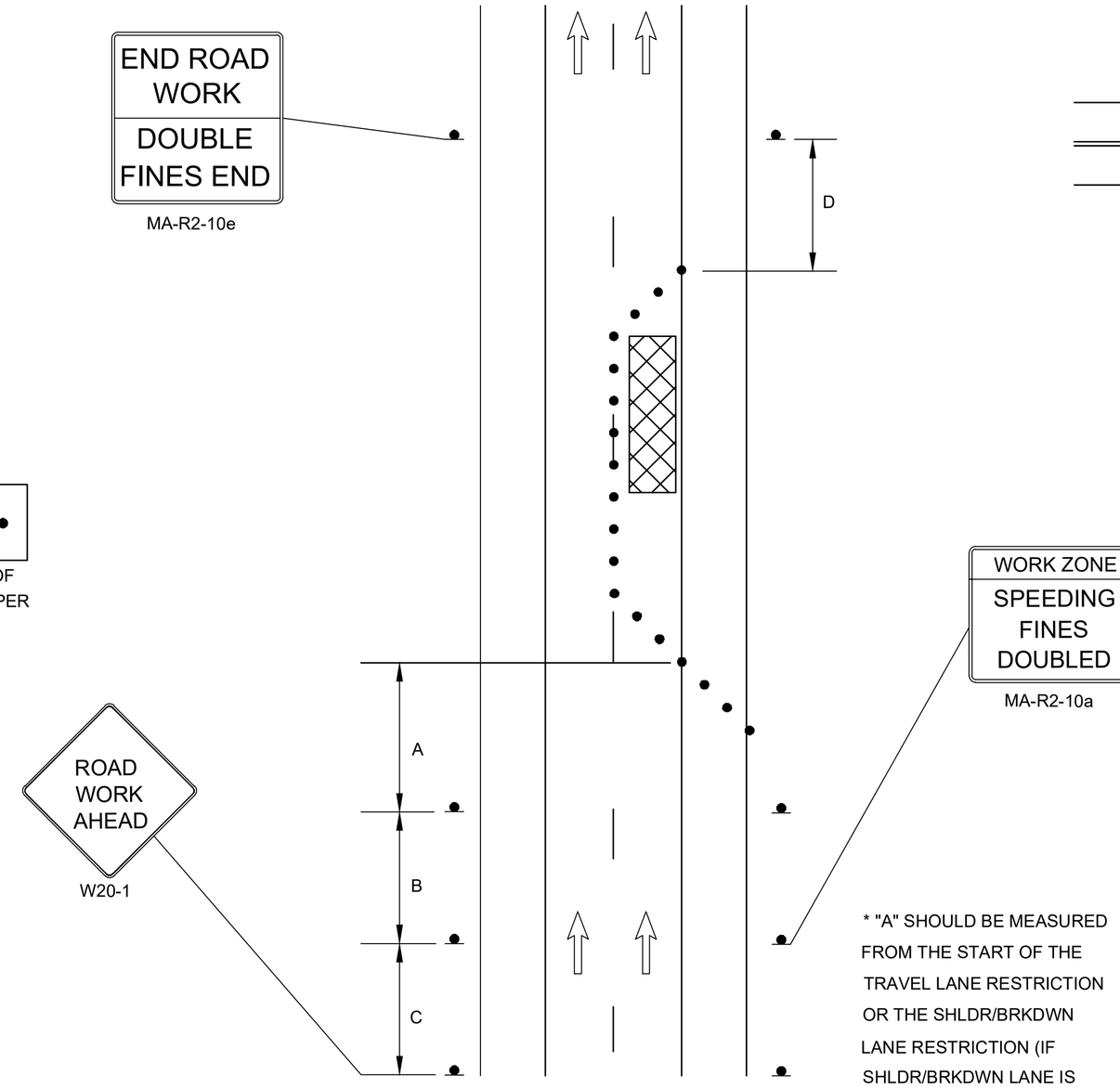
TRAFFIC MANAGEMENT PLAN - 3

NOTES:

1. PROTECTION MEASURES SHALL BE APPROPRIATE FOR WORK CONDITION. SEE SHEET GEN-17 AND DHW-7 FOR TYPICAL WORK ZONE PROTECTION MEASURES.
2. SHALL BE USED FOR LONG TERM AND INTERMEDIATE SETUP ONLY.
3. PROPER PROTECTIONS SHALL BE IN PLACE AT ALL TIMES, NOT ONLY DURING ACTIVE WORK.
4. REFERENCE SHEET ML-1 FOR VARYING SPEED REDUCTION TREATMENT APPLICATIONS.



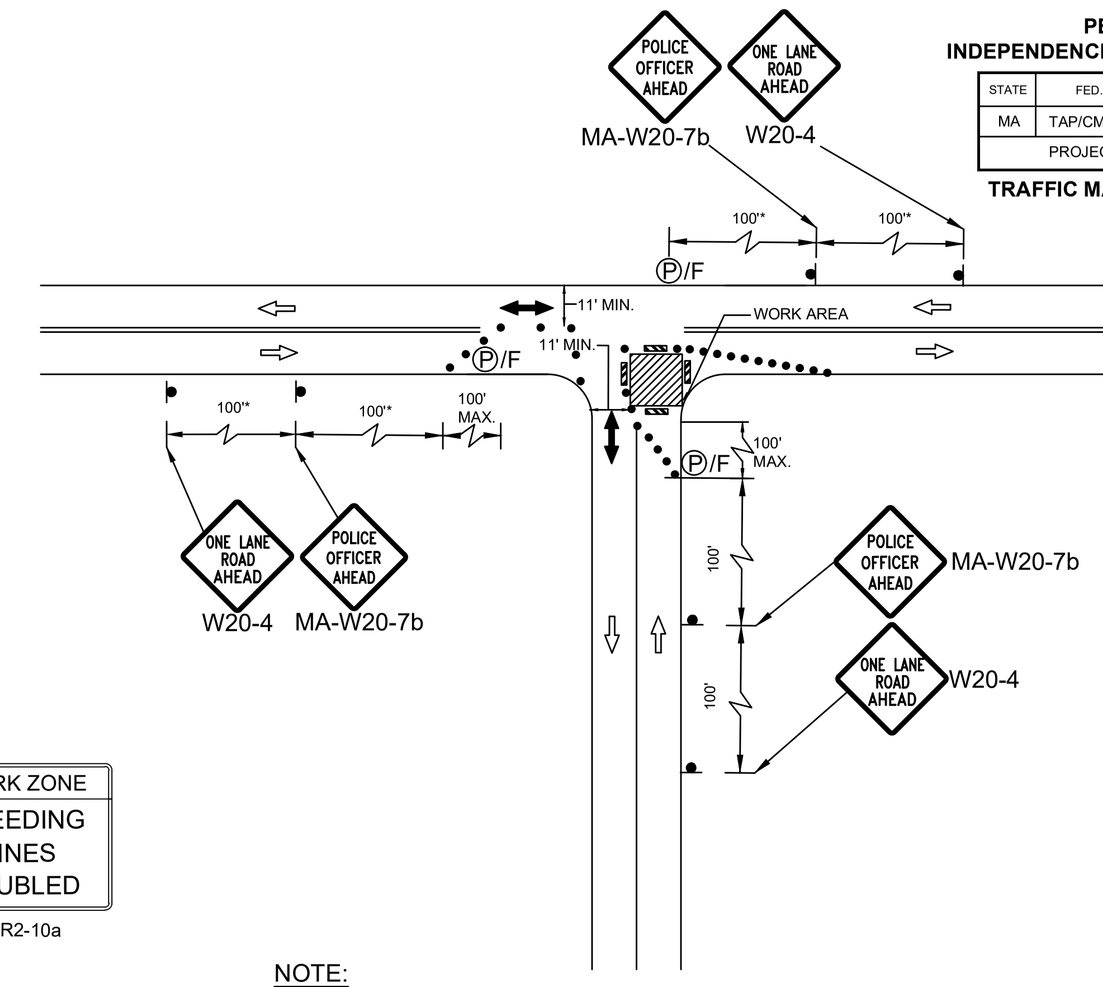
TYPICAL TRAFFIC MANAGEMENT PLAN
RIGHT LANE CLOSURE
NOT TO SCALE



* "A" SHOULD BE MEASURED FROM THE START OF THE TRAVEL LANE RESTRICTION OR THE SHLDR/BRKDWN LANE RESTRICTION (IF SHLDR/BRKDWN LANE IS ONLY LANE BEING CLOSED)

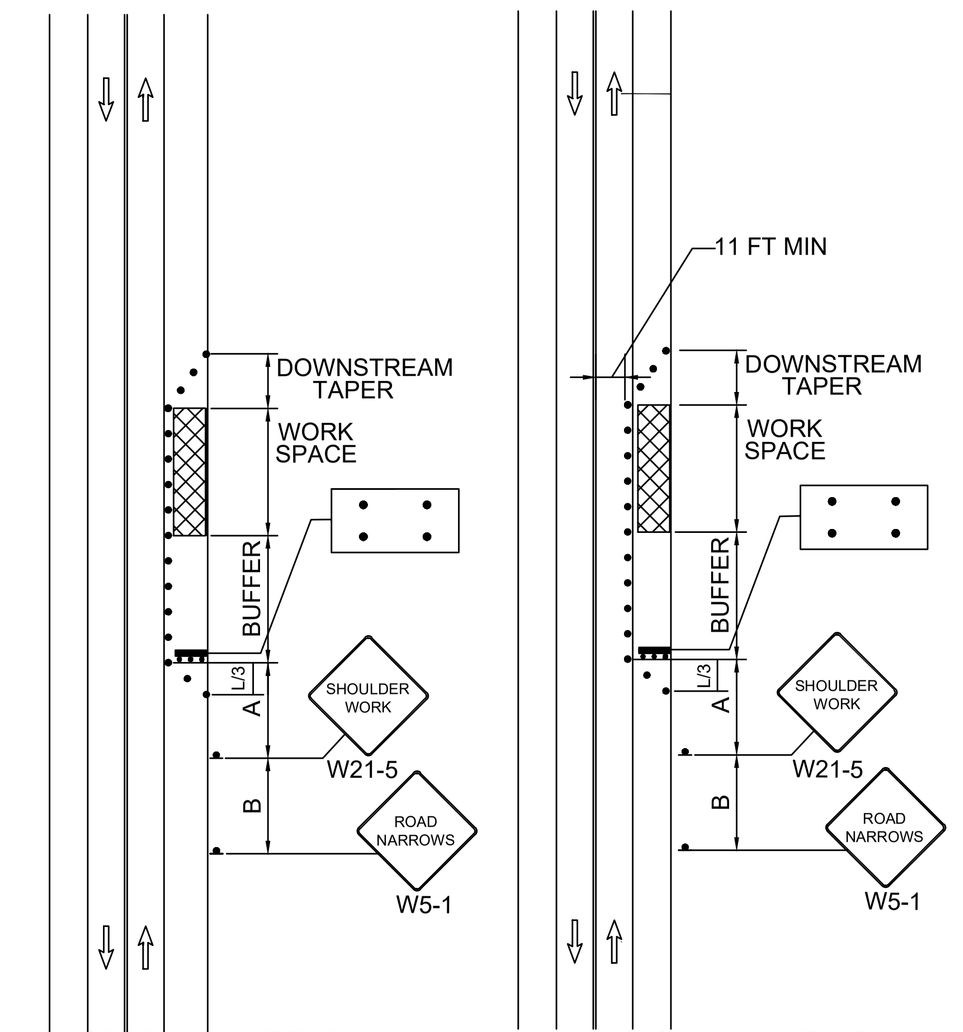
TYPICAL TRAFFIC MANAGEMENT PLAN
WORK ZONE SIGN SPACING
NOT TO SCALE

ROAD TYPE	DISTANCE			
	A	B	C	D
URBAN (30 MPH OR LESS)	100 FEET	100 FEET	100 FEET	100 FEET
EXPRESSWAY/FREEWAY	1,000 FEET	1,500 FEET	2,640 FEET	500 FEET



NOTE:
USE SIMILAR TRAFFIC SETUP FOR WORK AT OPPOSITE SIDE OF INTERSECTION.

TYPICAL TRAFFIC MANAGEMENT PLAN
SINGLE LANE APPROACH ONE QUADRANT CLOSURE AT T-INTERSECTION
NOT TO SCALE



WORK SPACE NOT ENCROACHING INTO TRAVEL LANE

WORK SPACE ENCROACHING INTO TRAVEL LANE

TRAFFIC DEVICE LEGEND

- WORK ZONE
- DIRECTION OF VEHICULAR TRAFFIC
- DIRECTION OF PROPOSED VEHICULAR TRAFFIC
- SIGN
- TYPE III BARRICADE
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- Ⓟ POLICE OFFICER

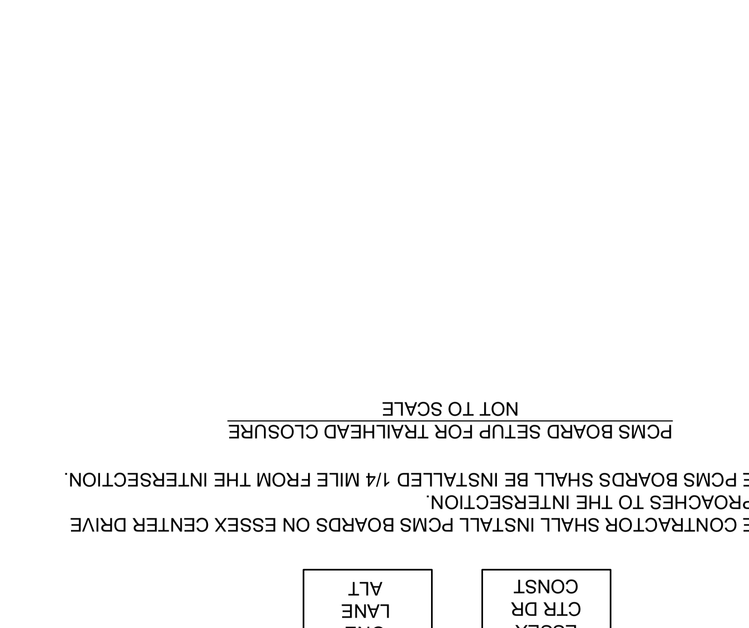
SHT015_HD(TMP).DWG Plotted on 16-Jul-2025 4:51 PM

TRAFFIC DEVICE LEGEND

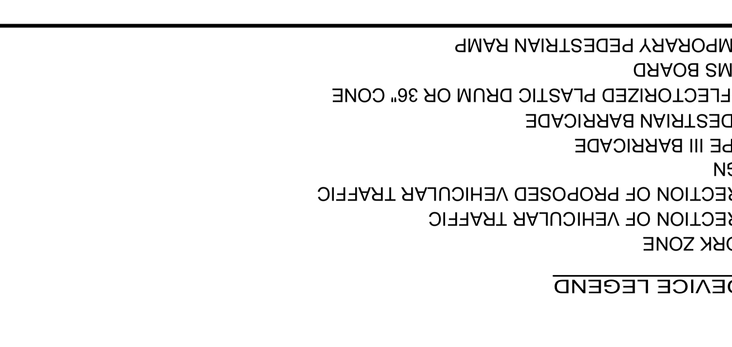
- WORK ZONE
- DIRECTION OF VEHICULAR TRAFFIC
- DIRECTION OF PROPOSED VEHICULAR TRAFFIC
- SIGN
- TYPE III BARRICADE
- PEDESTRIAN BARRICADE
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- PCMS BOARD
- TEMPORARY PEDESTRIAN RAMP

PCMS BOARD SETUP FOR TRAILHEAD CLOSURE
NOT TO SCALE

NOTE:
- THE CONTRACTOR SHALL INSTALL PCMS BOARDS ON ESSEX CENTER DRIVE APPROACHES TO THE INTERSECTION.
- THE PCMS BOARDS SHALL BE INSTALLED 1/4 MILE FROM THE INTERSECTION.

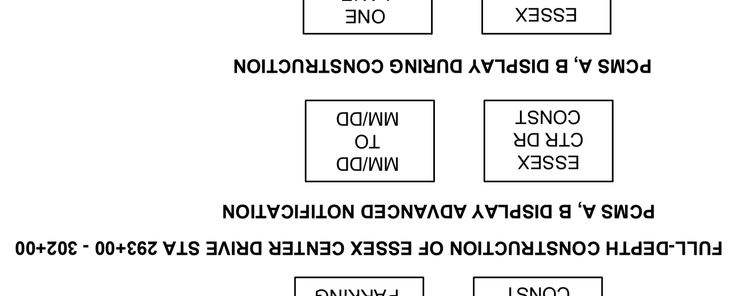


TRAILHEAD CONSTRUCTION STAGES 2A, 2B, 3
PCMS A, B DISPLAY ADVANCED NOTIFICATION



PCMS A,B DISPLAY DURING CONSTRUCTION

FULL-DEPTH CONSTRUCTION OF ESSEX CENTER DRIVE STA 293+00 - 302+00
PCMS A, B DISPLAY ADVANCED NOTIFICATION



PCMS A, B DISPLAY DURING CONSTRUCTION

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	58	145
	PROJECT FILE NO. 609211		

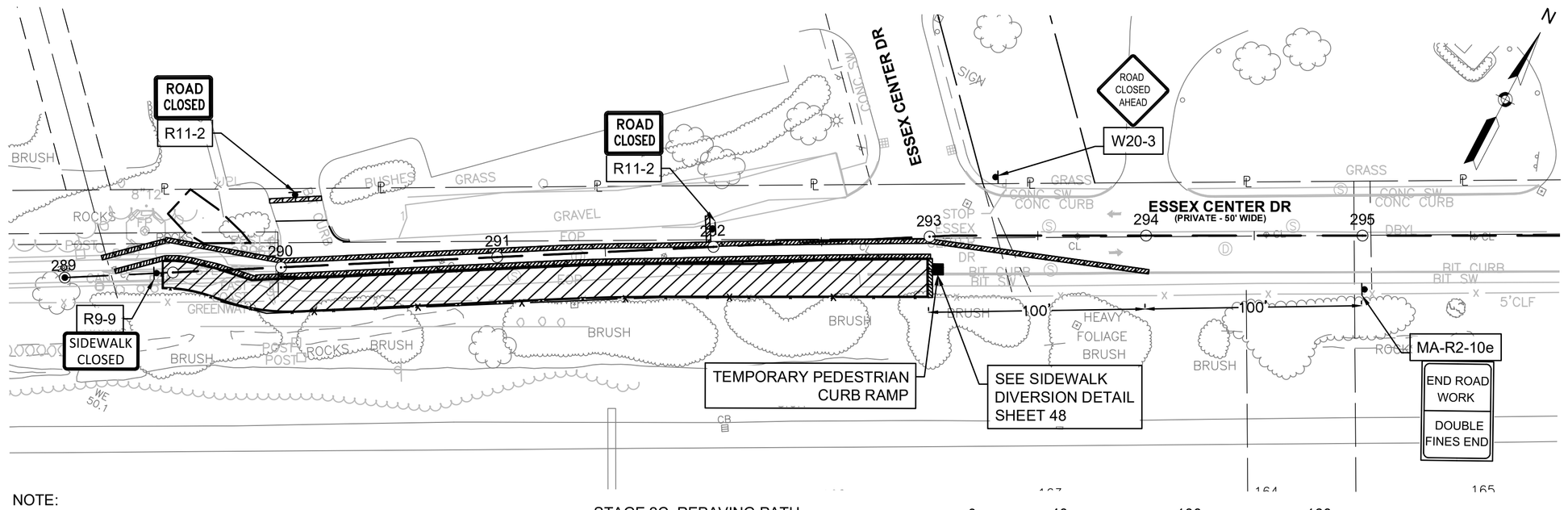
TRAFFIC MANAGEMENT PLAN - 4

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	59	145
PROJECT FILE NO.	609211		

TRAFFIC MANAGEMENT PLAN - 5

SHT015_HD(TMP).DWG Plotted on 16-Jul-2025 4:52 PM

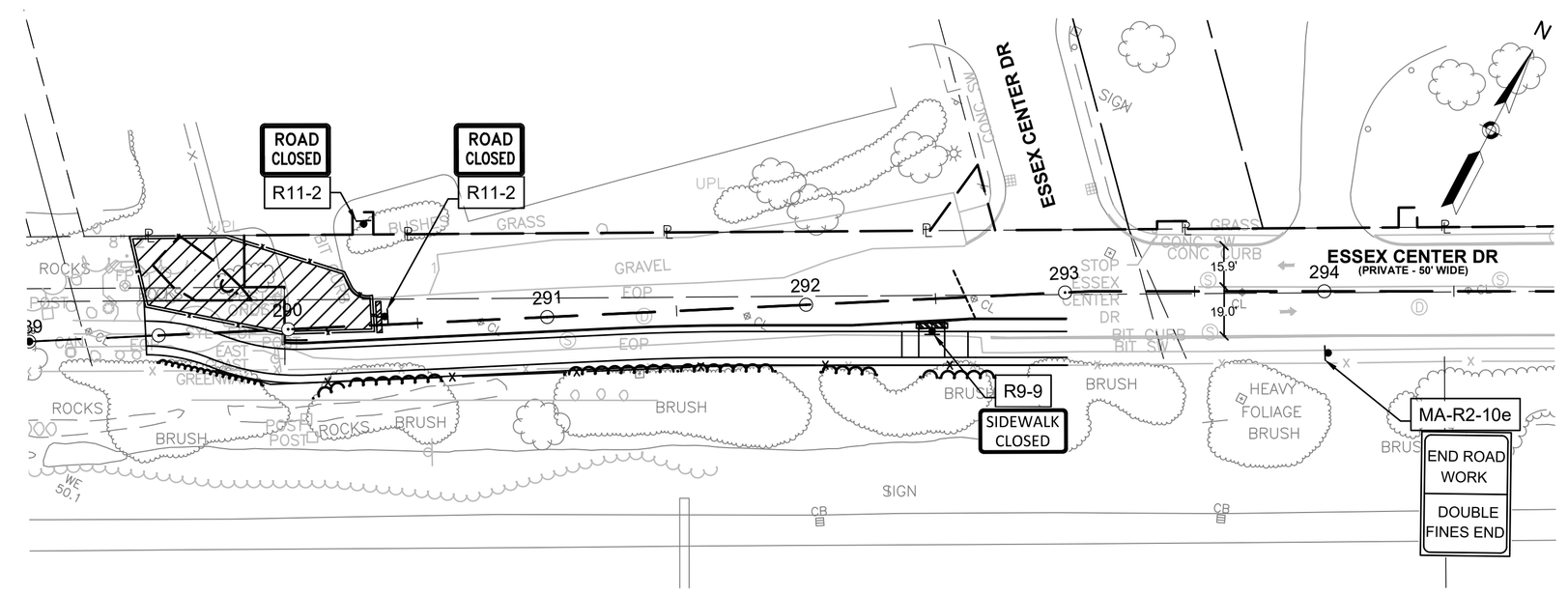


NOTE:
ALL WORK IN THIS PHASE SHALL OCCUR AT NIGHT TO LIMIT IMPACTS TO TRAIL USERS AND PARKING

STAGE 2C: REPAVING PATH

0 40 100 160

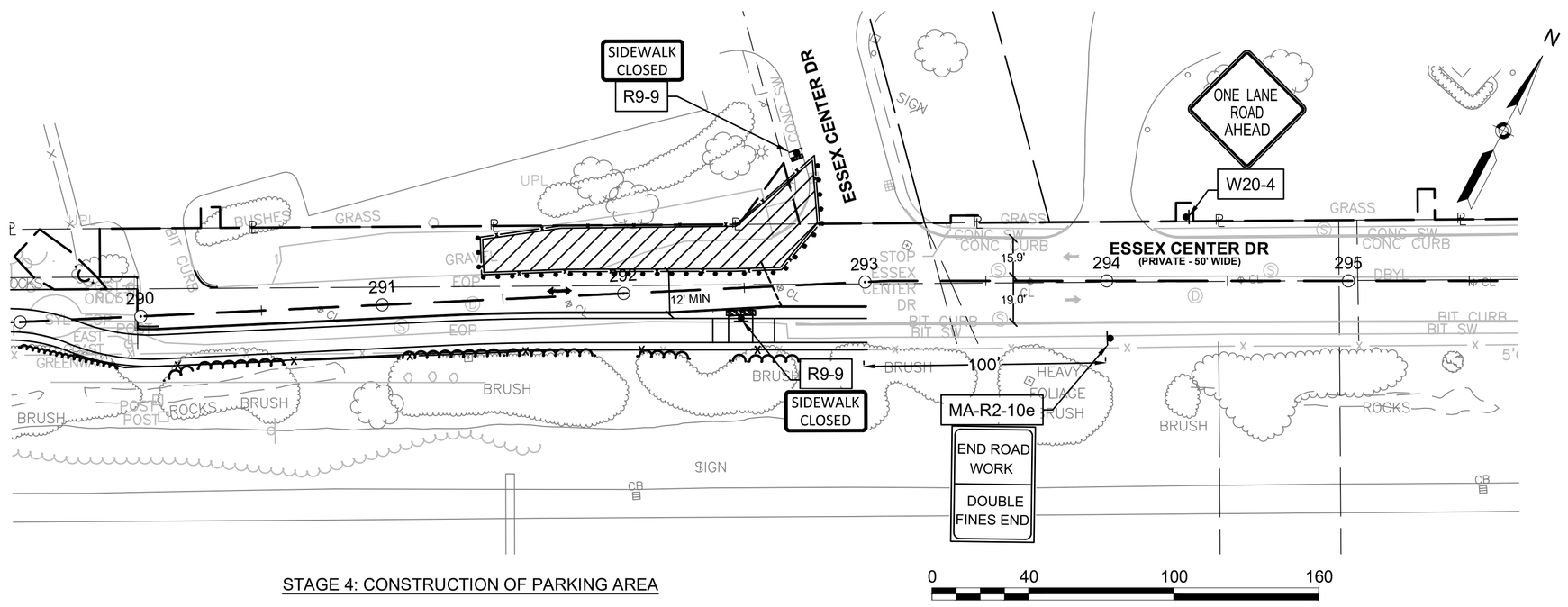
SCALE: 1" = 40'



STAGE 3: CONSTRUCTION OF PARKING AREA AT HOSPITAL DRIVE AND COMPLETION OF SWALE

0 40 100 160

SCALE: 1" = 40'



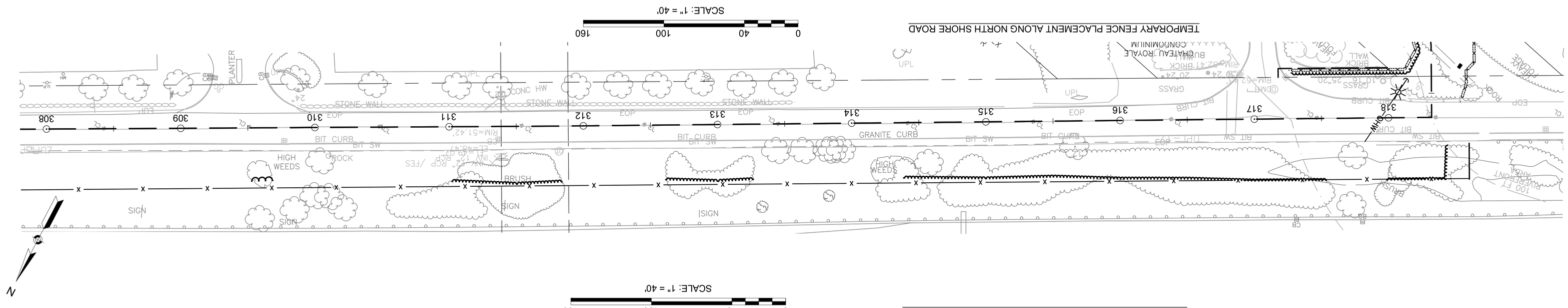
STAGE 4: CONSTRUCTION OF PARKING AREA

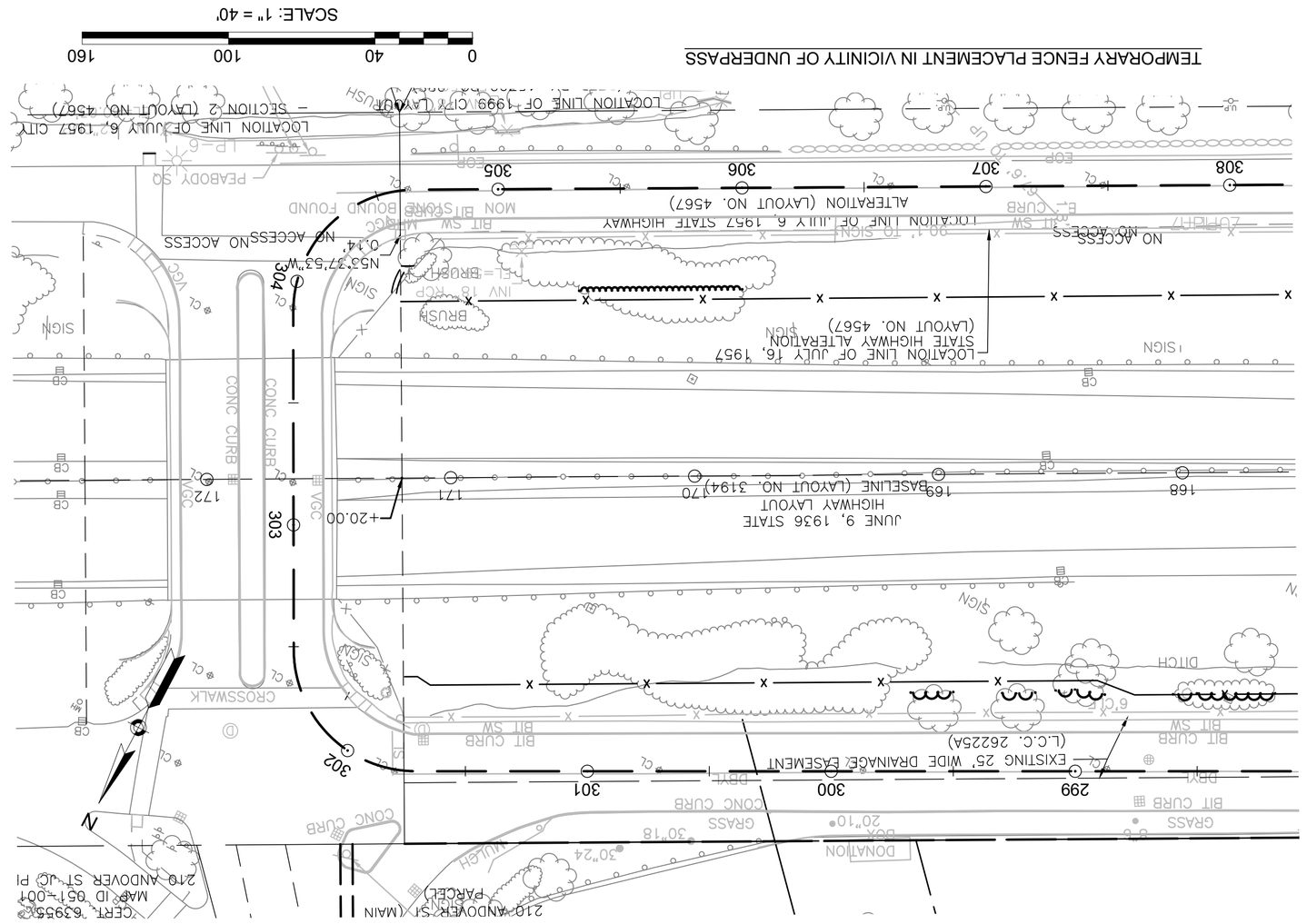
0 40 100 160

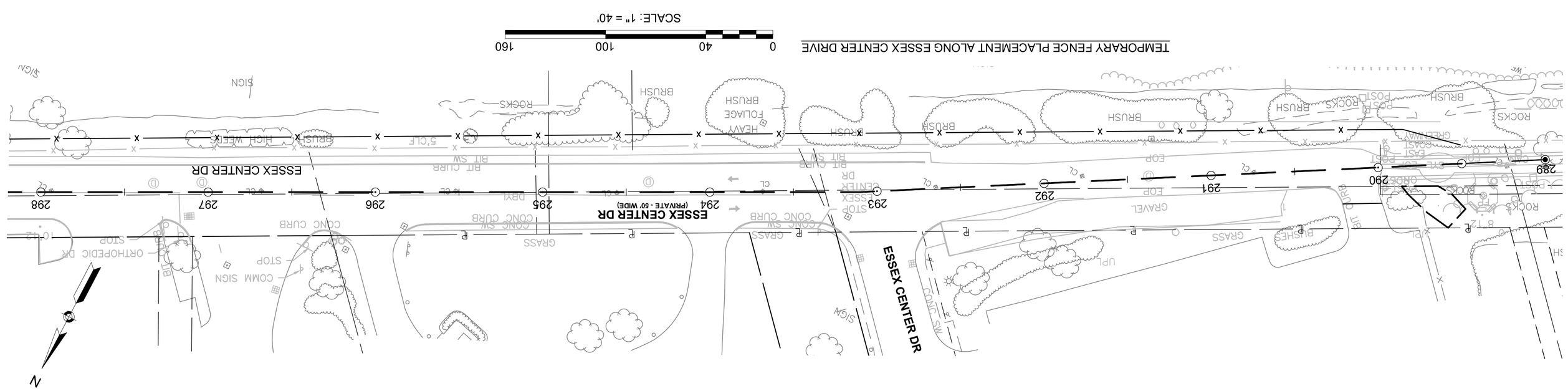
SCALE: 1" = 40'

TRAFFIC DEVICE LEGEND

- WORK ZONE
- DIRECTION OF VEHICULAR TRAFFIC
- DIRECTION OF PROPOSED VEHICULAR TRAFFIC
- SIGN
- TYPE III BARRICADE
- PEDESTRIAN BARRICADE
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- PCMS BOARD
- TEMPORARY PEDESTRIAN RAMP







NOTES:

1. CONTRACTOR TO INSTALL TEMPORARY FENCING PRIOR TO REMOVAL OF EXISTING FENCING.
2. SEE NOTE 26 ON SHEET 55 REGARDING PLACEMENT OF THE FENCE.
3. TEMPORARY FENCE SHALL MEET AT EXISTING FENCE TO FORM CONTINUOUS BARRIER ALONG THE ROUTE 128 CORRIDOR.

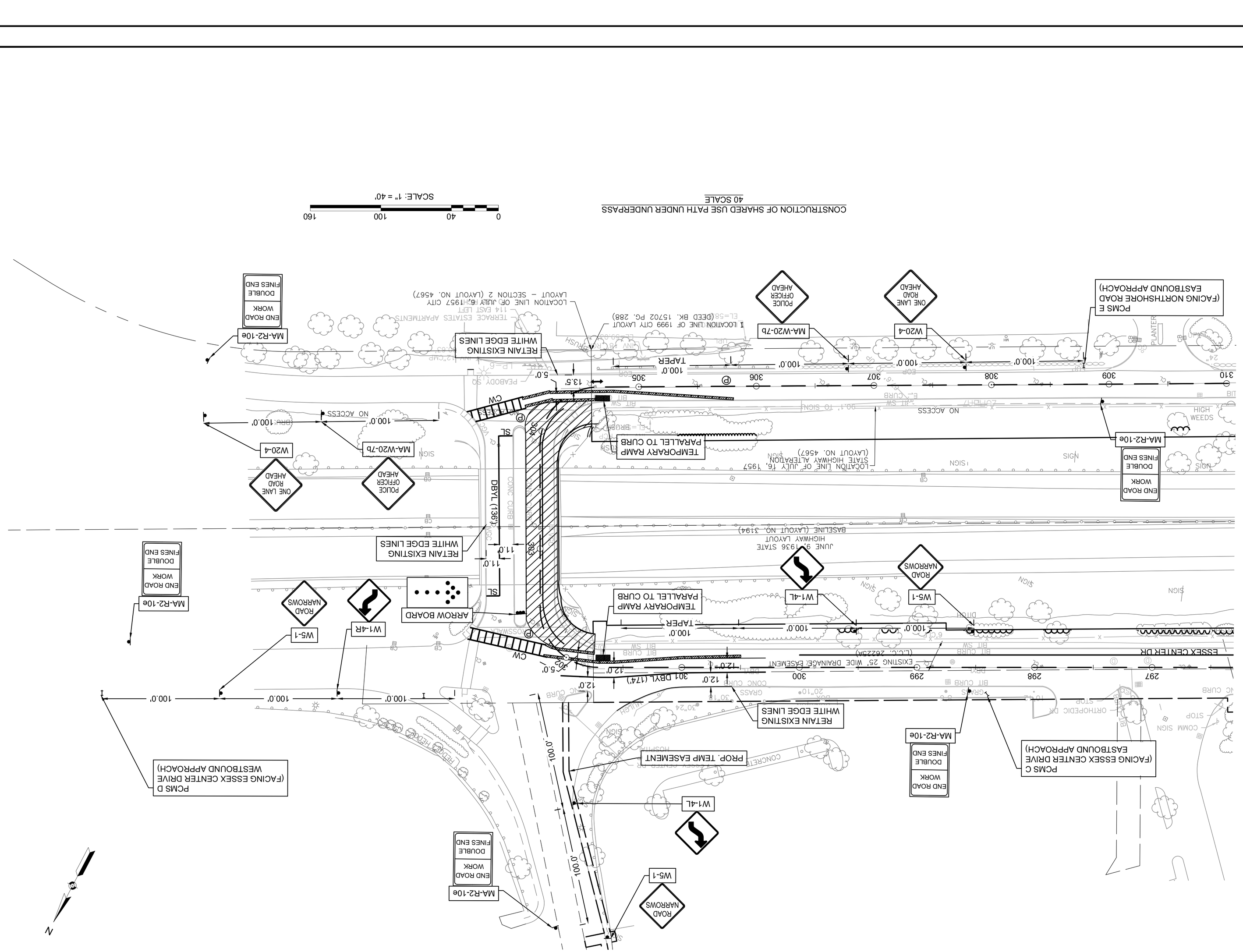
TRAFFIC MANAGEMENT - FENCING

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	60	145
	PROJECT FILE NO. 609211		

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

SHT015_HD(TMP).DWG Plotted on 16-Jul-2025 4:53 PM

Proposal No. 609211-132091


TRAFFIC DEVICE LEGEND
WORK ZONE
DIRECTION OF VEHICULAR TRAFFIC
DIRECTION OF PROPOSED VEHICULAR TRAFFIC
SIGN
TYPE III BARRICADE
PEDESTRIAN BARRICADE
REFLECTORIZED PLASTIC DRUM OR 36" CONE
PCMS BOARD
TEMPORARY PEDESTRIAN RAMP
POLICE DETAIL
CONSTRUCTION OF SHARED USE PATH UNDER UNDERPASS
40 SCALE
SCALE: 1" = 40'
0
40
100
160
UNDERPASS PATH SEGMENT CONSTRUCTION
PCMS C, D, E DISPLAY ADVANCED NOTIFICATION
UNDER-PASS CONST
MM/DD TO MM/DD
PCMS C, D, E DISPLAY DURING CONSTRUCTION
UNDER-PASS CONST
LANE SHIFT AHEAD
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION
TRAFFIC MANAGEMENT - UNDERPASS
STATE
MA
FED. AID PROJ. NO.
TAP/CMQ-0034(027)X
SHEET NO.
61
TOTAL SHEETS
145
PROJECT FILE NO.
609211
A00805 - 9
Proposal No. 609211-132091
SHT015_HDTMP1.DWG
Plotted on 16-Jul-2025 4:53 PM

TEMPORARY TRAFFIC SIGN SUMMARY SHEET

IDENTIFICATION NUMBER	SIZE OF SIGN (INCHES)		TEXT	TEXT DIMENSIONS (INCHES)			NUMBER OF REQUIRED SIGNS	BACKGROUND	COLOR	BORDER	POST SIZE AND NUMBER REQUIRED	UNIT AREA IN SQUARE FEET	TOTAL AREA IN SQUARE FEET
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE MRK							
MA-R2-10a	48	36	WORK ZONE SPEEDING FINES DOUBLED	SEE MASSDOT STD. DETAIL			5	FLUORESCENT ORANGE AND RETROREFLECTIVE WHITE	BLACK	BLACK	P-5 10	12.00	60.00
MA-R2-10e	36	48	END ROAD WORK DOUBLE FINES END				5	FLUORESCENT ORANGE AND RETROREFLECTIVE WHITE	BLACK	BLACK	P-5 5	12.00	60.00
MA-W20-7b	36	36	POLICE OFFICER AHEAD				5	FLUORESCENT ORANGE	BLACK	BLACK	P-5 10	9.00	45.00
R9-9	24	12	SIDEWALK CLOSED	SEE MUTCD STD. DETAIL			2	RETROREFLECTIVE WHITE	BLACK	BLACK	MOUNTED ON TYPE III BARRICADE	2.00	4.00
R9-11aL	24	18	SIDEWALK CLOSED AHEAD CROSS HERE				1	RETROREFLECTIVE WHITE	BLACK	BLACK	MOUNTED ON TYPE III BARRICADE	3.00	3.00
R9-11aR	24	18	SIDEWALK CLOSED AHEAD CROSS HERE				1	RETROREFLECTIVE WHITE	BLACK	BLACK	MOUNTED ON TYPE III BARRICADE	3.00	3.00
R11-2	48	30	ROAD CLOSED				2	RETROREFLECTIVE WHITE	BLACK	BLACK	P-5 4	10.00	20.00
W13-1P	24	24	XX MPH				2	FLUORESCENT ORANGE	BLACK	BLACK	MOUNTED WITH W20-4	4.00	8.00
W20-1	36	36	ROAD WORK AHEAD				5	FLUORESCENT ORANGE	BLACK	BLACK	P-5 10	9.00	45.00
W20-4	36	36	ONE LANE ROAD AHEAD				4	FLUORESCENT ORANGE	BLACK	BLACK	P-5 8	9.00	36.00
W5-4a	18	18	PATH NARROWS				1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 1	2.25	2.25
W21-5	36	36	SHOULDER WORK				1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 2	9.00	9.00
W20-3	36	36	ROAD CLOSED AHEAD				1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 2	9.00	9.00

NOTES:

1. SIGN SUPPORTS MUST CONFORM TO THE CRITERIA SET FORTH IN THE NCHRP 350 REPORT AND/OR MASH.
2. TEXT DIMENSIONS AND COLOR SHALL BE PER MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) 2023 EDITION AND ALL REVISIONS, THE 2022 MASSACHUSETTS AMENDMENTS TO THE 2009 MUTCD, THE MASSDOT STANDARD SIGNS BOOK AND THE STANDARD MUNICIPAL TRAFFIC CODE.
3. TEMPORARY SPEED LIMITS SHALL BE DETERMINED BY THE FIELD ENGINEER AS CONSTRUCTION IS ABOUT TO START.

TEMPORARY TRAFFIC SIGN SUMMARY SHEET

IDENTIFICATION NUMBER	SIZE OF SIGN (INCHES)		TEXT	TEXT DIMENSIONS (INCHES)			NUMBER OF REQUIRED SIGNS	BACKGROUND	COLOR	BORDER	POST SIZE AND NUMBER REQUIRED	UNIT AREA IN SQUARE FEET	TOTAL AREA IN SQUARE FEET
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE MRK							
W1-4L	36	36		SEE MUTCD STD. DETAIL			2	FLUORESCENT ORANGE	BLACK	BLACK	P-5 4	9.00	18.00
W1-4R	36	36					1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 2	9.00	9.00
W5-1	36	36	ROAD NARROWS				3	FLUORESCENT ORANGE	BLACK	BLACK	P-5 6	9.00	27.00
R5-1	36	36	DO NOT ENTER				1	RETROREFLECTIVE WHITE	RED	BLACK	P-5 1	9.00	9.00
W4-2R	36	36					1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 2	9.00	9.00
W20-5R	36	36	RIGHT LANE CLOSED 1/2 MILE				1	FLUORESCENT ORANGE	BLACK	BLACK	P-5 2	9.00	9.00
TOTAL													385.25

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	TAP/CMQ-0034(027)X	62	145
	PROJECT FILE NO. 609211		

TEMPORARY TRAFFIC SIGN SUMMARY

SHT015_HDTMP.DWG Plotted on 16-Jul-2025 4:53 PM

DOCUMENT A00808

PROJECT UTILITY COORDINATION FORM

THIS PAGE INTENTIONALLY LEFT BLANK

Project Utilities Coordination (PUC) Form

CONTACTS AND GENERAL UTILITY INFORMATION

7/30/2024
Revision Date:

City/Town:	Project File #:	PUC Completed by:	Utility Pole Set:		
Peabody	609211	Ray Stinson	Peabody Mun/Verizon: PMLP Pole Set & removes poles		
Route/Street:	**Asst. Dist. Const /Dist. Utility Reimb. Eng**	**Mass DOT PM:**	**Scheduled Ad Date:**	**Total Poles Relocated:**	7/30/2025 PRINTED
Independence Greenway Extension	Richard.DeSantis@dot.state.ma.us 857 368 4074 Amanda.Klemm@dot.state.ma.us/781-570-1154	Stephanie Upson (203) 872-2118	8/23/2025	5	

Consultant:	Contact:	Office #	Cell #	Email
Muni Consult- Green International Affiliates, Inc.	Alexandra Russell Andrew Feingold Dennis Vertiyev (PM)	(978) 923-0400		arussell@greenintl.com afeingold@greenintl.com dvertiyev@greenintl.com

Utility Company	Contact	Office #	Cell #	Email	Scope, Budget, Duration Submitted		Reimbursement			Potential for District Initiated Early Relocation *		Utilities On Bridge/Structure		Utilities Underground (UG) /Aerial (OH)	
					Yes	No	Agreement	Non-Reimb'le	Notes	YES	NO	YES	NO	UG	OH
Peabody Municipal Light Plant	Brian Abcunas William Cardello	978-531-5975 978-573-1233	ex234 978-587-4489	babcunas@pmlp.com WCardello@pmlp.com	x		x		R&R poles: 25,26,27,28 and LP #3. PMLP may reduce height of all poles from 65 to 50ft. Consider Adjust guy wires at pole #5 - 343+50. PMLD to R&R Cobra heads and R&D Poles	x			x		x
Peabody Fire Alarm	Joseph DaSilva	(978) 531-3444		joe.dasilva@peabody-ma.gov		x		x	OHW REM on 2 spans. No force account submitted. Fire alarm can be removed in advance.	x			x		x
Astound/ RCN	Alex Ortiz Jenn Oneill	(781) 316-8878 (617) 756-9881		Alex.Ortiz@astound.com jenn.o'neill@astound.com	x		x		24F cable on Warren St, Ext. OHW transfers and new fiber splicing. (review slack/ Expedited Schedule)	x			x		x
Comcast	Wendy Brown Jason Delgado	978-848-5163 978-927-5700	(603) 541-1082 978-408-5876	wendy_brown@cable.comcast.com Jason_Delgado@comcast.com		x		x	OHW transfers. No force being submitted.	x			x		x
Verizon	Paul Diamantopoulos	(774) 409- 3160		Paul.E.Diamantopoulos@verizon.com	x		x		OHW transfers, and Guys.	x			x		x
National Grid Gas	Melissa Owens	(781) 907-2845		melissa.owens@nationalgrid.com		x		x	GG ADJ only		x		x	x	
National Grid Gas Reg Pit R&R	Cody Mehrer	(781) 747-8677		Cody.Mehrer@nationalgrid.com		x		x	Contractor to get as-builts for recently moved Reg pit on Endicott St.		x		x	x	
MBTA Bus	Joshua Weiland Miles Taylor	617-352-4845 617-721-9646		jweiland@mbta.com mtaylor@mbta.com		x		x	Bus Route 435 on Essex Drive in eastbound direction only. In the event of full depth construction on Essex drive - reach out to Miles Taylor for coordination with the busing operations/ garage.		x		x	N/A	
For Information Only															
Peabody City Engineer	William Paulitz	(978) 536-7126		William.Paulitz@Peabody-ma.gov					Lead- Notify for all work						
Peabody Water	Robert Langley	(978) 536-0600		Robert.langley@peabody-ma.gov					Coord to ADJ WG, and to install a meter on Hydrants if necessary						
Peabody Sewer	Robert Langley	(978) 536-0600		Robert.langley@peabody-ma.gov					Critical sewer main to remain active						
Peabody Police	Capt. Scott Richards Traffic Commander	(978) 538-6359		srichards@peabodypolice.org					Review use of Roadway Flaggers in advance						
Community Development	Curt Bellavance	(978) 538-5770		Curt.Bellavance@peabody-ma.gov					keep in loop for all work/Schedule						
No Facilities or No Conflicts															
S. Essex Sewer	Peter Pommersheim	(978) 744 4550	(617) 320-8049	ppommersheim@sesd.com					Sewer Interceptor Approx 1000 feet away						
MBTA Document Control Group	Christine Bresnahan	(617) 222-3361	(617) 455-7087	CBresnahan@mbta.com					No Rail or ROW affected- Property is all City of Peabody						
Crown Castle	Mark Vegnani	(508) 208-9117		Mark.Vegnani@crowncastle.com					No facilities - 2023 07 14						
MWRA Water	Rajesh Shah	617-305-5827		rajesh.shah@mwra.com					2023 7 12 No Facilities						
MWRA Sewer	Solomon Wondimu	(617) 570-5433		record.drawings@mwra.com					2023 7 7 No Facilities						
Enbridge	Kathy Aruda	(508) 938-7728 (617) 560-1442	(617) 921-4910	Kathleen.Aruda@enbridge.com					2023 7 6 facilities 1 mile away						
CSX	Michael Slipper			michael_sliper@csx.com					2021 06 07 No Facilities						
Tenn. Gas	David wood	(860) 763-6005	(413) 530-7117	KMEncroachmentsNorth@kindermorgan.com					2021 06 07 No Involvement						
First Light	Heather Araujo	(207) 432-2045		FirstLight_MA@firstlight.net					2021 06 09 Facilities on Endicott, no impact.						
VZ Wireless	Liz Glidden	(508) 245-8832		elizabeth.glidden@vzw.com					2023 7 20 No Facilities						

Utility Relocation Notes for MassDOT Contractor

Unless otherwise noted by Contract, the MassDOT Contractor is to provide the District Construction Office with 7 Calendar Days advance notification in order to validate the current progress and provide the required 30 Days advance notice-to-proceed for the first Utility - and each subsequent Utility. These advance notifications are to be identified in the Contractor's Schedules (Pre-Con preparation, Baseline, Subnets, and Updated/Monthly Schedules) as specified in Subsection 8.02 (for DBB Contracts) and/or Section 9 (of DB Contracts). Note: The durations included below do not include these lead-times. See Additional 'Important Basis notes for Contractor' - on last PUC Form page.

Additional notes:

Underpass lighting to be owned/ maintained by City of Peabody when final installation is complete
Electric manholes on Essex center drive - coordinate with property owner (Sports Medicine North) before adjust work begins
Coordinate with NGrid Gas with any work around Endicott Street regular pit, Request As-Built Plans from "Gas Data Req" <gasdatareq@nationalgrid.com>

Suggested Sequence of Relocation (Based on Consultant proposed construction staging)

The sequence as detailed on the following pages is based on the consultants proposed staging plan. This information was compiled through meetings that included all of the utilities listed below along with the designer and Peabody. The information provided is the best available information prior to project advertisement.

PUC FORM - CONTINUED

Is 'enabling' (prep) work, by the Contractor, necessary prior to the start of the first series of utility relocations:	Yes	No
	X	

Has any of the Utility work been identified to work concurrently	Yes	No
	X	

Project File #:	609211
City/Town:	Peabody
Route/Street:	Independence Greenway Extension

7/30/2025 PRINTED

massDOT Highway Division

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work. Contractor note: In planning and executing the work, the Access Restraints listed in the Special Provisions, takes precedence over the checklist in these 4 columns.				Access Restraint & Limitations of Operations Notes. Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site: Utility working with no other Utilities in vicinity	Concurrent Utilities: Utility working with other Utilities on site	Contractor Off-Site: No Contractor physical construction operations on-site (while Utility is	Contractor Concurrent: Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
Stage : 1 Phase : A			Enabling' work by the Contractor - Call in dig safe to mark out UG, Coordinate with MassDOT RE, Survey and DURE to mark poles, Curb and Back of SW, Coordinate with DURE to meet all Utilities and walk site to confirm Prop. Pole Re-Locations and delineation of work. Coord with DURE to send 30 day notices for pole work. Request WO #s from Peabody Electric for Disconnect/Reconnects for Existing / Proposed Signal(if applicable), Cobra heads(relocated by PMLP), and other work as necessary. Coordinate tree trimming/ clearing with PMLP or any other affected utility. Coordinate MBTA Bus operations for Essex Center drive - route # 435 if any disruption to their Bus route will happen during any construction activities, and for full depth.							
			UTILITY OPERATIONS - MBTA BUS Operations							
Task: 1			***Utility Co. MBTA BUS OPS***							
	c		Coord w/Bus Ops for #435 at Essex Drive for any disturbance to their route. Full depth operations, lane closures, detours, etc.			x		x	n	
			Sub-Total	**0**						
			UTILITY OPERATIONS - Existing ITS at 308+00 right							
Task: 2			***Utility Co. MassDOT ITS and Contractor***							
	C		Test pitting recommended to find, and expose existing ITS conduit for current electric message board on Rt.128			**x**		**x**	**n**	
	C		Care should be taken as not to disturb existing conduit during any excavation activities			**x**		**x**	**n**	
			Sub-Total	**0**						
Stage : 1 Phase : B			Enabling' work by the Contractor - Coordinate with Peabody Sewer Department to begin construction efforts all along their existing sewer main. Coordinate CCTV or any special sub contractor for protection/ monitoring of sewer main, as built CCTV, etc.							
			UTILITY OPERATIONS - Sewer, clearing and grubbing, path construction							
Task: 3			***Contractor***							
	c		Coordinate CCTV operations of existing sewer line, culverts, existing pipes.			x		x	n	
	c		Confirm all clearing and grubbing limits, and tree trimming needed			x		x	n	
	c		Agree on access needed for sewer department, and maintain during construction			x		x	n	
			Sub-Total	**0**						
Stage : 1 Phase : C			Enabling' work by the Contractor - Coordinate with PMLP to begin utility pole relocations. Determine material and install lead times for all the utility pole moves - This has bee identified as a Possible early action Item. Dig Safe, Meet with DURE &RE, Stake out poles, guy wires, confirm any critical clearances(ADA or path construction), Verify if Contractor or PMLP will Perform Tree Trimming, Clearing, confirm tree trimming requirements, ensure access is created for all UPL relocations.							
			UTILITY OPERATIONS - Utility poles, guy anchors, OHW transfers, guy poles							
Task: 4			***Utility Co. Peabody Municipal Light Plant (PMLP)***							
	c		Confirm all necessary clearing and access is done for PMLP or if they will do some trimming themselves.							
		u	Install Poles & transfer OHW(primaries & secondaries), Guys, Strand, Flood Lights, any cobra heads, and Police Camera	12	x			x		
		u	343+50 - left: Pole #5 Adjust guy anchors to existing pole. Contractor to confirm access and clearing performed for PMLP	1	x			x		DUCE Estiamte
			Sub-Total	**13**						
Task: 5			***Utility Co. Fire Alarm***							
		u	Remove inactive Cable 1 or 2 spans only - Consider this may have been done in advance. - no force account.	1	x			x		*DUCE ESTIMATE*
			Sub-Total	**1**						
Task: 6			***Utility Co. Astound/ RCN***							
		u	Transfer OHW & splice new fiber -(Review slack and duration in advance with Astound, - If slack is available time saving possible)	58	x			x		
			Sub-Total	**58**						
Task: 7			***Utility Co. Comcast***							
		u	Transfer OHW to new poles - no force account being submitted.	4	x			x		*DUCE ESTIMATE*
			Sub-Total	**4**						
Task: 8			***Utility Co. Verizon***							
		u	Transfer OHW to new poles	4	x			x		
		u	Install guy anchor attachments	4	x			x		
			Sub-Total	**8**						
Task: 9			***Utility Co. Peabody Municipal Light Plant (PMLP)***							
	c		Remove old UPL's	1	x			x		*DUCE ESTIMATE*
			Sub-Total	**1**						
			Total OHW Relocations	**85**						
Stage 3 Phase A			Enabling' work by the Contractor - Call in dig safe, notify MBTA bus operations, saw cutting, environmental controls throughout project. Coordinate with utilities to adjust structures in advance of full depth box widening and milling/ paving operations. Set grades for all structures to be adjusted. Coordinate with North Shore Sports Medicine to adjust electric MH's on Essex Center Drive.							
			UTILITY OPERATIONS - Adjust structures for finish grade including full depth on Essex drive, and path construction							
Task: 10			***Utility Co.***							
	U		NGrid gas - adjust gates	2		**x**		**X**		*DUCE ESTIMATE*
	U		Verizon - adjust telephone manholes	2		**x**		**X**		*DUCE ESTIMATE*
	C		Adjust water gates, drainage, sewer, traffic signal HH(if applicable), Electric MH's along Essex Center Drive							
	C		Sewer remodels and adjusts							
			Sub-Total	**4**						
			National Grid Gas - No force account, but work in area							
Task: 11			***NGrid Gas / Contractor to coordinate work***							
		u	At 75 Endicott St National Grid just completed the installation of a plastic main across the Proctor Brooke bridge and the regulator station. Work scheduled in 2024 to replace gas main on #54-91 Warren Street.							
	c		For any gas gate work please contact Michael Colpitts 978-778-5750							
			Sub-Total	**0**						
			Peabody Municipal Light							
Task: 12			***Pedestrian lighting under bridge***							
	c		Coordinate with PMLP to disconnect/ reconnect to work on lighting							
	c		Set up final inspection of lighting with PMLP and Owner (City of Peabody)							
			Sub-Total	**0**						

IMPORTANT BASIS NOTES - FOR CONTRACTOR

1. Unless otherwise specified in the MassDOT Construction Contract, or unless specifically noted within this PUC Form, these durations (herein) are based upon the Contractor providing *unimpeded access* to the Utility company to perform Utility relocations (see Note 5 - Access).
2. "Concurrent Utilities" operations noted herein, are to signify those Utility Company operations that can be worked concurrently (e.g. Utility A and Utility B work on-site together) - MassDOT and the Contractor are to prepare NTPs to Utilities accordingly.
3. "Potential Access Restraints" noted within this PUC Form are for planning purposes. See MassDOT Contract for Contractual Access Restraints (refer to Subsections 8.02, 8.03, and/or 8.06 for Design Bid Build Contracts and Volume II Section 9 for Design Build Contracts).
4. Utility non-work periods - For planning purposes, the durations above contain some non work days (contingency) for New England conditions (precipitation, high temperatures, low temperatures, snow, ice). Gas line work however, typically has a seasonal restriction and can NOT be installed from 15-November to 15-March. Municipally Owned Electric and Gas Utilities are also restricted from proceeding from 15-November to 15-March. The Contractor shall (and the CTD plan) reflect this calendar restriction within the schedule (unless otherwise note).
5. Access - Unless otherwise noted in the Contract, and in addition to the 'enabling' notes above, the Contractor must provide safe and unimpeded access (for trucks, lifts, cranes, etc.) to the Utilities, to allow for the proposed relocation(s) - including but not limited to snow removal, clearing and grubbing, guard rail removal, barrier removal, tree removal, and grading. Any costs associated with these tasks are deemed to be incidental to the project.
6. For all MassDOT construction contracts issued after January 2014, the new Utility Coordination/documentation specification is required. This is Section 8.14 in Design-Bid-Build Contracts (see Design-Build index reference for applicable section #).
7. Prior to starting any and all enabling work for Utilities, the Contractor is to plan in advance with submittals and approved durations.
8. * Potential District Initiated Early Utility Relocation - if noted herein, the District reserves the right to initiate early utility relocation in advance of the Contract NTP. In submitting a bid price and in the development/basis of the Baseline Schedule, the Contractor shall not plan the Work with the potential benefit of any form of 'early utility relocation.' As a requirement of the Baseline submission, unless otherwise noted in this Specification, the earliest that the first Utility company is to receive the 30 days advance notification to mobilize to the site, will be 7 calendar days after the pre-construction meeting and never sooner than 7 days after the Contract NTP.
9.

Project Name: Peabody Independence Greenway

Project File No.: 609211 **Respon. for Design:** Municipality

Prepared By:

Revision Date: 7/30/2025 **Design Stage:** PS&E 5 DUCE

Notes: **1) Offsets are measured to center of pole unless otherwise noted.**

3) Occupant: P = Power; T = Telephone; C = Cable TV; F = Fire Alarm; J = Joint

4) Locations shall not be changed without approval of MassDOT and/or the Utility Companies

		Existing Pole Information						Proposed by Designer											MassDOT / Utility Company Comments
Line No.	Sheet No.	Pole No.	Streetlight ("X" if Yes)	Risers ("X" if Yes)	Station	Offset		Cut (6 Inch + Changes ONLY)	Fill (6 Inch + Changes ONLY)	Retain/ Relocate/ Replace	Reason	Station	Offset		GPS Coordinates (MA State Plane NAD 83) Northing	GPS Coordinates (MA State Plane NAD 83) Easting	Min. Offset (ft) Face of Curb to face of Pole (Existing or Proposed)	Design Exception Req. (Horizontal Offset)	Designer Comments	
1	21	1	X		290+48.02	15.39	LT	N/A	N/A	RETAIN					3020886.8113	805114.1219	2.22		Retain pole	
2	21	6	X		304+13.08	62.01	LT	N/A	N/A	RETAIN					3021218.2320	806316.0370	3.00'		Retain pole	
3	21	7			308+03.06	14.95	RT	N/A	N/A	RETAIN					3021041.9701	805917.6500	1.00'		Retain pole	
4	22	12 S			316+17.71	17.79	RT	N/A	N/A	RETAIN					3020667.0482	805194.3565	5.40		Retain pole and guy	
5	22	12	X		316+60.62	17.49	RT	N/A	N/A	RETAIN					3020646.8424	805156.5208	5.10		Retain pole	
6	22	3-81, 853-6			317+82.18	17.56	RT	N/A	N/A	RETAIN					3020590.3593	805048.8577	4.93		Retain pole and guy	
7	22	853-5			N.A.	N.A.	RT	N/A	N/A	RETAIN					3020544.5829	804959.3482	5.53		Retain pole	
8	22	2			318+48.96	34.56	RT	N/A	N/A	RETAIN					3020520.6493	804990.0016	28.54		Retain pole	
9	22	3	X		318+49.64	10.87	LT	N/A	N/A	RELOCATE	CONFLICT	318+07.39	19.04	LT	3020541.0998	805030.5751	5.16		Proposed pole relocation and replace 10' sidewalk anchor guy (BO-PMLP)	
10	23	4			330+71.03	21.63	LT	N/A	N/A	RETAIN					3020222.8727	806185.2919	15.60*		Retain pole	
11	23	5			343+45.18	33.43	LT	N/A	N/A	RETAIN					3019838.2330	807402.4420	26.90*		Retain pole and guy	
12	24	29			345+62.26	40.43	LT	N/A	N/A	RETAIN					3019745.9640	807606.6700	34.18*		Retain pole and guy	
13	24	28	X		347+48.93	8.11	LT	N/A	N/A	RELOCATE	CONFLICT	347+12.56	14.15	LT	3019638.2549	807714.7071	4.13*		Proposed pole relocation (BO-PMLP)	
14	24	27	X		349+09.94	6.97	RT	N/A	N/A	RELOCATE	CONFLICT	349+9.78	8.00	RT	3019498.3469	807856.5716	1.00*		Proposed pole relocation and replace 20' guy wire (BO-PMLP)	
15	24	26			350+63.25	2.01	LT	N/A	N/A	RELOCATE	CONFLICT	350+27.64	9.23	LT	3019467.3597	807971.5872	1.00*		Proposed pole w/ camera relocation and replace 15' guy wire (BO-PMLP)	
16	24	166/25/10-3			352+05.78	32.86	LT	N/A	N/A	REPLACE	Upgrade Pole	SAME HOLE - Cut and Kick			3019393.6517	808138.5173	25.58*		Replace pole and 20' guy (BO-PMLP)	
*Note: No vehicle access is expected																				

Total - Remove & Reset	4
Total - Replace	1
Total - Proposed	0
Total - Upgrades	0

Proposal No. 609211-132091

A00808 - 5

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00810

MassDOT Herbicide Use Report

Proposal No. 609211-132091

MassDOT Herbicide Use Report

Date Submitted:

Use multiple sheets for multiple application techniques or sites as needed.

Contractor Performing Work:

Project or Contract No:

Town/s:

Associated Route:

Project Description:

MDAR ALERT*:

Treatment Description:

Area Treated (as applicable)

Acres: **Sq Yds:** **Miles:**

Weeds Targeted:

Gallons Formula Used:

Application Method:

Date/Time Began:

Date/Time End:

Product Used:

Name: _____	Name: _____	Name: _____
EPA Reg. No: _____	EPA Reg. No: _____	EPA Reg. No: _____
% Active Ingredient	% Active Ingredient	% Active Ingredient
Dry: _____	Dry: _____	Dry: _____
Liquid: _____	Liquid: _____	Liquid: _____
Formulation (dilution rate): _____	Formulation (dilution rate): _____	Formulation (dilution rate): _____

Additional products used (surfactants, etc.) or other information:

Applicators: **License Numbers:**

* Please note:
EDRR Species (MAM, Hogweed, Pepperweed, Kudzu, etc.)
Tree of Heaven 1) stands of >20 trees; 2) >5 trees near nursery, landscape company, or highway rest area where trucks stop

Upon completion, please submit form to MassDOT District Engineer and Landscape Design Section in Boston office.

07/18/2018

DOCUMENT A00811

WATERING LOG
for
MassDOT Plantings

Watering Log for MassDOT Plantings

Project Description:

Contract No:

Project No:

Plant Locations/s: (Attach planting plan/s as necessary)

Notes:

	Separate logs shall be kept to track areas or plants with different watering schedules. Trees shall receive a minimum of 10 gallons with each watering and shrubs a minimum of 5 gallons. Provide note that if watering is not performed as scheduled due to rain. Record date of rainfall and amount.												
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													

Each week, following watering, Log shall be submitted to the MassDOT Engineer.
6/15/2018

DOCUMENT A00820

Massachusetts Department of Transportation
Conditions of Custody

REQUEST FOR RELEASE OF MASSDOT AUTOCAD FILES FORM
(Only to be used following award of contract)

City/Town: PEABODY Project File Number: 609211

Contract Number: 132091

Project Description: Independence Greenway Extension

All AutoCAD files are provided solely as a courtesy to facilitate public access to information. MassDOT attempts to provide current and accurate information but cannot guarantee so. MassDOT provides such documents, files or other data "as is" without any warranty of any kind, either expressed or implied, including but not limited to, accuracy, reliability, omissions, completeness and currentness. The Commonwealth of Massachusetts and its Consultants shall not be liable for any claim for damages, including lost profits or other consequential, exemplary, incidental, indirect or special damages, relating in any way to the documents, files or other data accessible from this file, including, but not limited to, claims arising out of or related to electronic access or transmission of data or viruses. Because data stored on electronic media can deteriorate undetected or be modified without our knowledge, MassDOT cannot be held liable for its completeness or correctness. MassDOT makes no representation as to the compatibility of these files beyond the version of the stated CAD software.

By signing this form, I agree that it shall be my responsibility to reconcile this electronic data with the conformed contract documents, and that only the conformed contract documents shall be regarded as legal documents for this Project. I understand that this authorization does not give me the right to distribute the files. I agree to the terms above and wish to receive the AutoCAD files.

This signed form shall be emailed to the Highway Design Engineer at the MassDOT -Highway Division at the following email address:

DOTHighwayDesign@dot.state.ma.us
Attn: AutoCAD Files

Name of person requesting AutoCAD files: _____

Affiliation/Company: _____

Address: _____

_____

Telephone number: _____

Email address: _____

Signature/Date: _____

THIS PAGE IS INTENTIONALLY LEFT BLANK

DOCUMENT A00829

ARMY CORPS OF ENGINEERS
AND
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMBINED APPLICATION

THIS PAGE INTENTIONALLY LEFT BLANK

May 15, 2024

Heidi Davis
Massachusetts Department of Environmental Protection
Wetlands Program
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: **Water Quality Certification Application**
BRP WW 26 Combined Application for Minor Fill and Minor Dredging Project Certification
Independence Greenway Extension
Peabody, MA
MassDOT File No. 609211

Dear Ms. Davis:

On behalf of the City of Peabody, with construction funding from the Massachusetts Department of Transportation (MassDOT) Highway Division, Green International Affiliates, Inc. is submitting this Joint Application for 401 Water Quality Certification (WQC) for Minor Fill and Minor Dredging Projects (BRP WW 26) and 404 ACOE Pre-Construction Notification (PCN) for the proposed Independence Greenway Extension in the City of Peabody.

The project requires a 401 WQC and authorization under Section 404 as the construction of the proposed Independence Greenway Extension is anticipated to permanently impact approximately 10,343 square feet and will temporarily impact approximately 2,082 square feet of Land under Water/Waters of the U.S. and will also result in approximately 1,491 cubic yards of dredging below the Ordinary High Water mark . The project is anticipated to permanently impact approximately 2,225 square feet and will temporarily impact approximately 4,641 square feet of Vegetated Wetlands (VWs). A Notice of Intent application for the proposed work has been submitted to the Peabody Conservation Commission on April 10, 2024 under the Wetlands Protection Act and its implementing regulations 310 CMR 10.00. on April 9, 2024 and is currently under the Commission's review (DEP File No. 055-0939).

A pre-filing site visit for this project was held with the Massachusetts Department of Environmental Protection (MassDEP) on February 26, 2024. The project proponent hereby certifies that all information contained herein is true, accurate, and complete to the best of my knowledge and belief. The project proponent hereby requests that the certifying authority review and take action on this CWA 401 certification request within the applicable reasonable period of time.

If you require any additional information regarding the subject project, please contact me at (978) 843-5218 or by email at dspicer@greenintl.com.

Sincerely,
Green International Affiliates, Inc.

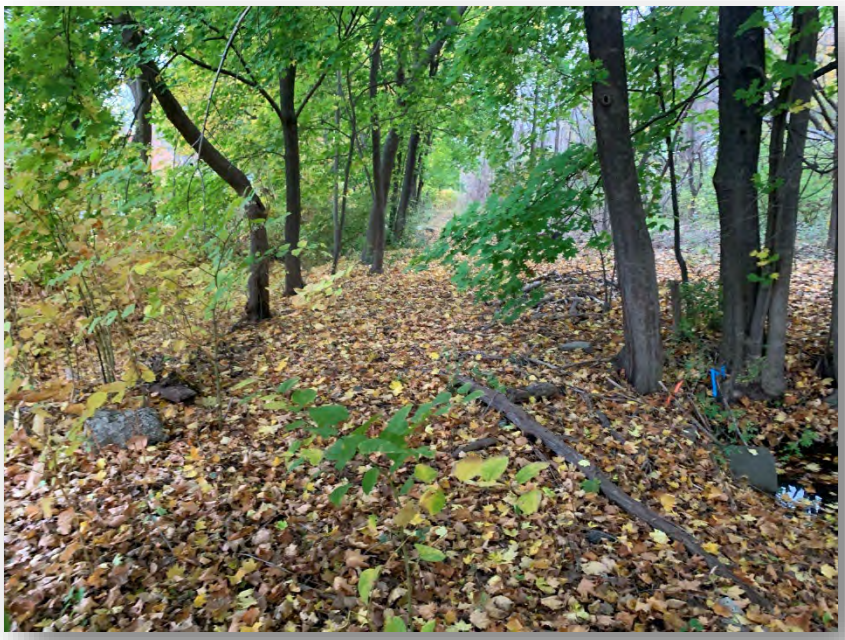
Danielle H. Spicer, P.E.
Stormwater & Permitting Group Leader

CC: Dan Vasconcelos, US Army Corps of Engineers
Tyler Lewis, MassDEP
Ryan Hale, MassDEP
Stephanie Upson, MassDOT PM
Melissa Lenker, MassDOT, Wetlands and Water Resources Supervisor
Erica Larner, MassDOT, Wetlands and Water Resources Coordinator
Peabody Conservation Commission DEP – Northeast Region

JOINT APPLICATION FOR 401 WATER QULAITY CERTIFICATION
AND 404 PRE-CONSTRUCTION NOTIFICATION

Independence Greenway Extension
Peabody, Massachusetts

MassDOT Project No. 609211



Prepared for

City of Peabody

May 15, 2024

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.

Building Strong Client Relationships Through Engineering Excellence

TABLE OF CONTENTS

WATER QUALITY CERTIFICATE AND ACOE PCN FORMS 3

1.0 INTRODUCTION AND OVERVIEW 1

2.0 EXISTING CONDITIONS 2

2.1 Property Information 2

2.2 Description of Water Bodies Adjacent to Project Site 4

3.0 PROPOSED CONDITIONS 5

4.0 ANTICIPATED CONSTRUCTION SEQUENCE 6

5.0 IMPACTS TO WATERS OF THE UNITED STATES 7

5.1 Permanent Vegetated Wetland and Land Under Water/Waters of the United States Impacts 7

5.2 Temporary Vegetated Wetland Land Under Water/Waters of the United States Impacts 9

5.3 Bank Impacts 10

6.0 RESOURCE AREA IMPACTS MITIGATION 11

6.1 Wetland Replication 11

6.2 Floodplain Impacts Mitigation 11

6.3 Streambed and Bank Impacts Mitigation 11

6.4 Stormwater Mitigation 12

6.5 Other Mitigation Activities 12

7.0 SEDIMENTATION CONTROL MEASURES 12

8.0 DEWATERING 12

9.0 STORMWATER MANAGEMENT 13

10.0 FISHERIES AND WILDLIFE / NATURAL HERITAGE ENDANGERED SPECIES / VERNAL POOLS 13

11.0 STREAM CROSSING NARRATIVE 14

12.0 ALTERNATIVES ANALYSIS 18

13.0 CONCLUSION 26

APPENDICES 27

APPENDIX A – PUBLIC NOTICE 28

APPENDIX B - WETLANDS DELINEATION REPORT WITH DATA FORMS 29

APPENDIX C – PHOTOS 30

APPENDIX D – SPECIAL PROVISIONS 31

APPENDIX E – FIGURES 32

APPENDIX F – SEDIMENT SAMPLING PLAN APPROVAL & REPORT 33

APPENDIX G – STORMWATER MANAGEMENT REPORT (BOUND SEPARATELY) 34

APPENDIX H – WQC/ACOE SUBMISSION PLANS (BOUND SEPARATELY) 35

WATER QUALITY CERTIFICATE AND ACOE PCN FORMS

(This page is left blank for double sided printing)

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

WW26 - Combined Licenses/Permits for Waterways and Water Quality Certification Application

Permittee Information

Name:

Phone: (978) 538-5780
Address: CITY OF PEABODY, 24 LOWELL STREET (CONTACT: BRENDAN CALLAHAN)
PEABODY, MA 01960

Application Submitter Information

Name: OXANA FARTUSHNAYA
Phone: (978) 843-5276, (857) 753-9193
Address: 100 AMES POND DRIVE, SUITE 200
TEWKSBURY, MA 01886

Location Information

Proctor Brook
0 N/A - FORMER B & M RAILROAD EASEMENT PEABODY, MA 01960
Latitude: 42.532867
Longitude: 70.938436

Pre-Consultation Information

Have you consulted with MassDEP about the combined application process?	Yes
Date you consulted with MassDEP	02/26/2024

Application Information

Please select the 401 Water Quality Certification for Dredging Application (if applicable)	WW08 - 401 Minor Dredging - Minor < 5000 cubic yards
Please select the 401 Water Quality Certification for Fill/Excavation Application (if applicable)	WW10 - 401 Major Fill and Excavation - Major >= 5000 square feet

Other Primary Location Info

Parcel ID	Map# 062, 063, 074; no assigned Parcel ID
Municipality	PEABODY

Project Location Info

Will the project occur in multiple municipalities?	No

Pre-Application Information

Has the DEP Agency specified that you are exempt from this process?	No
Has the project's Sampling Analysis Plan been approved by the DEP Agency? If yes, please attach a document 'DEP Sampling Analysis Plan' in the document section.	Yes

Project Information

Project Name	Independence Greenway Extension, City of Peabody
Have you completed the Public Notice as per 314 CMR 9.00? If yes, please attach a completed ‘Proof of Public Notice’ document in the document section.	Yes
Date of Public Notice per 314 CMR 9.05(3)	05/23/2024
Name of the Local Newspaper	Peabody Weekly News
Will the proposed project occur in any wetlands or waters designated as 'Outstanding Resource Waters'?	No
Identify the loss, or alteration, in square feet for Land under water	12425
Identify the loss, or alteration, in square feet for Other Resources	6866

Material to be Dredged

Briefly describe in general the proposed project or activity, including the purpose and intended use of the project, and the duration of the work within any waterbody	This Joint Application for 401 Water Quality Certification (WQC) and 404 ACOE Pre-Construction Notification (PCN) has been prepared on behalf of the City of Peabody for the Independence Greenway Extension transportation improvement project in the City of Peabody. The City of Peabody with construction funding from the Massachusetts Department of Transportation, Highway Division (MassDOT) proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles (MassDOT Project No. 609211). The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody. The Independence Greenway Extension project is a continuation of a rail trail facility that can be utilized by pedestrians and bicyclists for recreation or for short-range trips to businesses or other destinations along the Greenway. This project will expand the City's network of bicycle routes and provide a dedicated bike trail between the busy Northshore Mall and residential/commercial areas adjacent to downtown Peabody. The project will consist of the following improvements: • Modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared use path; • Construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street; • Construction of a light duty timber boardwalk structure supported on helical piles; • Various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and • Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements. The project requires a 401 WQC and authorization under Section 404 as the construction of the proposed Independence Greenway Extension is anticipated to permanently impact approximately 10,343 square feet and will temporarily impact approximately 2,082 square feet of Land under Water/Waters of the U.S. and will also result in approximately 1,491 cubic yards of dredging below the Ordinary High Water mark. The project is anticipated to permanently impact approximately 2,225 square feet and will temporarily impact approximately 4,641 square feet of Vegetated Wetlands (VWs). A filing of a Pre-Construction Notification (PCN) Form in accordance with Section 404 with the U.S. Army Corps of Engineers under GP 7, 9, 23, and 24 will also occur concurrently with this Section 401 WQC filing. A Notice of Intent application for the proposed work has been submitted to the Peabody Conservation Commission on April 10, 2024 under the Wetlands Protection Act and its implementing regulations 310 CMR 10.00. on April 9, 2024 and is currently under review (DEP File No. 055-0939). In addition, the proposed work exceeds the activity thresholds described in 301 CMR 11.03 (3)(b)(1)(f), 301 CMR 11.03(3)(b)1(d); and 301 CMR 11.03(3)(b)1(b); consequently, the project is cutrently undergoing a MEPA review process by the Executive Office of Energy and Environmental Affairs (EEA) (EEA File No. 16778). The anticipated duration of construction is a period of 24 months. (see Project Narrative for more information).
Proposed Start Date	12/21/2024
What is the expected frequency of maintenance dredging of this project?	N/A

Length of the proposed project (If applicable, please include the maximum and minimum)	110 (maximum near Culvert# 1 location)
Width of the proposed project (If applicable, please include the maximum and minimum)	110 (maximum near Culvert# 1 location)
Depth of the proposed project (If applicable, please include the maximum and minimum)	4 (maximum at all locations)
Volume of the proposed project(Cubic yards)	1,491
Type of proposed project	Improvement dredging
Briefly describe the physical dredging operation (such as., dredging methods), the method of release of the dredged material into the disposal site, and the name of the contractor if other than the applicant. (Please attach a detailed document - "Dredging and Disposal Operation" in the document section of the application)	Construction means and methods will ultimately be determined by the project contractor. Excess material will be disposed of at the State designated disposal upland site as needed. There will be no ocean disposal.
Briefly describe all measures designed to avoid and minimize adverse impacts of the project on aquatic life and the aquatic ecosystem. Where impacts cannot be avoided or minimized, what mitigation measures are proposed? (If necessary, please attach a document - "Performance Standard to avoid and minimize and mitigate impact" in the document section of the application)	The extent of dredging will not exceed that reasonably necessary to accommodate the need for culvert structure replacements and adjacent scour protection and bank stabilization countermeasures. The design and timing of dredging and dredged material disposal activity will minimize impacts on aquatic life and the aquatic ecosystem to the maximum extent feasible. The disturbed areas will be stabilized and restored upon completion of construction. During construction, sediment control barriers will be installed on both sides of the structure to protect the adjacent resource areas. The erosion controls will be maintained in good condition until on-site soils are stabilized.
Does the proposed project have any past history of chemical or oil spills of discharge?	Yes
Does the proposed project have any past history of Upstream or on-site industrial or municipal discharge within 1,000 feet of the proposed project?	No
Does the proposed project have any past history of chronic pollutant loading from port or harbor use and/or other sources of pollutants? (eg. CSO or POTW discharges)	No
Please provide as much historical information as you have, including dates, amounts, concentrations, etc. of such spills or discharge. If necessary, please attach a document - "Due diligence Review".	See "Due Diligence Review" document in the Attachments.

Proposed Ocean Site

Location of proposed disposal site and its physical boundaries	N/A

Has the site been designated by the State or E.P.A. as a dredge disposal site?	No
If no, give a brief description of the characteristics of the proposed disposal site and an explanation as to why no currently designated site is feasible for this project.	When suitable, dredged materials will be reused as structural fill on site to the maximum extent practicable. Excess material will be disposed of at the State designated disposal upland site as needed. There will be no ocean disposal.
Is the anticipated disposal site located within a designated ocean sanctuary as established by federal law or G.L.c. 132A, sec. 13?	No

Disposal/Dewatering Land Site

Location of proposed disposal and dewatering sites and physical boundaries	It is anticipated that a NPDES Construction General Permit (CGP) will be required for the project; therefore, if trench dewatering is needed, all pumped effluent will be done in compliance with the dewatering requirements within the CGP. There will be no direct discharge of pumped water into any wetland, resource area, or closed drainage system. Dewatering of excavated stream bed materials shall take place on an impervious surface within or near the project site. Material will be stockpiled at the construction staging area and reused as fill when suitable.
Indicate drainage characteristics of dewatering and disposal sites from the results of test pits, borings, and percolation tests as applicable	Material will be stockpiled at a construction staging area and reused as structural fill on site when found to be suitable.
How long are the dewatering and disposal sites estimated to be in use from this project?	Areas of temporary storage and dewatering of excavated riverbed materials should only be in use for the duration of this project. It is expected that much of the material will be re-used at the site as fill. The dewatering site will not be used for any future project. Means and methods will ultimately be determined by the contractor.

Proposed Barge Site

Are you proposing dewatering of dredged sediment on a barge? If yes, please attach a document 'Plans for adequate containment' in the document section.	No

Grain Size Analysis

Number of Sieve	Percentage of total by weight passing
4	67.8
10	50
40	25.4
60	21.7
200	17.7
4	59.1
10	50.7
40	36.2
60	29.9
200	15.1

Chemical Analysis of Sediment

Average Concentration (In ppm)
2.66 (Culvert 1); 4.84 (Culvert 2); 5.53 (Boardwalk)
0.31 (Culvert 1); 0.48 (Culvert 2); 0.73 (Boardwalk)
14.9 (Culvert 1); 96.7 (Culvert 2); 130.0 (Boardwalk)
ND (Culvert 1); 57.0 (Culvert 2); 29.6 (Boardwalk)
17.0 (Culvert 1); 51.0 (Culvert 2); 110.0 (Boardwalk)
0.011 (Culvert 1); 0.085 (Culvert 2); 0.098 (Boardwalk)
ND (all locations)
29.2 (Culvert 1); 43.4 (Culvert 2); 41.4 (Boardwalk)

Additional Information

Is your project subject to U.S. Army Corps of Engineers – Section 404 of Federal Clean Water Act? If yes, please attach a document 'USACE Authorization' in the document section.	Yes
USACE File Number	TBD - pending

Is your project subject to Massachusetts Environmental Policy Act (MEPA)? If yes, application cannot be submitted until 1) the MEPA process is completed and 2) a Final certificate issued by MEPA is submitted to the “Document(s)” Tab. If no, please attach a document with justification that this project is not subject to MEPA review in the document section (including addressing the applicability of the MEPA review thresholds at 301 CMR 11.03)	Yes
MEPA File Number	16778
Date of MEPA Certificate Issuance	05/24/2024
Is your project subject to Massachusetts Wetlands Protection Act?	Yes
MassDEP Wetlands File Number(s)	055-0939
Is the project going to impact Eelgrass bed? If yes, please attach a document 'Eelgrass Management Plan' in the document section.	No
Does this project contain an attached written Alternatives Analysis? If yes, please attach a document 'Alternatives Analysis' in the document section.	Yes
If yes, does this Alternatives Analysis screen all practicable alternatives to the proposed discharge that would have less adverse impact on the aquatic ecosystem?	Yes
Does this project require a license from the Federal Energy Regulatory Commission?	No
Is any of your proposed work exempt from the Massachusetts Wetlands Protection Act or taking place in a federal non-state wetland?	No

Statement and Disclosures

Proposed dredging activity or dredged material management might occur within Rare Species Habitat as defined at 314 CMR 9.02. By checking this box, you agree that you have consulted with the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife. Please attach a 'NHESP Determination Letter or Conservation Management Permit' in the document section.	

Any in-water activity may effect fish or shellfish, spawning and/or habitat.
By checking this box, you agree that you have consulted with Massachusetts Division of Marine Fisheries (DMF) and/or Massachusetts Division of Fisheries and Wildlife (DFW) about Time of Year Restriction (TOY).
Please attach Consultation Letter from DMF and/or DFW in the document section.

Project Information

Project Name	Independence Greenway Extension, City of Peabody

Proposed Activity

This Joint Application for 401 Water Quality Certification (WQC) and 404 ACOE Pre-Construction Notification (PCN) has been prepared on behalf of the City of Peabody for the Independence Greenway Extension transportation improvement project in the City of Peabody. The City of Peabody with construction funding from the Massachusetts Department of Transportation, Highway Division (MassDOT) proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles (MassDOT Project No. 609211). The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody.

The Independence Greenway Extension project is a continuation of a rail trail facility that can be utilized by pedestrians and bicyclists for recreation or for short-range trips to businesses or other destinations along the Greenway. This project will expand the City's network of bicycle routes and provide a dedicated bike trail between the busy Northshore Mall and residential/commercial areas adjacent to downtown Peabody.

The project will consist of the following improvements:
• Modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared use path;
• Construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street;
• Construction of a light duty timber boardwalk structure supported on helical piles;
• Various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and
• Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements.

The project requires a 401 WQC and authorization under Section 404 as the construction of the proposed Independence Greenway Extension is anticipated to permanently impact approximately 10,343 square feet and will temporarily impact approximately 2,082 square feet of Land under Water/Waters of the U.S. and will also result in approximately 1,491 cubic yards of dredging below the Ordinary High Water mark. The project is anticipated to permanently impact approximately 2,225 square feet and will temporarily impact approximately 4,641 square feet of Vegetated Wetlands (VWs). A filing of a Pre-Construction Notification (PCN) Form in accordance with Section 404 with the U.S. Army Corps of Engineers under GP 7, 9, 23, and 24 will also occur concurrently with this Section 401 WQC filing.

A Notice of Intent application for the proposed work has been submitted to the Peabody Conservation Commission on April 10, 2024 under the Wetlands Protection Act and its implementing regulations 310 CMR 10.00. on April 9, 2024 and is currently under review (DEP File No. 055-0939).

In addition, the proposed work exceeds the activity thresholds described in 301 CMR 11.03 (3)(b)(1)(f), 301 CMR 11.03(3)(b)1(d); and 301 CMR 11.03(3)(b)1(b); consequently, the project is cutrently undergoing a MEPA review process by the Executive Office of Energy and Environmental Affairs (EEA) (EEA File No. 16778).

The anticipated duration of construction is a period of 24 months. (see Project Narrative for more information).

Project Type

Industrial

Utility

Real Estate Subdivision	
Institutional	
Other	Yes
Please provide additional information for the selection of your project major type	This Joint Application for 401 Water Quality Certification (WQC) and 404 ACOE Pre-Construction Notification (PCN) has been prepared on behalf of the City of Peabody for the Independence Greenway Extension transportation improvement project in the City of Peabody. The City of Peabody with construction funding from the Massachusetts Department of Transportation, Highway Division (MassDOT) proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles (MassDOT Project No. 609211). The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody. The Independence Greenway Extension project is a continuation of a rail trail facility that can be utilized by pedestrians and bicyclists for recreation or for short-range trips to businesses or other destinations along the Greenway. This project will expand the City's network of bicycle routes and provide a dedicated bike trail between the busy Northshore Mall and residential/commercial areas adjacent to downtown Peabody. The project will consist of the following improvements: • Modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared use path; • Construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street; • Construction of a light duty timber boardwalk structure supported on helical piles; • Various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and • Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements. The project requires a 401 WQC and authorization under Section 404 as the construction of the proposed Independence Greenway Extension is anticipated to permanently impact approximately 10,343 square feet and will temporarily impact approximately 2,082 square feet of Land under Water/Waters of the U.S. and will also result in approximately 1,491 cubic yards of dredging below the Ordinary High Water mark. The project is anticipated to permanently impact approximately 2,225 square feet and will temporarily impact approximately 4,641 square feet of Vegetated Wetlands (VWs). A filing of a Pre-Construction Notification (PCN) Form in accordance with Section 404 with the U.S. Army Corps of Engineers under GP 7, 9, 23, and 24 will also occur concurrently with this Section 401 WQC filing. A Notice of Intent application for the proposed work has been submitted to the Peabody Conservation Commission on April 10, 2024 under the Wetlands Protection Act and its implementing regulations 310 CMR 10.00. on April 9, 2024 and is currently under review (DEP File No. 055-0939). In addition, the proposed work exceeds the activity thresholds described in 301 CMR 11.03 (3)(b)(1)(f), 301 CMR 11.03(3)(b)1(d); and 301 CMR 11.03(3)(b)1(b); consequently, the project is cutrently undergoing a MEPA review process by the Executive Office of Energy and Environmental Affairs (EEA) (EEA File No. 16778). The anticipated duration of construction is a period of 24 months. (see Project Narrative for more information).

Proposed Areal Extent Info

Bordering Vegetated Wetland (sqft)	6866
Isolated Vegetated Wetland (sqft)	0
Non-tidal Land Under Water (sqft)	12425
Salt Marsh (sqft)	0
Land Under the Ocean (sqft)	0
Intertidal Zone (sqft)	0
Total cumulative loss (sqft)	19291

Compliance with 314 CMR 9.00

Does the proposed project meet the definition of a Single and Complete Project at 314 CMR 9.02?	Yes
Does the proposed project include "multi-phased activities"?	Yes
Does the proposed project meet the definition of an Ecological Restoration Project?	No
Have you completed the Public Notice as per 314 CMR 9.05(3)? If yes, please attach a completed 'Proof of Public Notice' document in the document section.	Yes
Date of Public Notice per 314 CMR 9.05(3)	05/23/2024
Does the required Alternatives Analysis screen all practicable alternatives to the proposed discharge that would have less adverse impact on the aquatic ecosystem?	Yes
Does this proposed project meet the definition of Water-Dependent at 314 CMR 9.02?	Yes
Is the proposed project restricted to access to one dwelling unit?	No
Will the cumulative discharges of dredged or fill material to Waters of the United States within the Commonwealth exceed 1 acre in areal extent?	No
Report the areal extent, as expressed in square feet, of all proposed restoration or replication of Bordering Vegetated Wetlands and/or Isolated Vegetated Wetlands	2500 (Proposed Wetland Replication Area); 4,641 (Restoration or temporary disturbed wetlands)
Will any proposed discharges of dredged or fill material or any proposed restoration or replication occur within Rare Species Habitat as defined at 314 CMR 9.02?	No

Will the proposed project include or consist of the construction of a new non-tidal crossing of any Land Under Water?	No
Will the proposed project include or consist of the construction of a new tidal crossing of any Land Under Water?	No
Will the proposed project include or consist of the repair, replacement, and/or expansion of an existing non-tidal crossing of any Land Under Water?	Yes
If yes, will such repair, replacement, and/or expansion of an existing crossing comply with the Massachusetts River and Stream Crossing Standards (March 8, 2012) to the maximum extent practicable (see Practicable at 314 CMR 9.02)?	Yes
Will the proposed project include or consist of the repair, replacement, and/or expansion of an existing tidal crossing of any Land Under Water?	No
Does the proposed project include any amount of discharges of dredged or fill material to any Outstanding Resource Water?	No
Will any proposed "discharge of dredged or fill materials" occur within any certified Vernal Pool (as defined at 314 CMR 9.02)?	No

Additional Information

Is your project subject to Massachusetts Environmental Policy Act (MEPA)?	Yes
MEPA File Number (if available)	16778
Date of MEPA Certificate Issuance (if available)	05/24/2024
Is your project subject to Massachusetts Wetlands Protection Act?	Yes
MassDEP Wetlands File Number(s) (if available)	055-0939
Is your project subject to Massachusetts Public Waterfront Act?	No
Is your project subject to Massachusetts Historical Commission?	Yes
MHC File Number (if available)	Section 106 consultation was completed in August 2022. No historic or archeological properties will be affected by the proposed activity.
Is your project subject to Massachusetts Bureau of Underwater Archeological Resources?	Yes
BUAR File Number (if available)	Section 106 consultation was completed in August 2022. No historic or archeological properties will be affected by the proposed activity.

Is your project subject to U.S. Army Corps of Engineers – Section 404 of Federal Clean Water Act?	Yes
USACE File Number (if available)	TBD - Pending

List of Documents

Documents	Required Documents: 1. Alternatives Analysis 2. Characteristics of the proposed ocean disposal site 3. Chemical Analysis of Sediment 4. Consultation Letter from DMF and/or DFW 5. DEP Sampling Analysis Approval 6. Dredging and Disposal Operation 7. Grain Size Analysis 8. MEPA Certificate 9. NHESP Determination Letter or Conservation Management Permit 10. Plans for adequate containment during dewatering on a barge 11. Project Narrative 12. Project Plan Set 13. Proof of Public Notice 14. Site Plans 15. USGS Quadrangle Map

Special Fee Provision

Exemption	Yes
Exemption Type	City/Town/County Government
Exclusion (special agreement or policy)	
Substitution (ASP/IRP)	
Double Fee for Enforcement	
Hardship payment extension request	

Attachments

Name	Description	Type	Latest Updated
10. Dewatering on a Barge - Not Applicable - 609211_Peabody.pdf	N/A	Plans for adequate containment during dewatering on a barge	05/30/2024
14. Site Plans - see 12 - Project Plans - 609211 Peabody.pdf	see attachment 12. Project Plan Set	Site Plans	05/30/2024
16. WQC Appendix G - Stormwater Report - 609211 Peabody.pdf	Stormwater Management Report attached	Other	05/30/2024
1. Alternatives Analysis - 609211 Peabody.pdf	attached	Alternatives Analysis	05/30/2024
13. Proof of Public Notice - 90375.pdf	attached	Proof of Published Public Notice	05/30/2024
15. USGS Quadrangle Map - 609211 Peabody.pdf	attached	USGS Quadrangle Map	05/30/2024
13. Proof of Public Notice - 90375.pdf	attached	Proof of Public Notice	05/30/2024
12. Project Plan Set - 609211 Peabody.pdf	attached	Project Plan Set	05/30/2024
3. Chemical Analysis of Sediment - 609211 Peabody.pdf	attached - see notes	Chemical Analysis of Sediment	05/30/2024
8.a.MEPA 16778 DEIR File No. 16778 Certificate - 609211 Peabody.pdf	DEIR Cert, dated 5/24/2024, attached	MEPA Certificate	05/30/2024
2. No ocean disposal - 609211 Peabody .pdf	N/A	Characteristics of the proposed ocean disposal site	05/30/2024
4. DMF and DFW - Not Applicable - 609211 Peabody.pdf	N/A	Consultation Letter from DMF and/or DFW	05/30/2024
5. DEP Sediment Sampling Analysis Approval- 609211 Peabody.pdf	attached	DEP Sampling Analysis Approval	05/30/2024
6. Dredging & Disposal Operation - 609211 Peabody.pdf	attached	Dredging and Disposal Operation	05/30/2024
7. Grain Size Analysis - 609211 Peabody.pdf	attached - see notes	Grain Size Analysis	05/30/2024
8. MEPA EENF File No. 16778 Certificate - 609211 Peabody.pdf	attached	MEPA Certificate	05/30/2024
9. NHESP - Not Applicable - 609211 Peabody.pdf	N/A	NHESP Determination Letter or Conservation Management Permit	05/30/2024
11. Project Narrative - 609211 Peabody.pdf	attached	Project Narrative	05/30/2024

Application Contacts

Name	Organization Name	Contact Person	Telephone #	Contact Type	Email
OXANA, FARTUSHNAYA	n/a	n/a	(978) 843-5276	Application Prepared By	ofartushnaya@greenintl.com

Certification Information

Individual
OXANA FARTUSHNAYA
100 AMES POND DRIVE, SUITE 200
TEWKSBURY, MA 01886
United States

Telephone #: (978) 843-5276, (857) 753-9193
E-mail: ofartushnaya@greenintl.com

I certify that I have read and understand the instructions that accompany this application and that the statements made as part of this application are true, complete, and correct and that no material information has been omitted. By checking the box below, I understand and agree that I am electronically signing and filing this application.

1.0 INTRODUCTION AND OVERVIEW

This Joint Application for 401 Water Quality Certification (WQC) and 404 ACOE Pre-Construction Notification (PCN) has been prepared on behalf of the City of Peabody for the Independence Greenway Extension transportation improvement project in the City of Peabody. The City of Peabody with construction funding from the Massachusetts Department of Transportation, Highway Division (MassDOT) proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles (MassDOT Project No. 609211). The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody.

The Independence Greenway Extension project is a continuation of a rail trail facility that can be utilized by pedestrians and bicyclists for recreation or for short-range trips to businesses or other destinations along the Greenway. This project will expand the City's network of bicycle routes and provide a dedicated bike trail between the busy Northshore Mall and residential/commercial areas adjacent to downtown Peabody.

The project will consist of the following improvements:

- Modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared use path;
- Construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street;
- Construction of a light duty timber boardwalk structure supported on helical piles;
- Various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and
- Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements.

This project transforms the former railroad bed into a shared use pathway. As the proposed project is a pathway for pedestrian and/or nonmotorized vehicle access, it is therefore categorized as a "Redevelopment Project" under the Massachusetts Stormwater Management Standards. The project is therefore designed to meet the Standards to the maximum extent practicable. A stormwater report is attached in Appendix G to this Application demonstrating the compliance of the project with the ten state stormwater standards.

In addition, the proposed work exceeds the activity thresholds described in *301 CMR 11.03 (3)(b)(1)(f)* for alteration of ½ or more acres of any other wetland, 301 CMR 11.03(3)(b)1(d) for alteration of 5,000 or more of bordering or isolated vegetated wetlands; and 301 CMR 11.03(3)(b)1(b) for alteration of 500 or more linear feet of inland bank; consequently, an Expanded Environmental Notification Form (EENF) was filed to initiate project review under MEPA by the Executive Office of Energy and Environmental Affairs (EEA). An EENF Certificate for the EEA File No. 16778 was issued on January 29, 2024 determining that the project required the submission of an Environmental Impact Report (EIR). The Draft Environmental Impact Report addressing the comments and scope received in the EENF Certificate was filed with the MEPA Office on April 1, 2024 and is currently under review.

The proposed work within Waters of the United States requires a Section 401 Water Quality Certification pursuant to 314 CMR 9.04(1) since the project will result in dredging of more than 100 CY of material and placement of fill within Land Under Water. Therefore, the Combined Major Fill/Minor Dredging Water Quality Certification application package is being submitted to the Department of Environmental Protection (DEP) in association with this project. A filing of a Pre-Construction Notification (PCN) Form in accordance with Section 404 with the U.S. Army Corps of Engineers under GP 7, 9, 23, and 24 will also occur concurrently with the Section 401 WQC filing.

The MassDEP Waterways Program evaluated the site conditions within the limits of the proposed work areas (i.e., culvert crossings and boardwalk crossing), and has identified that Proctor Brook is not practicably navigable within the boundaries of the project footprint due to the bottom topography and shallow water depths. As a result, the portions of the proposed project located in/on/over/under Proctor Brook as identified on the plans do not require authorization pursuant to M.G.L. Chapter 91 or the Waterways Regulations at 310 CMR 9.00.

The proposed work requires submission of a Notice of Intent (NOI) to the Peabody Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (WPA) Regulations and its implementing regulations 310 CMR 10.00 for work within the Bordering Vegetated Wetland (BVW), the Land Under Water (LUW), the 100-foot Buffer Zone, the Bordering Land Subject to Flooding (BLSF), Bank and within the Riverfront Area and pursuant to the City of Peabody local Wetlands and Rivers Protection Regulations. The Notice of Intend was submitted on April 10, 2024 is currently under review. An Order of Conditions (OOC) for the project (DEP File No. 055-0939) will be forthcoming by the Peabody Conservation Commission.

2.0 EXISTING CONDITIONS

2.1 Property Information

The existing Independence Greenway was built in 2008 and is functionally classified as a Bike Path, being an exclusive pedestrian/bicycle facility open year-round from dusk until dawn. It currently consists of two discontinuous segments separated by Interstate 95 and Route 1. The overall length of the west section is 2.9 miles, and it starts between Russell Street and the Ipswich River, and the section ends at Lt. Ross Park. The east section starts from Peabody Road near Proctor Brook and runs for 1.7 miles to end at Essex Center Drive behind the Northshore Mall. The trail was built on the route of the former Boston and Maine Railroad right-of-way north of Lowell Street. The existing Greenway is owned and maintained by the City of Peabody.

The existing west and east sections of the Independence Greenway provide 14’-0” wide pavement carrying two-way traffic on two 5’-0” wide travel lanes and two 2’-0” wide shoulders. The present eastern terminus of the Independence Greenway is located at Essex Center Drive behind the Northshore Mall. The allowed uses on the Greenway include walking/running, bicycling, inline/roller skating, snowshoeing and cross-country skiing. No motorized vehicles, snow mobiles, or horseback riding is allowed on the trail.

Essex Center Drive is classified as a Local Roadway maintained under the private jurisdiction of the Northshore Mall. It serves mostly as a circulating road for the Northshore Mall and its adjacent office and commercial buildings, including Lahey Medical Center. Essex Center Drive is a two-lane, two-way road with a typical pavement width of 30 feet. The travel lanes, separated by a double yellow centerline, are approximately 15 feet wide. There is a consistent 5-foot bituminous sidewalk along the east side of the road and a cement concrete sidewalk on the west side of the road in front of Lahey Medical Center.

The second segment of the Essex Center Drive runs through an underpass under Route 128, connecting the rest of the Essex Center Drive and the mall driveway to the Northshore Road and from Route 128 North. This segment is under the jurisdiction of MassDOT as part of Route 128 above. The roadway is 23 feet wide, with an 11-foot right turn lane and a 12-foot right turn lane in the eastbound direction, with a 9.5-foot-wide raised median between the directions, which contain support columns for the bridge above. There are 3.5-foot-wide sidewalks in the underpass, which do not allow ADA accessible path of travel. In addition, the sidewalks are too narrow for cyclists to comfortably ride on or even walk with a bicycle to pass someone walking in the other direction without one person having to walk in the roadway.

Northshore Road is a local roadway under the City of Peabody jurisdiction south of the Route 128 underpass, and under the jurisdiction of MassDOT north of the underpass. Northshore Road connects the Northshore Mall south entrance with Lowell Street and Route 114, as well as ramps to Route 128 North. Northshore Road is 23 feet wide with 11-foot-wide lanes separated by a double yellow centerline. There is a 4.5-foot-wide bituminous sidewalk on the west side of the street. The posted speed limit on Northshore Road is 25 mph in both directions.

The former B&M railroad-owned easement between Northshore Road and Endicott Street is currently wooded and is roughly parallel to, and overlaps with, Proctor Brook, which generally flows west to east until its confluence with Goldthwaite Brook near Peabody Square to form the North River, which eventually empties downstream into Salem harbor. There are currently no existing trails, roadways, or railroad tracks at this location.

The project corridor contains a former bridge structure, oriented west to east, that used to carry railroad tracks over Proctor Brook. There are presently granite stone blocks extending across Proctor Brook and granite stone abutments, which remain intact along Proctor Brook's western bank with remnants of stone wingwalls splayed along the sides of the abutments.

The wetlands and waterbodies exist directly adjacent to the former railroad right-of-way on both sides along the project corridor. There are several existing stream crossings and hydrologic connections beneath the former railroad track bed within the project limits:

- The existing twin culverts consisting of 42-inch diameter Reinforced Concrete Pipes (RCPs) at Sta. 329+85 convey Proctor Brook which flows south-to-north at this location. Due to the existing 42-inch twin culverts being obstructed with sediment and debris, the pipes are not able to pass the sufficient flow during larger storm events and the bank overtime became eroded and expanded west of the existing culverts at this location.
- The existing 30-inch diameter Corrugated Metal Pipe (CMP) at Sta. 340+10 conveys an intermittent stream flowing into Proctor Brook on the north side of the former railroad bed. The existing culvert is corroded.
- The existing 24-inch diameter CMP at Sta. 342+20 conveys hydrological connection of Proctor Brook with wetland V-series on the south side of the former railroad tracks. The existing culvert is corroded.
- The former 4'H x 6.4'W concrete culvert at Sta. 346+20 used to convey Proctor Brook beneath discontinued railroad bed; Proctor Brook flows in the north-to-south direction at this location. The culvert was washed out after the railroad was discontinued and the tracks were removed; there are remains of the former culvert in the existing channel at this location.

- The existing remains of the former railroad bridge crossing over Proctor Brook at Sta. 351+50, which crosses the former railroad right-of-way in the south-to-north direction at this location. The bridge was washed out after the railroad was discontinued and track were removed.
- The existing 15-inch RCP culvert conveying intermittent stream at Sta. 358+51 near the eastern limit of the project at Endicott Street. There are no known deficiencies with the existing culvert.

2.2 Description of Water Bodies Adjacent to Project Site

Wetland resource areas exist within and adjacent to the project area (see Appendix B – Wetlands Delineation Report and Appendix E - Figure 3, Protected Resource Areas Map for details).

Surface runoff on Essex Center Drive, its Route 128 underpass, Northshore Road, and Endicott Street is mainly distributed by "country drainage", where runoff sheet flows into the pervious shoulder, roadside ditches, wetlands, or private front yards. Additionally, there are separate closed drainage systems spread throughout the project, servicing existing watershed areas via catch basin curb inlets and at low points. Where stormwater does not sheet flow off the roadway via country drainage, it travels via curb along the roadway into these closed drainage systems. The existing site can be analyzed as ten (10) watershed areas that contribute runoff to ten (10) discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. There are several culverts that convey Proctor Brook and intermittent streams that provide hydrological connections beneath the existing railroad track bed as described in detail above. The bankfull width of Proctor Brook varies over the project corridor and at each culvert crossing, with the bankfull widths ranging from 6 to 35 feet throughout the corridor.

Per the Flood Insurance Rate Maps (FIRM) for the City of Peabody, Massachusetts, Essex County, Panel 25009C0412F, dated 07/03/2012, and Panels 25009C0416G, 25009C0418G, dated 07/16/2014, portions of the project in the vicinity of Proctor Brook are located within the 100-year floodplain. The floodplain areas are shown on Figure 4 – FEMA Map. The Flood Insurance Study, by the Federal Management Agency and last revised on July 16, 2014, includes a detailed study of the project area, showing the 100-year floodplain elevations in the project vicinity. Sections of Proctor Brook flowing along the project corridor have various 100-year flood elevations which drop from 47.1 feet near the western project limit to 39.6 feet at the eastern project limit (NAVD 88). See Figure 7A-7H in Appendix E for details and exact locations of the FEMA 100-year flood lines and elevations.

All waterbodies, wetlands and streams on site belong to the North Coastal watershed. There is one perennial stream, Proctor Brook, within the project area. Within the vicinity of the project, Proctor Brook flows in the west-to-east direction until its confluence with Goldthwaite Brook near Peabody Square to form the North River, which eventually empties downstream into Salem harbor. Proctor Brook is classified as a Class "B" water, which designates these waters as a habitat for fish, other aquatic life, and wildlife including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation, even if not allowed. Where designated in 314 CMR 4.06, they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). These waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses and shall have consistently good aesthetic value. Additionally, there are no National Wild & Scenic Rivers, National Wildlife Refuges, National Forests, National Marine Sanctuaries, National Parks, or any other areas administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service, and USACE project lands and easements within the project site.

According to the 2018 Integrated List of Waters, Proctor Brook (Waterbody ID MA 93-39) belongs to Massachusetts Category 5 Waters, due to several impairments and has a Final Pathogen TMDL. Additionally, Proctor Brook is not designated as a Cold-Water Fishery.

Per MassGIS online data mapping, there are no stormwater "critical areas" as defined in MassDEP's wetland regulations as Outstanding Resource Waters (ORW), Special Resource Waters, recharge areas for public water supplies or cold-water fisheries either crossing or located adjacent to the project area. There are also no Areas of Critical Environmental Concern (ACECs) within or adjacent to the project area (see Figure 3).

3.0 PROPOSED CONDITIONS

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is approximately 1.3 miles.

The proposed project is located along the former railroad right-of-way that has not seen any improvements since the rails were removed. The proposed bituminous shared-use trail pavement will match the dimensions of the existing discontinued railroad structure. This will include 10’-0” wide hot mix asphalt pavement carrying two 5’-0” wide travel lanes, one in each direction, and two 2’-0” wide stone dust shoulders on both sides.

To make the former railroad right-of-way usable for a bicycle/pedestrian path, and to avoid filling protected wetland resources areas and FEMA-designated 100-year floodplain associated with Proctor Brook, a light duty timber boardwalk structure supported on helical piles is proposed to replace the previous railroad bridge that was washed away.

The proposed 56-span light duty timber boardwalk structure will be approximately 437’- 9” long with an out-to-out width of 13’-00” and will provide a clear width of 12’- 1” to accommodate two 5’- 0” wide travel lanes, one in each direction, and two 1’-0” shoulders on each side to provide service to bikers, pedestrians and and/or nonmotorized vehicle access. The shared use path will support emergency vehicles, but the boardwalk section will not.

The proposed shared-use trail will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (Fourth Edition, 2012) and the MassDOT Separated Bike Lane Planning & Design Guide 2015. The proposed bridge will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges and the most recent supplemental Specifications, Standard Nomenclature and Engineering Directives.

The project will result in approximately 2.5 acres of clearing and grubbing along the former railroad right-of-way between Northshore Road and Endicott Street.

The project includes drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. The proposed drainage design will add catch basins to replace

existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. The proposed catch basins will have deep sumps to provide additional stormwater treatment. A stormwater BMP (infiltration trench) is proposed to be installed in the eastern end of the project to help with peak rate attenuation and improve water quality. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge. There are no new untreated point source discharges created because of this project (see Stormwater Report in Appendix G for details).

Drainage and structural improvements to the following stream crossings are proposed as part of this project:

- The existing 42-inch twin culverts crossing at Sta. 329+85 is proposed to be replaced with a 4'H x 8'W precast reinforced concrete box culvert with a natural stream bottom and will match existing invert elevations.
- The existing corroded 30-inch diameter CMP culvert at Sta. 340+10 is proposed to be replaced with 36-inch DIP and will be embedded 12-inches and will have a layer of natural streambed material to match the existing surface elevations. The Hydraulic opening of this culvert will be maintained. A 12-inch layer of natural streambed material will also be placed on top of stone at the pipe ends on each side of the culvert to restore natural substrate.
- The existing 24-inch diameter CMP at Sta. 342+20 is proposed to be replaced with 24-inch DIP with placement of the riprap at pipe ends for scour protection. A 12-inch layer of natural streambed material will also be placed on top of stone at the pipe ends at the outlet of this culvert within Proctor Brook to restore natural substrate.
- The former 4'H x 6.4'W concrete culvert at Sta. 346+20 is proposed to be replaced with a 4'H x 8'W precast reinforced concrete box culvert with a natural stream bottom and will match existing invert elevations.
- As described above, the proposed light duty timber boardwalk structure will replace the former washed out railroad bridge crossing over Proctor Brook at Sta. 351+50.
- The existing 15-inch RCP culvert conveying the intermittent stream at Sta. 358+51 is proposed to be replaced with a 16-inch DIP to be able to support the H-20 vehicle loading with a shallow depth of cover.

Compliance of the proposed culvert replacements with the Massachusetts River and Stream Crossing Standards are discussed in Section 11 of this Application.

The proposed drainage will overall maintain historic drainage patterns, distributing runoff to the existing discharge points. All work will be done in a manner that will limit the impacts to adjacent protected wetland resource areas.

4.0 ANTICIPATED CONSTRUCTION SEQUENCE

Construction phasing will ultimately be determined by the project contractor. The construction phasing is assumed to generally include the following items:

1. Installation of sediment and erosion control measures.
2. Clearing and rough grading of the former railroad right-of-way between Northshore Road and Endicott Street.
3. Construction of wetland replication area.

4. Construction of flood storage compensation area.
5. Reconstruction of existing culverts and other drainage improvements sections along the project corridor.
6. Construction of light duty timber boardwalk structure supported on helical piles.
7. Construction of proposed bituminous shared-use trail along the project corridor.
8. Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements.
9. Construction of modifications at the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared-use path.
10. Completing shared-use path construction, upgrading signage and pavement markings.
11. Installation of landscaping and grassed areas.
12. Maintaining wetland replication area: checking for plantings that are damaged or failing to thrive and adjusting/replacing plantings as recommended by Wetland Specialist.
13. Removal of sediment and erosion control measures and dispose of same.

Equipment that is likely to be utilized for this project includes dump trucks, flatbed trucks, front-end loader(s), backhoe(s), skid steer(s), excavator, hoe rams, drilling rigs, concrete pumpers, boom trucks, air hammers, air compressor(s), and a crane. Equipment can be parked on roadway pavements off-limits for construction staging purposes. Staging equipment in Vegetated Wetland or Waterway resource areas shall be prohibited.

5.0 IMPACTS TO WATERS OF THE UNITED STATES

The project's resource area impacts will occur in Vegetated Wetlands, Land Under Water (LUW)/Waters of the United States (WOTUS), and Bank, resulting from both permanent and temporary construction taking place from Northshore Road to Endicott Street. The main perennial stream present on the project site is Proctor Brook, which is a perennial stream traveling in the west-to-east direction. Proctor Brook crosses the project corridor at three (3) locations: at approximate Sta. 329+85, Sta. 346+20 and Sta. 351+50.

5.1 Permanent Vegetated Wetland and Land Under Water/Waters of the United States Impacts

There are direct impacts to VWs and LUW/WOTUS associated with the project, as shown in Tables 1 and 2 above. The direct impacts to VWs and LUW/WOTUS were minimized to the maximum extent feasible but cannot be avoided in order to achieve the project goals.

The overall impacts to Vegetated Wetlands (VWs) and Land Under Water (LUW)/Waters of the United States (WOTUS) are summarized below:

Table 5.1: VWs Impacts

Wetland Area Series (STA. #)	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)
Z (STA. 329+85)	264	245
Y (STA. 329+85)	447	58
V (STA. 340+10)	168	88
V (STA. 342+20)	183	435
V (STA. 346+20)	914	216
E (STA. 346+20)	126	72
E (STA. 346+90)	117	66
X (STA. 352+00)	6	3,461
Total	**2,225**	**4,641**

Table 5.2: LUW/WOTUS Impacts

Resource Area	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)	Dredge Volume (cy)
STA. 329+85	8,365	1,009	1,210
STA. 340+10	107	32	16
STA. 342+20	79	64	12
STA. 345+50	13	72	-
STA. 346+20	1,474	355	241
STA. 351+50	305	550	12
Total	**10,343**	**2,082**	**1,491**

The majority of permanent VW impacts are associated with the proposed bank protection and stabilization countermeasures near the proposed culverts; other BVW impacts are associated with the adjacent areas of slope stabilization and regrading. The extensive work within the LUW at the locations of Culvert No. 1 (Sta. 329+85) and Culvert No. 2 (Sta. 346+20) is required to place riprap countermeasures, which were designed in accordance with the guidelines outlined in Hydraulic Engineering Circular No. 14, specifically Chapters 5 and 10. These guidelines were utilized to estimate scour levels at culvert outlets and to develop the design for riprap basins and aprons, respectively. In order to mitigate the impacts of the high volume of riprap at the culvert inlets and outlets of these two culverts at Sta. 329+85 and Sta. 346+20, as well as at the outlets of the smaller culverts within Proctor Brook at Sta. 340+10 and Sta. 342+20, additional 12-inch layer of natural streambed material will be placed on top of the riprap and stone for pipe ends on each side of the culvert as shown on the plans to restore natural substrate. Dredging of approximately 1,491 CY below Ordinary High Water (OHW) mark will be required to complete proposed culvert replacement and for placement of riprap and stone for pipe ends topped with a 12-inch layer of natural streambed material as shown on the plans to restore natural substrate. The dredging volumes are shown in Table 2 above as well as on the plans.

In order to mitigate impacts to bank of Proctor Brook and intermittent stream crossings caused by the placement of riprap for scour protection and bank stabilization near the proposed culvert replacements, the vegetated riprap is proposed for bank protection and stabilization. The bankfull width of Proctor Brook varies over the project corridor and at each culvert crossing, with the bankfull widths ranging from 6 to 35 feet throughout the corridor.

In addition to the placement of the natural streambed material at culverts, vegetated stakes will also be utilized within the riprap area in order to further aid in slope stabilization and restoring the area to natural conditions. The selected method is to plant live vegetated stakes in the voids between the riprap area in order to further aid in slope stabilization and restoring the area to natural conditions. The proposed live stakes will integrate brush layering, pole planting, and live siltation techniques during rock placement to ensure contact with native ground and will be laid horizontally to maximize rooting in accordance with MassDOT specifications for Live Stakes (See Special Provision Item 799.775 – Live Stakes) which is included in Appendix D – Special Provisions. The MassDOT Special Provision for Item 799.775 Live Stakes specifies that the live stakes be a minimum of four feet in length, a minimum of three-quarter inch (3/4") in diameter, harvested locally, and have side branches removed with the bark intact. Additionally, the stakes will have at least two (2) bud scars near the top to facilitate branch development and shall be planted at 90-degrees to the slope.

The proposed extension on the Independence Greenway and stream crossing replacements necessary to achieve the project purpose are expected to result in an overall improvement of the existing wetland resource areas and the area in general, which are currently degraded, overgrown with invasives and brush, and contain a lot of debris and garbage. There are no Essential Fish Habitat, land containing shellfish or wildlife habitat located within or in close proximity to the project area, therefore the project will not negatively impact these interests.

Permanent impacts will be caused by the replacement of the existing Proctor Brook crossings beneath the former railroad bed (proposed shared-use path), including placement of riprap at the proposed culvert inlets and outlets for scour protection and associated regrading near proposed culverts.

GZA GeoEnvironmental Inc. collected four sediment samples at various locations specified by Green International Affiliates Inc. on May 17, 2023 and the samples were delivered to ESS Laboratory in Cranston, Rhode Island for analysis. The analysis was done on January 15, 2019, and the results of these analyses are presented in Appendix F of this submittal. Any contaminated dredged materials will be managed in accordance with MassDOT Specification Items 180 and 181 included in the Contract as well as in accordance with all applicable local, state, and Federal regulations.

5.2 Temporary Vegetated Wetland Land Under Water/Waters of the United States Impacts

Temporary disturbance to VW (4,641 square feet) will be required for installation of Erosion & Sediment Control BMPs. The 3,461 square feet of temporary impact to VW X is caused by placement of the temporary timber matting to protect the VW X from negative impacts by construction machines during installation of helical piles for the duration of its construction. Approximately 1,180 square feet of temporary impacts to VWs will result from the installation of Erosion & Sediment Control BMPs during construction. After the erosion controls have been removed the VWs will be restored to preexisting conditions in accordance with the MassDOT Specifications for Item 755.45 – Wetland Restoration included in Appendix D of this Application.

The temporary impacts of 2,082 square feet of LUW/WOTUS are associated with the control of water during construction and installation of erosion and sediment controls to protect the downstream waterway during the replacements of the stream crossings, installation of boardwalk. The proposed replacement of Culverts 1 and 2 at Sta. 329+85 and 346+20, respectively, may require dewatering to take place, and installation of erosion & sediment controls at the boardwalk will result in temporary LUW/WOTUS impacts at these locations. During construction, dewatering for culverts within temporary cofferdams to allow for construction "in the dry" will be required for removal of groundwater from excavations for structural components and from surface water that enters the work area by precipitation or splash-over.

The Contractor will be expected to perform this work in accordance with MassDOT specifications for Control of Water (Items 991.11, 991.12 and 991.13 – Control of Water for Structures - Culvert No. 1, Culvert No. 2 and Bridge Structure No. P-03-020 (CAK) respectively). The Contractor must treat dewatering discharges, prior to outletting these flows to local waterways, for removal of sediments. This will be done by use of sediment tanks, fractionalization tanks, sediment basins, or other approved means. Outlets from these treatment measures will discharge onto splash pads or other measures that will prevent concentrated flows that could erode bank soils or streambed materials en route to the receiving watercourse. See Section 8.0 for further information about dewatering.

There will be no direct discharge of pumped water into any wetland, resource area, or closed drainage system.

5.3 Bank Impacts

As summarized in Table 5.3 below, the proposed project activities will impact Bank associated with Proctor Brook and two (2) intermittent streams within the project limits:

Table 5.3: Bank Impacts

Bank (STA. #)	Permanent Impacts (LF)	Temporary Impacts (LF)
Proctor Brook (West STA. 329+85)	117	9
Proctor Brook (East STA. 329+85)	125	39
Proctor Brook (North STA. 340+10)	10	3
Intermittent Stream (South STA. 340+00)	17	13
Proctor Brook (STA. 342+20)	15	17
Proctor Brook (West STA. 346+20)	94	4
Proctor Brook (East STA. 346+20)	78	5
Proctor Brook (West STA. 351+00)	37	4
Intermittent Stream (358+00)	125	107
Total	**618**	**201**

These activities consist of the proposed replacement of culverts conveying Proctor Brook beneath the former railroad/proposed shared-use path and 2 adjacent intermittent streams. Permanent impacts to Bank will be caused by the replacement of the existing Proctor Brook crossings beneath the former railroad bed (proposed shared-use path), including placement of riprap at the proposed culvert inlets and outlets required for scour protection and associated regrading near proposed culverts.

Temporary disturbance to Bank will be required for installation of Erosion & Sediment Control BMPs. The permanent and temporary impacts to Bank are summarized in Table 5.3 above.

As demonstrated in Table 5.3 above, thought the project will result in cumulative permanent bank impacts of more than 200 linear feet, it will not result in 200 linear feet or more of bank impacts to any one segment of Bank. As shown on the project plans, the affected streambed and bank will be restored upon completion of construction, therefore, there will be no adverse effects to WOTUS from the proposed project activities. In addition, the project provides compensatory mitigation for impacted resource areas, as required by applicable state and federal regulations and described in detail in Section 6.0 of this report.

6.0 RESOURCE AREA IMPACTS MITIGATION

The Project has been designed to minimize environmental impacts and mitigate damage to the environment to the maximum extent practicable. Measures to mitigate impacts resulting from the project activities have been developed throughout the planning and environmental review processes. A combination of erosion and sediment control BMPs will be installed and maintained for the duration of construction to protect the adjacent resource areas, as described in the approved plans.

6.1 Wetland Replication

The project has been designed to avoid wetland resource area impacts to the maximum extent practicable and will mitigate unavoidable resource area impacts in accordance with state regulations (Massachusetts Wetland Protection Act regulations at 310 CMR 10.55(4)(b), and the Massachusetts Department of Environmental Protection's ("MassDEP") "Massachusetts Inland Wetland Replication Guidelines" (MassDEP, March 2002). Vegetated Wetland areas impacted by the construction activities will be replicated in accordance with the standards cited above. Project elements are incorporated into the proposed work that help to minimize impacts to wetland resource areas.

To mitigate for total Vegetated Wetland (VW) losses (fill) of 2,225 square feet associated with the subject project, a wetland replication area of approximately 2,500 square feet on the northern side of the proposed bikeway around Sta. 327+00 adjacent to VW Z is proposed and designed in accordance with 310 CMR 10.55 (4)(b) provisions and MassDOT Specification 755.35, Inland Wetland Replication Area, which is included in Appendix D – Special Provisions.

6.2 Floodplain Impacts Mitigation

As, required by the State 310 CMR 10.00 regulations, a compensatory flood storage area of 3,472 cubic feet was designed to compensate for the project's net fill of approximately 2,859 cubic feet. The compensatory flood storage has been designed to exceed the project's net fill in order to provide a net cut across the project which will aid in the project's flood mitigation. The proposed flood storage compensation area will be located near the eastern end of the project approximately 350 feet west of Endicott Street (approx. Sta. 355+50) and has been designed to comply with the General Performance Standards presented in 310 CMR 10.57 (4)(a).

6.3 Streambed and Bank Impacts Mitigation

In order to mitigate the impacts of the high volume of riprap at the culvert inlets and outlets placed for scour protection, a 12-inch (minimum) layer of natural streambed material will be placed on top of the riprap of the two culverts to reestablish the natural streambed, and it will match existing invert elevations.

In addition to the placement of the natural streambed material at these two culverts, vegetated stakes will also be utilized within the riprap area in order to further aid in slope stabilization and restoring the area to natural conditions. Due to the proposed slope being 1.5:1 at both stream crossing locations (Culvert No.1 and Culvert No. 2), there are limited biotechnical engineering countermeasures for bank stabilization. The proposed live stakes will integrate brush layering, pole planting, and live siltation techniques during rock placement to ensure contact with native ground and will be laid horizontally to maximize rooting in accordance with MassDOT specifications for Live Stakes (for details see Item 799.775 – Live Stakes, which is included in Appendix D – Special Provisions).

6.4 Stormwater Mitigation

The proposed drainage systems will maintain the historic drainage patterns, distributing runoff to the existing discharge points. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge. One stormwater BMP, an infiltration trench, is proposed to capture and treat runoff and reduce peak rates. New catch basins with deep sumps and hoods are proposed to provide additional treatment.

6.5 Other Mitigation Activities

Existing areas that are currently degraded by the presence of invasive plants, debris, and garbage will be improved by the proposed work which will involve herbicide treatment of invasive plants currently existing within the project limits and as directed will occur as part of this project in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33, included in Appendix D – Special Provisions) as well as the removal of debris and garbage from the project site. All areas will be stabilized upon completion of the work.

7.0 SEDIMENTATION CONTROL MEASURES

To protect the wetland resource areas during construction, a combination of erosion and sediment control BMPs will be installed. Erosion control measures will be implemented as described in the approved plans. Primary erosion control techniques proposed include compost filter tubes, coir rolls/logs, sedimentation fence barriers, and street sweeping. The Contractor will have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials will include, but are not limited to, compost filter tubes, sedimentation fence, silt sacks for catch basins, erosion control matting and crushed stone. The erosion controls will be maintained in good condition until on-site soils are stabilized. All areas will be permanently stabilized following the completion of construction work.

8.0 DEWATERING

It is anticipated that a NPDES Construction General Permit (CGP) will be required for the project; therefore, if trench dewatering is needed, all pumped effluent will be done in compliance with the dewatering requirements within the CGP. There will be no direct discharge of pumped water into any wetland, resource area, or closed drainage system.

Dewatering of excavated stream bed materials shall take place on an impervious surface within or near the project site. Material will be stockpiled at the construction staging area and reused as fill when suitable. Dewatering for bridges within temporary cofferdams to allow for construction “in the dry” will be required for removal of groundwater from excavations for structural components and from surface water that enters the work area by precipitation or splash-over.

Areas of temporary storage and dewatering of excavated riverbed materials should only be in use for the duration of this project. It is expected that much of the material will be re-used at the site as fill. The dewatering site will not be used for any future project. Means and methods will ultimately be determined by the contractor.

9.0 STORMWATER MANAGEMENT

As the proposed project is a pathway for pedestrian and/or nonmotorized vehicle access, it is therefore categorized as a "Redevelopment Project" under the Massachusetts Stormwater Management Standards. The project is therefore designed to meet the Standards to the maximum extent practicable.

Stormwater management for this project has been designed in compliance with the Stormwater Management Standards as outlined in 310 CMR 10.05(6)(k) through (q) and defined in detail in the DEP's Stormwater Management Handbook. The project has been designed to improve upon existing stormwater conditions while minimizing impacts to nearby resource areas from both the construction and operation of the proposed project.

To improve upon existing conditions, stormwater runoff contributing to one of the existing discharge points will have a portion of the catchment area routed to a treatment BMP prior to discharge. The proposed BMP is an infiltration trench located in the median adjacent to the proposed shared use path along North Shore Road, between the shared-use path and Route 128 (Northbound). While the location of this proposed infiltration trench is outside of WPA jurisdiction, the proposed infiltration trench will still help improve the quality of discharged stormwater from the overall project. Due to the close proximity of wetlands to the proposed shared-use path throughout the rest of the project, as well as the seasonal high groundwater elevation and presence of existing utilities, it is not possible to provide additional infiltration SCMs within WPA jurisdiction. Additionally, new catch basins have been proposed to replace existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. The proposed catch basins will have deep sumps and hoods to provide additional treatment. This project also includes the replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed. All proposed drainage systems will maintain the historic drainage patterns, distributing runoff to the existing discharge points. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge.

A full Stormwater Management Report documenting compliance with the DEP's Stormwater Management Standards, including required calculations and description of methodology, is attached as Appendix G to this report.

10.0 FISHERIES AND WILDLIFE / NATURAL HERITAGE ENDANGERED SPECIES / VERNAL POOLS

The project site is not located within an area designated as a Priority Habitat of Rare Species or Estimated Habitat of Rare Wildlife by the Natural Heritage & Endangered Species Program (NHESP) 2021 Maps. No certified vernal pools are located in proximity to the project area. The closest potential vernal pool (PVP18854) is located approximately 300 feet west of the project limit, below the current boundary of the

Independence Greenway behind the North Shore Lahey Clinic. The project activities are not expected to negatively affect this vernal pool. A combination of erosion and sediment control measures will be installed as shown on the attached plan set in the vicinity of the resource areas, therefore, the above areas will not be affected during construction.

Additionally, there are no Cold-Water Fisheries or Essential Fish Habitat within the project area. The project is not located within or in close proximity to Areas of Critical Environmental Concern (ACECs). There are no Outstanding Resource Waters (ORW) within or adjacent to the project limits. Please refer to Figure 3 – Protected Resource Area Map in Appendix E for details.

According to the Federally Listed Endangered and Threatened Species in Massachusetts, the Northern Long-eared Bat (*Myotis septentrionalis*) (NLEB) is an Endangered bat species located Statewide and is protected by the Massachusetts Natural Heritage and Endangered Species Program (NHESP). The closest recorded NLEB hibernaculum is located 6.5 miles west in the Town of Lynnfield. This project has been reviewed by MassDOT Highway Division's Environmental Services Section and received a "No Effect" determination on the endangered Indiana bat (*Myotis sodalis*) or the endangered northern long-eared bat (*Myotis septentrionalis*) on June 21, 2023. No time of year restrictions are required for the project at this time. If additional cutting is proposed by the Contractor that is outside the scope of this contract, additional review is required by the MassDOT Highway Division's Environmental Services Section, and time of year restrictions may apply to such tree cutting.

A recent initiative by USFWS lists the Monarch Butterfly (*Danaus plexippus*), as a Candidate species, which may also be present within the project limits. The migratory population of these species may occur in the eastern United States. Since the Monarchs lay eggs on milkweed, and larvae feed only on plants in the milkweed family (*Asclepiadaceae*), the loss of milkweed from agricultural lands has been mentioned to negatively affect Eastern North America Monarch population along with other factors such as droughts, nectar source, and, not as often, roadkill. There are generally no Section 7 requirements for Candidate species; however, the USFWS encourages all agencies to take advantage of any opportunity they may have to conserve the species.

11.0 STREAM CROSSING NARRATIVE

The existing 24-inch diameter CMP culvert at Sta. 342+20 conveys a hydrological connection between Proctor Brook and the BVW V-series beneath the former railroad bed; therefore, the replacement of this culvert is not required to meet the MA Stream Crossing General Standards (SCGS). However, the proposed stone for pipe ends on the outlet side of the culvert in Proctor Brook will be topped with a 12-inch layer of natural streambed in order to reestablish natural substrate upon completion of construction.

The compliance of each stream crossing with the Massachusetts River and Stream Crossing Standards are summarized in Table 11.1 below.

Table 11.1: Compliance with Massachusetts River and Stream Crossing Standards

Stream Crossing (STA. #)	SCGS #1	SCGS #2	SCGS #3	SCGS #4	SCGS #5	SCGS #6
Culvert No. 1 Replacement at STA. 329+85	Not met	Partially Met	Not met	Met	Met	Met
Culvert Replacement STA. 340+10	Not met	Met	N/A	Met	Met	Not met
Culvert No. 2 Replacement at STA. 346+20	Not met	Partially Met	Met	Met	Met	Met
Prop. Timber Boardwalk at STA. 351+50	Met	N/A	Met	N/A	Met	Met
Culvert Replacement at STA. 358+51	Not met	Not met	N/A	Met	Met	Not met

The proposed replacement concrete box culverts at Sta. 329+85 and Sta. 346+20 achieve partial compliance with the Massachusetts River and Stream Crossing Standards (revised March 2011) as discussed below and summarized in Table 11.1 above. SCGS #1 cannot be complied with for either culvert. An open bottom culvert requires the installation of a footing which will result in significantly more excavation and, as a result, significantly more impacts within the surrounding wetland resource areas.

The proposed timber boardwalk pedestrian bridge at Sta. 351+50 achieves compliance with the Massachusetts River and Stream Crossing Standards by conforming with the SCGS #1, #3, #5, and #6. SCGS #2 and SCGS #4 do not apply.

The proposed embedded 36-inch diameter DIP culvert at Sta. 340+10 and the proposed 16-inch DIP culvert Sta. 358+51 both convey intermittent streams under the former railroad bed. These culverts will achieve partial compliance with the MA SCGSs as discussed below and summarized in Table 11.1 above.

SCGS #1 posits that "*Spans (bridges, 3-sided box culverts, open-bottom culverts or arches) that preserve the natural stream channel are strongly preferred*." The project proposes the replacement of the existing undersized culverts with larger box culverts. The existing culverts are not open bottom, and replacement of the culverts with open bottom structures is not feasible in order to expeditiously complete the replacement of the culverts, without disturbing substantially more adjacent resource areas and established site hydrology. An open bottom culvert requires the installation of a footing which will result in significantly more excavation and fill within the surrounding wetland resource areas. Therefore, this standard cannot be complied with. The proposed timber boardwalk pedestrian bridge at Sta. 351+50 will preserve Proctor Brook's natural stream channel and therefore complies with SCGS #1.

SCGS #2 provides recommendations for a culverted crossing to be embedded a minimum of 2 feet for box culverts or at least 25% for round pipe culverts. When embedment material includes elements > 15 inches in diameter, embedment depths should be at least twice the D84 (particle width larger than 84 % of particles) of the embedment material.

As shown in the Plans, the proposed concrete box replacement Culverts 1 and 2 will be embedded 12" with a natural streambed material proposed in the bottom of Culverts 1 and 2 at the same elevations as the existing surface. Embedding of these box culverts to the depth of 2 feet is not feasible due to the need to maintain the distance between the bottom of the structures and the existing 42-inch sewer lines located below both crossings, as shown on the Culvert 1 and Culvert 2 Plan and Longitudinal Section sheets in Appendix I. Considering that the embedment depth of a minimum of 2 feet for box culverts is

recommended in order to prevent streambed washout, and ensure compliance and long-term success of the proposed replacement stream crossing, the proposed design at both culverts includes concrete baffles in the bottom of box culverts to help hold the 12-inch layer of natural streambed in place and prevent washouts.

The proposed 36-inch culvert at Sta 340+10 will be embedded 12-inches, which exceeds the recommended minimum embedment depth of 25% for the round pipe culverts. This culvert was upsized in order to be embedded to provide a layer of natural streambed to match the existing surface elevations.

The proposed 16-inch DIP conveying an intermittent stream beneath the proposed bikeway at Sta 358+51 is not being embedded due to the small diameter of the culvert under both the existing and proposed conditions; upsizing this culvert significantly to allow for embedment and placement of natural streambed within it is precluded due to the hydraulic requirements. In addition, significantly upsizing this culvert to be embedded to provide enough room for placement of the natural streambed material would result in the need to elevate the profile of the bike path at this location, resulting in more impacts to the existing Bank of the stream as well as fill within the 100-year floodplain.

SCGS #3 calls for a new span to incorporate a width that, at a minimum, equals 1.2 times bankfull width of the stream.

- Proposed Culvert No. 1 (Sta. 329+85) – The existing bankfull width is approximately 19 feet, however, the existing twin culvert spans approximately 7 feet and therefore does not comply with the SCGS. The proposed span of the culvert replacement is 8 feet. Although the proposed span still does not meet the SCGS of 1.2 times bankfull width, this is an improvement upon the existing conditions and meets the standards to the maximum extent practicable. It is not feasible to replace the culvert with a span greater than 8 feet, without disturbing substantially more adjacent resources areas and the established site hydrology. A hydraulic study was done to match existing flows and not to increase the base flood elevation associated with Proctor Brook. The culvert was sized using hydrological calculations to ensure no potential flooding of the properties and infrastructure will occur as a result of this replacement. It was found that further increasing the hydraulic opening for this culvert in order to meet this standard would increase downstream flooding, which is not permitted. Therefore, this standard is met to the MEP.

- Proposed Culvert No. 2 (Sta. 346+20) – The bankfull width of the stream at the location of Culvert No. 2 is approximately 6 feet. The proposed culvert replacement has a span of 8 feet, which approximately 1.33 times the bankfull width of the stream, and therefore meets SGS #3.

- Proposed Timber Boardwalk Pedestrian Bridge (Sta. 351+50) – The bankfull width of the stream at the location of the proposed timber boardwalk is approximately 35 feet. The span of the proposed timber boardwalk is approximately 437 feet which greatly exceeds the minimum of 1.2 times the bankfull width of the stream in order to avoid greater impacts to surrounding resource area, and therefore meets SCGS #3.

- Proposed embedded 36-inch DIP culvert (Sta. 340+10) – Per ACOE terminology, an intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow. Since this culvert conveys an intermittent stream that does not have a year-round flow, this standard is not applicable. However, the proposed design evaluated all opportunities for improvement recommended by the

MA Stream Crossing standard. The approximate width of the intermittent stream during the flow period both at the culvert inlet and outlet is approximately 9 feet. The existing 30-inch CMP is proposed to be replaced with the 36-inch DIP culvert, that will be embedded 12 inches with a layer of natural streambed material in the bottom of it to meet the existing surface elevations. Therefore, the proposed design results in an improvement upon the existing conditions at this stream crossing by embedding the culvert 12 inches and, therefore, increasing the width of the crossing at this location.

- Proposed 16-inch DIP culvert (Sta. 358+51) – As mentioned above, this standard it not applicable to intermittent streams. However, the proposed design evaluated all opportunities for improvement recommended by the MA Stream Crossing standard. The width of the intermittent stream both at the culvert inlet and outlet is approximately 9 feet. The existing 15-inch RCP is proposed to be replaced with the 16-inch DIP culvert, which is an improvement upon the existing conditions at this stream crossing. Since this culvert is conveying and an intermittent stream beneath the existing railroad bed, significant widening of the crossing is precluded due to the hydraulic requirements and to maintain a shallow for depth of cover required to avoid additional fill within the 100-year floodplain.

SCGS #4 calls for placement of natural substrate within the structure. As shown in the Plans, the proposed replacement Culverts No. 1 and 2 will utilize concrete box culvert span-type structures of larger dimensions than existing culverts and will accommodate 12 inches of natural streambed material in the bottom. In addition, natural streambed material will be placed on top of the riprap in the areas of scour countermeasures outside of the culverts in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The limits if riprap required for scour protection were minimized to the maximum extent feasible.

The proposed embedded 36-inch culvert at Sta. 340+10 and the proposed 16-inch culvert Sta. 358+51 both convey intermittent streams under the former railroad bed; placement of the stone at pipe ends is required to prevent scour. As shown on the plans, a 12-inch layer of natural streambed material will be placed on top of the stone for pipe ends at Sta 340+10 within the stream areas in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed measures will result in providing a smooth transition from upstream to downstream of the crossing upon completion of construction.

SCGS #5 calls for "… *bed forms and streambed characteristics so that water depths and velocities are comparable to those found in the natural channel at a variety of flows*." The proposed Culverts No. 1 and 2 have been designed to provide as much accommodation to the existing channel as possible, and natural stream bed will allow for a smooth transition from upstream to downstream of each crossing upon completion of construction. Natural streambed material will be placed on top of the riprap in the areas of scour countermeasures outside of the culverts in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed timber boardwalk pedestrian bridge will preserve Proctor Brook's existing streambed characteristics. The proposed 36-inch Culvert at Sta. 340+10 will be embedded 12-inches with a layer of natural streambed material in the bottom of the culvert to meet the existing surface elevations. In addition, natural streambed material will be placed on both ends of the culvert on top of the stone for pipe ends in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed 16-inch DIP culvert at Sta. 358+51 will also maintain the existing streambed characteristics. Due to a very small area of riprap at the inlet and outlet at the proposed 16-inch DIP culvert at Sta. 358+51, no natural streambed layer is proposed; however, due to the location and the flow of this intermittent steam in the west-to-east directed, it is expected to be naturally reestablished shortly upon completion of construction.

SCGS #6 provides a desired level of "*openness*" for stream crossings so that wildlife will utilize the crossing for passage beneath a roadway. The desired ratio of cross-sectional area of opening to passage length is a minimum value of 0.82 feet. The embedded portion of a culvert is not included in the calculation of cross-sectional area for determining openness.

- Proposed Culvert No. 1 (Sta. 329+85) – A cross-sectional area of 24 square feet for the proposed culvert, divided by a passage length of 24 feet, both as shown in the Plans, yields a value of 1 foot.
- Proposed Culvert No. 2 (Sta. 346+20) – A cross-sectional area of 24 square feet divided by a passage length of 18 feet, both as shown in the Plans, yields a value of 1.33 feet.
- Proposed Timber Boardwalk Pedestrian Bridge (351+50) – A cross-sectional area of approximately 368 feet divided by a passage length of 13 feet, both as shown in the Plans, yields a value of 28.27 feet.
- Proposed embedded 36-inch DIP culvert (Sta. 340+10) – A cross-sectional area of the existing 30-inch CMP is approximately 4.9 square feet, divided by a passage length of 20 feet, both as shown in the Plans, yields a value of 0.24 feet. As mentioned above, upsizing this culvert significantly to allow to increase a level of "openness" is precluded due to the hydraulic requirements. The proposed 36-inch embedded replacement culvert's cross-sectional area is 5 square feet, therefore, though it is an improvement over existing conditions, it is not able to meet Standard #6 by providing a minimum level of openness of 0.82 feet.
- Proposed DIP culvert (Sta. 358+51) - A cross-sectional area of the existing 15-inch culvert is approximately 2.5 square feet. The proposed cross-sectional area of the 16-inch DIP culvert is 2.6 square feet, both divided by a passage length of 25 feet yield a value of approximately 0.1 feet. Therefore, the proposed replacement culvert is not able to meet Standard #6 by providing a minimum level of openness of 0.82 feet due to the. As mentioned above, upsizing this culvert significantly to allow to increase a level of "openness" is precluded due to the hydraulic requirements and to avoid additional impact the BLSF and the Bank of the stream.

As shown above, the proposed replacement of the perennial stream culverts and the proposed timber boardwalk pedestrian bridge are all able to meet Standard #6 by providing a minimum level of openness of 0.82 feet.

12.0 ALTERNATIVES ANALYSIS

Alternatives for the project included the "No-Build Alternative". The "No-Build Alternative" would lead to the bikeway extension not being constructed. Since the intent of this project is to extend the Independence Greenway by constructing a continuous shared-use path for bikers and pedestrians in order to continue the development of the Independence Greenway for Peabody's residents and visitors and as an important community and regional greenway network, therefore, the "No-Build Alternative" will not meet the purpose and need of the project, and it was therefore dismissed from further consideration.

A variety of alternatives were evaluated during the planning stages of the project. Options such as alternative sites, alternative alignments, and typical cross sections were evaluated. The primary purpose of the project was to develop a connection from the existing Peabody Independence Greenway path to the greater Border to Boston Trail, a developing shared use path network that will stretch 70 miles between the MA-NH state line and Boston. An alternative that involved using Warren Street extension as a segment of the path was also evaluated; however, one of the major design considerations was avoiding placing the shared use path for bicyclists and pedestrians directly adjacent to an existing high-traffic roadway in order

to promote safety. Additionally, this alternative location would not keep the shared use path as a linear connection, another one of the primary design goals for the project.

Additionally, options for narrowing sections of the shared use path, when wetland resources would be impacted, were also considered in order to reduce the overall resource area impacts of the project. However, the minimum width for a shared use path is 10 feet per MassDOT PDDG Section 11.4.1.1 and the minimum should width for a shared use path is 2 feet per MassDOT PDDG Section 11.4.1.2 and therefore these options were not feasible and therefore were not developed into substantial alternatives. While the path was not able to be narrowed in order to avoid wetland impacts, the grade of the proposed pathway was lowered to the maximum extent feasible to reduce floodplain impacts, the slide slopes of the path were tightened as much as possible, and a boardwalk with helical piles was proposed in lieu of traditional foundations to avoid large amount of fill within the floodplain and wetlands. The proposed depth of riprap is the minimum amount required to provide scour counter measures at the culverts in order to mitigate greater impacts to the brook while also meeting the project goals of restoring the natural stream bed and preventing future scour.

The following alternatives detailed below reflect the alternatives that were deemed the most feasible in order to meet the objectives of the project while also minimizing the environmental impacts to the maximum extent practicable. Each of the alternatives below more thoroughly detail the proposed alternatives that were carefully evaluated, and each reflect the above-described efforts to avoid, minimize, and mitigate environmental impacts while still meeting the project's purpose.

This section describes the alternatives for the major features, broken down by segment, of the proposed Greenway Extension that were analyzed and considered during the design process.

SEGMENT 1: ESSEX CENTER DRIVE: INDEPENDENCE GREENWAY TRAILHEAD TO UNDERPASS UNDER ROUTE 128

Alternative 1: 10-foot-wide travel lanes, five-foot striped bicycle lanes

Alternative 1 proposes to restripe Essex Center Drive with 10-foot-wide travel lanes and five-foot striped bicycle lanes. The bicycle lanes will be located on the outside of the motor vehicle lanes. Roadway widening or reconstruction is not anticipated under this alternative.

The westernmost 400 feet, passing the Lahey Medical Center parking lot from the existing trailhead, will be marked with shared lane markings and appropriate signage under this alternative. This is necessary due to the narrower width of the roadway in this area. This Alternative separates bicyclists from pedestrians, increasing the comfort of the latter relative to that of a shared-use path. However, bicyclists would need to share the roadway with motor vehicles. This represents a change in character from that of the existing bicycle route on the Greenway.

Alternative 2: 11-foot-wide travel lanes, 10-foot-wide multiuse path with buffer

Alternative 2 proposes Essex Center Drive to be reconstructed to provide 11-foot-wide vehicle travel lanes and replacing the existing sidewalk along the south side with a 10-foot-wide raised multiuse path with 5 feet of separation from the roadway. This will continue the character of the Greenway and will increase comfort for Greenway users when compared with on-street lanes. The raised multiuse path would be widened into the existing roadway and beyond the existing sidewalk, while maintaining the existing curb

along the north side of Essex Center Drive. A catch basin will need to be constructed at the corner of the intersection with the mall driveway and underpass to replace the existing due to the change in curb line.

Coordination with Northshore Mall and MassDOT has occurred and approval was stated in August 2023 to reconstruct the roadway with horizontal and vertical separation from the proposed shared-use path and to have part of the shared-use path occur within state layout with the City of Peabody maintaining the path. Coordination is ongoing regarding changes to access to the existing trailhead parking area that borders the Mall-owned portion of Essex Center Drive and the Lahey Medical Center. Additionally, to accommodate the continuation of the trail, parking would be prohibited on the south side of the shared roadway section before the sidewalk and bicycle lanes begin. This being stated, separating bicycle traffic from motor vehicle traffic is the preferred alternative for comfort and safety reasons.

SEGMENT 2: UNDERPASS UNDER ROUTE 128 BETWEEN ESSEX CENTER DRIVE AND NORTHSHORE ROAD

Alternative 1: Divert trail users onto sidewalk of the underpass

Alternative 1 proposes to have trail users divert from the proposed bicycle lanes on Essex Center Drive and from the proposed separated path on Northshore Road to use the sidewalk to connect through the underpass under Route 128. Bicyclists coming from the underpass sidewalk would be alerted to walk across Essex Center Drive at a proposed mid-block crossing west of the intersection of Essex Center Drive with the mall roadway to access the proposed westbound bicycle lane on Essex Center Drive. Although this would have minimal cost, this is not an ideal condition given that the existing sidewalk on the south side of the underpass is less than five feet wide.

Alternative 2: Sign and mark the outside lanes of the underpass as shared lanes, accommodate WB traffic with two stage left turn box and enhanced crossing markings through the Essex Center Drive intersection

Alternative 2 would stripe the outside lanes of the underpass with shared lane markings in each direction, and with appropriate signage alerting roadway users to the presence of the shared use lanes. In addition, this alternative would stripe a bicycle travel path through the intersection at the north end of the underpass to connect to Essex Center Drive. This path of travel would include a two-stage left- turn queue box which will provide bicyclists with a better opportunity to wait for a gap in opposing traffic to turn left. This alternative allows bicyclists to avoid the discomfort of dismounting and walking on the narrow sidewalk of the underpass. However, bicyclists would be requested to cross the underpass road on the roadway surface to continue towards the direction of the existing Greenway trail and thus presents bicyclist comfort and safety issues.

Alternative 3: Convert one roadway lane into 10-foot-wide multiuse path with 2 feet of buffer

As approved per discussion with the Northshore Mall and MassDOT in August 2023, the southbound underpass connecting Essex Center Drive and Northshore Road will be reduced from two to one vehicle lanes to provide a 10-foot-wide raised multiuse path with a 2-foot buffer and vertical separation from the curb abutting the roadway traffic. The roadway would be restriped to have one 11-foot travel lanes with 1.5-foot-wide shoulders. The curb along the roadway median will be maintained. This conversion will continue the character of the Greenway and will increase comfort for Greenway users when compared with on-street lanes in an unlit underpass. Review of existing and projected future traffic volumes indicates that it is not anticipated that the southbound lane reduction will result in traffic blocking Essex

Center Drive. This alternative would maintain motor vehicle/bicyclist separation and thus provide the greatest level of safety and comfort amongst the underpass alternatives. A catch basin will need to be constructed to replace the existing catch basin location approximately midway along the underpass due to the change in curb line.

Alternative 4: Seasonal closure of underpass lane for use as shared-use path

A variant of Alternative 3 proposes to close the leftmost southbound underpass lane to motor vehicle traffic during warmer months to provide a shared-use path with temporary bollards separating the path from the remaining lane. The temporary bollards would be removed in colder months when the shared-use path would be less frequently used such that the underpass would maintain two motor vehicle lanes in the southbound direction and bicyclists would dismount to use the remaining sidewalk. This alternative is not recommended as dismounting compliancy may be low and that this alternative would not always provide separation from motor vehicle traffic.

The preferred alternative for the Route 128 underpass is Alternative 3. Continuing the character of the existing shared-use path is important, especially in this section where shading from the overhead roadway would reduce visibility of bicyclists. Maintaining physical separation between bicyclists and motor vehicles is important in maintaining the safety and comfort of trail users.

SEGMENT 3: NORTHSHORE ROAD FROM ESSEX CENTER DRIVER TO RAILROAD RIGHT-OF-WAY

The proposed design for the Greenway Extension along Northshore Road comprises a multiuse path along the west side of the road and parallel to Route 128. The cross section is proposed to consist of a 10-foot-wide paved shared-use path with nine feet of separation from the path and curb along Northshore Road. On the highway side a grass drainage swale is proposed beyond the shoulder.

A road crossing is necessary to connect the path from the north side of Northshore Road to the proposed segment following the former railroad layout to the south.

Alternative 1: Install Standard W11-1 bicycle warning signage at the crossing

Alternative 1 proposes installing a standard crosswalk treatment, with W11-1 signage at the crosswalk and approximately 200’ in advance of the crosswalk. This treatment will make the crossing visible to drivers and ensure the safety of trail users crossing to/from North Shore Road and the old railroad ROW.

Alternative 2: Install W11-15 with RRFB and detection

Alternative 2 Proposed at this crossing is enhanced crosswalk treatment consistent with what has been installed on the trail in West Peabody at the Russell Street crossing. This treatment would install W11-15 signage with a Rectangular Rapid-Flash Beacon (RRFB) at the crosswalk, with standard advance warning signage approximately 200’ away from the crosswalk.

SEGMENT 4: RAILROAD ROW FROM NORTHSHORE ROAD TO ENDICOTT STREET:

The proposed design for the Greenway Extension in this segment consists of a mostly consistent cross-section with a 10-foot paved bikeway and two-foot-wide shoulders. This segment consists of a vacant

railroad Right-of-Way which is owned by the City for open-space/recreational use and has long been abandoned.

It is noted that due to the railbed's paralleling of Proctor Brook, there are three brook crossings proposed within this segment. Two precast concrete culverts are proposed while an approximately 450-foot-long wooden boardwalk with 11 feet of clear width is proposed approximately 350-750 feet west of Endicott Street.

Landscaping treatments with textured asphalt are proposed at the Northshore Road and Endicott Street trailheads. These treatments will serve to transition trail users to either the roadside trail segment along Northshore Road, or the sidewalk/roadway along Endicott Street. At each of these roadway crossings, a high-visibility crosswalk with RRFB are proposed.

The portion of the shared-use trail in the vicinity of the washed away railroad bridge requires construction of a light duty structure in order to make the former railroad right-of-way usable for a bicycle/pedestrian path and to avoid filling protected wetland resources areas and FEMA-designated 100-year floodplain associated with Proctor Brook. This structure would then tie into the proposed timber boardwalk from the east, which was designed at this location in order to avoid filling the wetland resource areas and the FEMA 100-year floodplain.

The various proposed bridge design alternatives are detailed below. Two (2) viable structure types and four (4) viable substructure and foundation types were considered, and the recommended foundation type of helical piles spaced 8'-0" to 14'-0" center-to-center and retaining walls comprised of timber lagging at each end of the boardwalk, was used in developing the following four (4) bridge alternatives:

Alternative A: Timber Boardwalk (Preferred)

The proposed timber boardwalk alternative consists of a timber deck with a 60'-0" structure length with multiple 8'-0" equal spans for the length of the structure. The boardwalk will have an out-to-out width of 13'-0" to provide a clear width that accommodates a 10'-0" wide pedestrian/bike path with two (2) 1'-0" shoulders. The proposed timber railing is 3'-6" high with vertical timber pickets spaced less than 4" apart with a continuous top handrail and bottom rub rail. All these railing components are required to meet state and federal (OSHA) safety standards for this type of path. The proposed timber decking is comprised of 2x6 timber boards placed transverse to the centerline of the path. The deck boards have a ¼" between their edges to provide a safe continuous riding surface that also allows for minor thermal expansion and contraction. There is an average of ~4-feet between the ground and the bottom of the 2x8 stringers which are spaced ~1-ft on center and support the deck planks for the full length of the boardwalk. Below the stringers there are timber bents comprised of three (3) 2x12s spaced every ~8-feet perpendicular to the center line of the path. This alternative has simple constructure methods, minimal environmental impacts, and requires minimal maintenance, resulting in lower lifecycle costs. In addition, it would be an extension of the timber boardwalk proposed east of this crossing, eliminating the need for additional substructure components on the east side, therefore, minimizing impacts to wetland resource areas and FEMA 100-year floodplain. The proposed substructure type would provide ease of constructability, lower material cost, and lessen the environmental impacts to adjacent sensitive areas. Timber Boardwalk on Helical Piles is the recommended alternative because it provides the most cost-effective structure with the fewest impacts to the surrounding environmentally sensitive areas. This design also has the shallowest

superstructure for meeting hydraulic criteria and the simplest construction method, which uses smaller equipment that can access the site from the trail.

Alternative B: Prefabricated Steel Truss with a Concrete Deck

This proposed bridge design is 60'-0" long with an out-to-out width of 12'-0". The truss will be constructed offsite and delivered to the construction site. The installation will be quicker than traditional bridge construction and have the option for technical guidance and oversight provided by the prefabricator. The installation has minimal impact to the environment when compared to more traditional construction materials and methods, though, would result in more impacts to wetland resource areas and FEMA 100-year floodplain than the preferred alternative A due to installation to the substructure components to support the fabricated steel truss superstructure. The installation might be difficult due to site accessibility for construction equipment and vehicles.

Alternative C: Prestressed Concrete Spread Box Beams with a Composite Concrete Deck

In this proposed bridge design, four (4) S36-12 prestressed concrete spread box beams will be used. The beams will be composite with a 5" cast-in-place deck and have a 3" paved wearing surface. The beams may not be able to support a span length of 60'-0" without a pier. These prestressed concrete beams are manufactured under controlled conditions and are more resistant to corrosion and deterioration than their steel counterparts. This option is a better choice for bridges over water with high constant humidity and for areas where it is difficult to access the superstructure for maintenance work. This alternative requires minimal maintenance, resulting in lower life cycle costs; however, the constructability and component delivery may be difficult due to site accessibility. This design is also significantly heavier than the timber boardwalk or timber beam alternatives and requires large equipment to ship and erect. This alternative would result in more impacts to wetland resource areas and FEMA 100-year floodplain than both Alternatives A and B due to installation to the substructure components, including potential need for an additional pier, to support the proposed superstructure with a span length of 60'-00".

Alternative D: Timber Bridge Structure with Timber Deck

This proposed design consists of three (3) 60'-0" glulam stringers spaced 5'-0" apart. Due to the loading requirements, the minimum depth of each beam would be 36". This depth exceeds the permissible depth requirements for wetland protection and hydraulic opening requirements and would result in even more extensive wetland resource area and FEMA 100-year floodplain impacts. The constructability and delivery of beams would prove to be difficult due to site constraints. However, the timber aesthetic would match the timber of the timber boardwalk and the design would require less maintenance than a steel structure over water.

Culvert Replacements

The potential benefits of replacing the existing culverts with culverts with larger openings under the projected 2070 storm conditions were evaluated. It was found that, based on the hydraulic analysis, replacing the existing culverts with larger openings, even just slightly larger openings than proposed, would result in increased downstream flooding, which is not permitted and would result in flood impacts to the surrounding community. HEC-RAS was used to calculate the water levels with projected flows based on updated precipitation estimates from NOAA 14 Plus. See the table 12.1 below for comparisons of water

levels and flows at the culvert crossings for the 10-year, 50-year, and 100-year storms for current flows versus the 2070 projected flows. The culverts were already experiencing overtopping and are also projected to overtop under the projected 2070 flows. For the boardwalk, the elevations do not overtop, even under the projected 2070 flows.

Table 12.1: HEC-RAS Results for 2070 Projected Flows

Location	10-Yr Storm (ft)	10-Yr Storm (2070) (ft)	50-Yr Storm (ft)	50-Yr Storm (2070) (ft)	100-Yr Storm (ft)	100-Yr Storm (2070) (ft)
Upstream of Culvert 1	45.01	*45.94*	46.17	*46.37*	46.33	*46.5*
Upstream of Culvert 2	40.86	*41.04*	41.25	*41.44*	41.39	*41.59*
Upstream of Boardwalk	39.33	*39.54*	39.82	*40.05*	40.19	*40.44*

Scour Countermeasures and Bank Protection Alternatives

In addition to evaluating a variety of different alternatives for the locations and design of the pathway segments, various alternatives for the areas of riprap placed for slope stabilization in BVWs adjacent to the top of the bank associated with Proctor Brook near the proposed Culverts No. 1 (Sta. 329+85) and No. 2 (Sta. 340+10) were evaluated in order to select the alternative with the least impacts to the surrounding resource areas. The alternatives analysis that was conducted for the rip rap areas is listed in Table 12.2 below.

Table 12.2: Alternatives for Rip Rap at Culvert Inlets/Outlets

Alternative	Details/Reason for Selection/Dismissal
Riprap for Scour Protection and Bank Stabilization	Dumped riprap was originally proposed in the riverbed at the proposed culvert inlets and outlets for scour protection. These riprap countermeasures extended slightly into the adjacent BVWs affecting the existing limits of the Bank of Proctor Brook. The proposed design minimized the extent of the required riprap countermeasures at culvert ends to the maximum extent feasible to still be able to provide the required protection from future scour. However, these impacts are unavoidable. The riprap countermeasures were designed in accordance with the guidelines outlined in Hydraulic Engineering Circular No. 14, specifically Chapters 5 and 10. These guidelines were utilized to estimate scour levels at culvert outlets and to develop the design for riprap basins and aprons, respectively. This alternative was modified to address MassDEP comments received during the MEPA ENF Review.

Vegetated Bank without Riprap	Nature-based solutions and biotechnical engineering countermeasures, such as are described in FEMA's document entitled "*Engineering With Nature - Alternative Techniques to Riprap Bank Stabilization*" and FHWA "*HEC 23 - Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance Third Edition"* were also evaluated in order to minimize adverse impacts to Bank, LUW and other jurisdictional resource areas. Utilizing natural methods of slope stabilization such as coir logs, willow whips, deeply rooted bunch grasses, keyed logs, etc. is not feasible for the banks steeper than 2:1. The proposed bank is 1.5:1 and the majority of the reviewed natural methods are not suitable for this incline. Therefore, not utilizing riprap does not achieve the goal of protecting and stabilizing the bank of Proctor Brook near the proposed replacement stream crossings beneath the bike path. It is also required to protect against scour during overtopping flow. Therefore, this alternative was dismissed from further consideration.
Vegetated Riprap for Bank Protection (Selected)	Due to the proposed slope being 1.5:1 at both stream crossing locations (Culvert No.1 and Culvert No. 2), there are limited biotechnical engineering countermeasures for bank stabilization. Most vegetative measures for bank stabilization are only recommended for up to 2:1 slopes. We reviewed the FHWA "*HEC 23 - Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance Third Edition*" and determined that one method they provide could be modified for the rip rap slope at Culvert No. 1 and Culvert No. 2. The selected method is to plant live stakes in the voids between the riprap. Because of the size and depth of the rip rap needed to protect the bank, live stakes will need to be 4 feet in length to allow them to be installed into the granular fill and subsoil under the rip rap. A description of the live stakes is provided in (Item 799.775 – Live Stakes), attached to this Report in Appendix E. A detail including installation methods is provided on the drawings.
Natural Streambed Restoration within Riverbed (selected)	In order to mitigate the impacts to the LUW of Proctor Brook associated with the high volume of riprap required at the culvert inlets and outlets for scour protection, a 12-inch (minimum) layer of natural streambed material will be placed on top of the riprap to reestablish the natural streambed, and it will match existing invert elevations.

Stormwater Mitigation

Several different stormwater best management practices were also evaluated in various locations throughout the project, including environmentally sensitive site design, low impact development techniques that minimize land disturbance and impervious surfaces, structural stormwater best management practices, pollution prevention, erosion and sedimentation control, and proper operation and maintenance of stormwater best management practices.

Primarily, infiltration SCMs were considered for the project in various locations; however, only one location was found to be feasible for an infiltration SCM due to limited space constraints, the seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. The only location that was found feasible for an infiltration SCM is the location of the proposed infiltration trench located adjacent to the proposed shared use path along North Shore Road, between the shared-use path and Route 128 (Northbound). While the location of this proposed infiltration SCM is outside of WPA jurisdiction, the proposed infiltration trench will still help improve the quality of discharged stormwater from the overall project. Due to the close proximity of wetlands to the proposed shared-use path throughout the rest of the project, as well as the seasonal high groundwater elevation and presence of existing utilities, it is not possible to provide additional infiltration SCMs within WPA jurisdiction.

Additionally, drywells were considered for additional stormwater treatment, but these provide very little stormwater treatment volume, require 2 feet of separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another alternative that was evaluated for this project was the use of proprietary devices at each discharge point for the stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

13.0 CONCLUSION

After careful analysis of the many different alternatives, the overall proposed chosen project was designed to meet its purpose and need which is to extend the Independence Greenway along the existing railroad right of way between the terminus point near the Northshore Mall to Endicott Street and to create a shared-use path intended to provide the highest level of service to bikers and pedestrians, providing protection from vehicles and limiting the number of crossings to the extent possible. The proposed Greenway provides public health benefits, economic and alternative transportation benefits, and provides a source of community pride and identity. It provides people of all ages with an attractive, safe, accessible, and no-cost destination to cycle, walk, or jog. Additionally, it provides a safe route to schools and neighborhoods for Peabody residents and away from Peabody's congested roadways. It is an efficient and safe alternative transportation resource for residents to commute to work, public transportation stations, as well as areas of commerce or public spaces. Finally, the Greenway connects the community to several large open space/conservation areas, such as Marble Meadows, Proctor Brook, Crystal Lake, and the Ipswich River, as well as areas of historical significance, such as Jacobs Cemetery and the Giles Corey Memorial, while simultaneously preserving a former transportation corridor providing the community a glance at the importance of Peabody's role in the region's railway network.

The project has been designed to avoid wetland resource area impacts to the maximum extent practicable. All unavoidable impacts will be mitigated in accordance with regulatory requirements. The applicant respectfully requests that MassDEP find these measures adequately protective of the interests identified in the 401 Water Quality Regulations and issue a Water Quality Certificate approving the work shown on the accompanying plan set.

APPENDICES

APPENDIX A – PUBLIC NOTICE

Public Notice

Massachusetts Department of Environmental Protection
Division of Wetlands and Waterways
100 Cambridge Street, Suite 900
Boston, MA 02114

Pursuant to 33 U.S.C. 1341 and M.G.L. c. 21 § 43 and 33 U.S.C. 1341 and M.G.L. c. 21 §§ 26 - 53, notice is given of a Combined Application for 401 Dredging, Fill/Excavation Water Quality Certification for the proposed work associated with the Independence Greenway Extension Project in the City of Peabody, Massachusetts by the City of Peabody Department of Community Development and Planning, 24 Lowell Street, Peabody, MA 01960 with construction funding from Massachusetts Department of Transportation – Highway Division, Ten Park Plaza, Room 7360, Boston, MA 02116. This project will involve extending the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles. Additional information may be obtained from the Applicant's representative, Green International Affiliates, Inc. located at 100 Ames Pond Drive, Suite 200 Tewksbury, MA 01876, attention Danielle Spicer, or by emailing dspicer@greenintl.com. Written comments should be sent to MassDEP, Attention Heidi Davis, 100 Cambridge Street Suite 900, Boston, MA 02114 within 21 days of this notice. Any group of ten persons, any aggrieved person, or any governmental body or private organization with a mandate to protect the environment who submits written comments may appeal the Department's Certification. Failure to submit written comments before the end of the public comment period may result in the waiver of any right to an adjudicatory hearing.

APPENDIX B - WETLANDS DELINEATION REPORT WITH DATA FORMS

APPENDIX C – PHOTOS

Photo Log – December 2016 & November 2022

Picture 1 – Looking Northeast on Essex Center Drive

Picture 2 – Looking Southeast at Northshore Road intersection with driveway Route 128 underpass

Picture 3 - Looking Southwest on Northshore Road

Picture 4 – Looking East at the Old Boston & Maine Railroad ROW proposed trailhead

Picture 5 – Looking north at the existing culvert outlet (downstream) (Sta. 329+85)

Picture 6 — Looking at the existing culvert outlet (downstream) (Sta. 329+85)

Picture 7 – Looking south at the existing culvert inlet (upstream) (Sta. 329+85)

Picture 8 – Looking at the existing culvert inlet (Sta. 329+85)

Picture 9 – Looking south at the existing culvert outlet (Proctor Brook side) (Sta. 340+10)

Picture 10 – Looking at the existing culvert inlet (intermittent stream side) (Sta. 340+10)

Picture 11 – Former culvert remains on the downstream side of Proctor Brook (Sta. 346+20)

Picture 12 – Former culvert remains in the middle of the Proctor Brook channel (Sta. 346+20)

Picture 13 – View south (downstream) at former culvert remains in Proctor Brook channel (Sta. 346+20)

Picture 14 –View east form the upstream side of former Proctor Brook crossing at Sta. 346+20

Picture 15 – View east (downstream) from the west bank of Proctor Brook at the remaining stonewall and retaining wall (Sta. 351+50)

Picture 16 – Old railroad bridge remains in the vicinity of Sta. 351+50

Picture 17 – Old railroad bridge remains in the vicinity of Sta. 351+50

Picture 18 – View southwest at old railroad bridge remains (Sta. 351+50)

Picture 19 – View west at the location of the existing 15-inch RCP culvert conveying intermittent stream under former railroad bed at Sta. 358+50 near eastern project limit

APPENDIX D – SPECIAL PROVISIONS

CONTRACTS:

- INCLUDE HERBICIDE REPORT FORM IN THE BOOK – SEE PROPOSAL DOCS FOLDER DOCUMENT A00810

REV. 2023.03.01 *(REV. DATE TO BE REMOVED BY CONTRACTS)*

ITEM 102.3 HERBICIDE TREATMENT OF INVASIVE PLANTS HOUR

This work must be performed by persons who meet the qualifications below and are approved by the Landscape Design Section.

Work under this item consists of herbicide treatment of invasive plants currently existing within the project limits and as directed. An Invasive Plant Management Strategy (IPMS) shall be submitted to the Engineer for review and approval and the IPMS shall be implemented on-site. The IPMS shall be measured and paid for under Item 102.33 Invasive Plant Management Strategy.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation items.

Payment is per hour on-site and shall be compensation for a minimum crew of 2 licensed applicators, 2 back-pack sprayers and mist-blowers, a properly equipped spray truck with spray hoses, and a tank with sufficient capacity for a full day of work. If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price. This item is not intended for manual removal of plants.

Management of plants determined to have been introduced to the site via imported loam, compost, mulch, plants, equipment, or other construction activities will be the Contractor's responsibility and at the Contractor's expense.

Herbicide shall be applied during daytime hours only.

Measures to prevent the introduction of invasive plant species to the site and to address introduction due to construction-related activities shall be covered under the Standard Specifications, Division I - Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property as amended in these Special Provisions.

Plant species targeted for management under this item shall be as determined in the field per the site walk and as specified in the IPMS.

The definition of invasive plant species shall be as described by Massachusetts Invasive Plant Advisory Group (MIPAG): "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems."

Control of invasive plants shall begin immediately with the initiation of construction activities and prior to any clearing or site disturbance. Treatment areas shall include stockpile locations and may, upon approval of the Engineer, extend outside the project limit. Treatment shall be done each consecutive year for the duration of the contract unless specified otherwise in the IMPS or unless directed otherwise by the MassDOT invasive species contact. Work shall be done during the growing season from May – October unless otherwise specified in the IPMS.

Areas identified for vegetation control measures shall be as shown on the plans and as determined in the field by the Engineer and a MassDOT Landscape Architect. Contact at MassDOT Landscape Design Section may be contacted at: Maxell.R.McNulty@dot.state.ma.us.

QUALIFICATIONS

The applicators shall submit and meet the qualifications outlined below. A list of contractors specializing in invasive management and approved by MassDOT Landscape Design Section is available on the following website: https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Requirements

1. Company must provide proof of qualifications by providing the following:
    a. Narrative describing company, its expertise and experience with invasive plant control.
    b. Demonstrate experience with herbicide treatment as part of restorations and in sensitive areas.
    c. Describe company's technical qualifications and past performance.

2. Company must meet licensing requirements:
    a. All crew applicators must have a Massachusetts Commercial Applicator License (CORE).
    b. At least one or more applicator must have a ROW certification, if required for work.
    c. Company must provide name(s) of applicator(s) and Applicator License/Certification number for all contractor crew leaders working on the project.
    d. Company must provide documentation of any warnings, penalties or fines received in the last three (3) years.

3. Company must provide proof of experience with invasive plant control and include following:
    a. At least five (5) references from prior invasive plant control work completed in last five (5) years. Provide contact information including address, phone number and email.
    b. Provide a summary of each of these projects including nature of the problem, specific invasive vegetation treated, dates and period of treatment, methodologies used, and summary of success or not in terms of meeting performance objectives. Include summary of equipment used.
    c. Photo documentation of these projects.
    d. GPS coordinates of project locations, if available.

4. Crew leader must have expertise with invasive plant control and provide the following:
    a. Have held Core license for at least five (5) years.
    b. Resume listing five (5) or more years of experience applying pesticides with the company or with another company specializing in vegetation management.

SUBMITTALS

No work shall begin without approval of the submittals.

Submittals include the following items:

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to proposed treatment the IPMS shall be submitted for approval by the Engineer and MassDOT Landscape Architect. All chemicals, methods and work done under this item shall be consistent with the IPMS. The IPMS shall be as described under Item 102.33.

Herbicide Use Report

Within two (2) weeks after each application, the Contractor shall provide to the Engineer a completed and signed MassDOT Herbicide Use Report.

Photo Documentation

Digital photos with date and time of herbicide application work may be required and shall be submitted upon request.

MATERIALS

All proposed herbicides shall be as approved in the IPMS. Herbicides shall be labeled for the method of treatment and shall meet all federal, state and local regulation requirements. Application rates will depend on herbicide proposed and shall be per the manufacturer's label for specific application.

METHODS

All methods used shall be as approved in the IPMS which shall be determined during the Initial Site Walk as described under Item 102.33 Invasive Plant Management Strategy.

The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

The Contractor shall notify the Engineer a minimum of 3 days prior to date of expected herbicide application. Applicators shall notify the Engineer upon arriving on-site and upon leaving the site.

Herbicide Applications

All herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau.

Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones.

Contractor shall not spray 2 hours prior to precipitation, during rain, or during windy conditions. The Contractor shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used.

Targeted vegetation shall be identified and marked prior to treatment. Plants treated by foliar spray, injection or glove application or other methods that leave standing vegetation, as opposed to cut-stump application, shall remain clearly marked for identification through the contract period.

Desirable vegetation shall be protected from both spray and other physical damage.

Contractor is responsible for any damage to vegetation not designated for removal or treatment. Vegetation damaged shall be restored. Cost of replacement plants and/or restoration shall be borne by the Contractor.

Contractor shall ensure that the public does not enter a work area while herbicide application or spraying is underway.

Disposal Of Invasive Plant Material

All material to be cleared shall become the property of the Contractor. The satisfactory disposal of all cleared plant material (seeds, roots, woody vegetation, associated soils, etc.) shall be the Contractor's responsibility.

The Contractor shall take measures to prevent viable plant material from leading to further infestations (seeds, roots, woody material, etc.) while stockpiled, in transit, or at final disposal locations. All precautions shall be taken to avoid contamination of natural landscapes with invasive plants or invasive plant material.

Chipping, shredding, or on-site burning of plant material must be approved by the Engineer and included in the IMPS.

For plant material taken to an incinerating facility per the IPMS, a receipt from that facility shall be submitted to the Engineer as proof of disposal.

Where feasible, it is preferable to dispose of plants on-site or to bury them on-site with on-going monitoring for re-sprouting. Disposal locations and methods must be approved and included in the IPMS. Site work such as grading and seeding to stabilize and restore disposal area shall be incidental to this item.

The Contractor shall be responsible for treating or otherwise managing areas of re-growth due to improper disposal. Treatment shall be at the Contractor's expense.

Follow-Up Treatment

Plants and areas shall be re-treated as necessary and as appropriate to the time of year. Treatment shall be for the duration of the contract and per the IPMS.

MEASURE OF SUCCESS

The expectation is a minimum of 85-95 percent control achieved after the first treatment, depending on plants targeted and extent of population, and based on the expectations laid out in the IPMS. The expectation for the contract duration is 95-100% eradication by the end of the treatment period, unless otherwise specified in the IPMS.

METHOD OF MEASUREMENT

Item 102.3 will be measured for payment by the Hour of crew time spent on the project doing actual herbicide application work. A crew shall be defined as a minimum of two licensed applicators each equipped with (at minimum) back-pack sprayer and mist blower. The crew shall also have a properly equipped spray truck with hoses and a tank with sufficient capacity for a full day of work.

BASIS OF PAYMENT

Item 102.3 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work.

Payment will be based upon time spent on the project doing actual work and shall not include travel time to and from the Contractor's place of business and shall also not include time for investigative field trips.

If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

The Invasive Plant Management Strategy will be paid for under Item 102.33.

ITEM 102.33 INVASIVE PLANT MANAGEMENT STRATEGY HOUR

REV. 2023.03.01 *(REV. DATE TO BE REMOVED BY CONTRACTS)*

This item consists of providing an Invasive Plant Management Strategy (IPMS) for the control of invasive plants currently existing on the project site and/or as directed and shall be coordinated with Item 102.3 Herbicide Treatment of Invasive Plants. The IPMS shall be submitted for review and approval and the IPMS shall be implemented on-site.

Herbicide treatment for invasive plants shall be as described under Item 102.3 Herbicide Treatment of Invasive Plants and shall be compensated per that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation as relevant to the project.

Individual attending the site walk and determining the Invasive Plant Management Strategy must demonstrate expertise with vegetation management and invasive plant control and submit qualifications as described below.

QUALIFICATIONS

Individual shall be from the same company as that providing services for Item 102.3 Herbicide Treatment of Invasive Plants and shall submit the following, if not submitted under Item 102.3:

- Submit copy of current Core license.
- Submit a resume listing five (5) or more years of experience managing invasive plants with a company specializing in vegetation management.
- References shall be submitted if requested.

SUBMITTALS

Task Summary & Reports

For measurement of payment, the contractor shall submit the total sum and a breakdown of hours for the tasks performed. At a minimum, the tasks shall include the Initial Site Walk, the IPMS Written Report, and if necessary to accommodate project or site changes, a Follow-up Site Inspection and accompanying IPMS Amendment.

Interim Site Monitoring Reports and/or a Final Report shall be submitted if requested by the MassDOT Landscape Design contact. The MassDOT Landscape Design contact must be notified to attend the final walk through when a Final Report has been requested.

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to construction activities and/or any proposed treatment, submit a written IPMS proposal for approval by the Engineer and MassDOT Landscape Architect. All

chemicals and methods proposed shall be consistent with applicable Massachusetts Wetlands Protection Act Order of Conditions.

The IPMS shall be completed in coordination with the Roadway Contractor and the Engineer and shall include the following as appropriate to the project:

I. Project Information

a. Company writing IPMS and performing herbicide application.
b. Date of site walk
c. Attendees at site walk
d. Expected end date of contract and expected last treatment (month/season)

II. Brief Description of Conditions

a. Provide a free-hand sketch on construction plans or aerial image showing species, location, and as relevant, show or note extent of population as relevant to Strategy (i.e., population extends off ROW preventing eradication, small population and eradication deemed feasible within contract schedule, etc.).

III. Coordination with Roadway Contractor regarding other work

a. Tree Work: Note coordination to be implemented with tree removal, clearing, and clearing and grubbing as applicable to the project.
b. Wetland Mitigation - Include management proposed for wetland mitigation areas in the IPMS, if and as required.
c. Planting: If there will be planting in areas proposed for treatment, propose treatment and schedule to avoid herbicide damage to plants.
d. Mowing: If coordination is required with state mowers, note need in IPMS.

IV. Soil Management

a. Provide specifics on how soil with invasive plant roots (in particular) or seeds will be handled (i.e., separate stockpiles, plant material will be buried on-site, re-used on-site, disposed off site and if so, where?).
b. Show stockpile locations on plan and include treatment schedule.
c. Note measures that will be implemented to avoid spread through equipment, including how and where equipment will be cleaned.
d. Soil to be removed from the project area shall not be assumed to be uncontaminated and must be evaluated prior to off-site management for potential contamination with hazardous materials. No soil may be disposed of off-site without proper assessment by the contractor and approval from the Resident Engineer (RE), District Environmental Engineer (DEE), or the project designee.
e. Any stockpiling of soil must be performed in compliance with Policy Directive P-22-001, Off-Site Stockpiling of Soil from MassDOT Construction Projects. This directive limits the allowable locations for off-site stockpiling of soil generated during MassDOT projects and includes various requirements that must be satisfied by the contractor prior to off-site stockpiling.

V. Invasive Plant Treatment & Management

a. Proposed chemical and methods of treatment for each species or area.
b. Time of treatment based on target plant species.
c. Submit product label including application methods and rates (entire MSDS information need not be submitted if available online).
d. Proposed performance metrics or measure of treatment success if different from that specified under Item 102.3.
e. Method for disposing invasive plant material. This includes material that may result in spread (i.e., seeds, roots) and material that has been treated and/or is not viable (foliage, dead wood, etc.). Methods may include grinding in place, stockpiling and treating, and incinerating offsite.
f. Expected follow-up treatment for duration of contract.

VI. Monitoring Schedule if requested by MassDOT.

Note: The IPMS is critical for identifying pre-construction conditions as well as strategies for minimizing import or spread of invasive plants. Failure to provide an approved IPMS may jeopardize this item, in which case, the contractor will be responsible for management of invasive plants found on-site at no cost to the contract.

Photo Documentation

Digital photos with date and time verification shall be provided with the IPMS and with any follow-up monitoring or reporting.

METHODS

Initial Site Walk

Prior to any construction activities and soil disturbance, the Contractor shall walk the site with the Engineer and the MassDOT Landscape Architect to determine the IPMS. During the site walk the Contractor shall identify limits of work and, as necessary, mark locations of areas designated for treatment and individual plants targeted for treatment or removal. The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

IPMS Follow-up Amendment

The IPMS may be amended to address additional concerns or adjust to conditions if required by the MassDOT Landscape Architect. The amended IPMS shall be submitted to the Engineer and MassDOT Landscape Architect for approval at least fourteen (14) days prior to any proposed treatment.

Interim Site Monitoring Inspection Reports

If required by the MassDOT Landscape Architect and Engineer, Interim Site Monitoring and an accompanying report shall be conducted.

Final Inspection

A final inspection and report documenting the status of the invasive control may be required for regulatory purposes or for instances where control will be continued by others. The report shall include photo documentation of pre-construction (existing) and post-treatment conditions, notations on a plan or aerial image of area treated, summary of treatment performed, and control achieved.

METHOD OF MEASUREMENT

Item 102.33 will be measured for payment by the Hour. The basis for measurement shall be per the completion of tasks as approved under the Task Summary submittal.

BASIS OF PAYMENT

Item 102.33 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work.

Payment shall not include travel time to and from the Contractor's place of business.

ITEM 755.35 INLAND WETLAND REPLICATION AREA LUMP SUM

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

The work under this item shall conform to the relevant provisions of Sections 120, 770, 771 of the Standard Specifications and the following:

Work under this item shall include furnishing material and the construction and maintenance of inland wetland replication areas as shown on the drawings and as required by the Engineer. Inland Wetland Replication Area shall hereafter be referred to as Replication Area. All work shall be in coordination with an approved Wetland Specialist as specified under that item.

Wetland Restoration work shall be as specified and compensated under that item. Construction of tidal wetlands shall be as specified under the approprate item for tidal wetland mitigation.

The Replication Area shall be constructed prior to wetland impacts unless otherwise approved by the Engineer, specified herein, or specified in permit conditions and approvals. Construction schedule shall be appropriate to planting and seeding season (see below). Changes to this schedule will require written approval from the Engineer.

DESCRIPTION OF WORK

Construction of the Replication Area shall be completed as shown on the drawings at the following location(s):

Area/s A at Station: ***327*** Area = ***2,500***sf.

Replication Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, U.S. Army Corps of Engineers Permit.

The Contractor is responsible for protection and preservation of natural areas adjacent to the Replication Area both within and outside the project limits and for the duration of the Contract; including but not limited to damage to soils or vegetation due to erosion, sedimentation, compaction, trampling, vehicles, storage of materials, or other negligence shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

The Wetland Specialist overseeing the Wetland Replication construction work shall not be from the same company as that which is performing planting, seeding, or participating in any aspect of the Wetland Replication construction.
-

SUBMITTALS - DOCUMENTS

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): As specified below, shall be submitted to the Engineer for distribution to appropriate regulatory agencies.

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.75 and 755.76.

SUBMITTALS - MATERIAL

Soil and Amendments

No soil, compost, or other soil amendment imported to the work site shall contain seeds, roots, stems, or other viable parts of invasive plants or other noxious plants.

At least sixty (60) days prior to installation and prior to ordering, the Contractor shall submit for approval sources of soil, compost, and amendments. Submittal shall include the supplier and location of the source. Off-site sources shall be identified and available for inspection by the Wetland Specialist prior to transport of material to the site to verify that they are likely to be free of invasive plant species, including all viable plant parts.

Samples of tested and approved wetland soil and soil amendments for soil texture, organic carbon content or other routine soil analysis parameters (e.g., pH, Cation Exchange Capacity, Percent Base Saturation) and Soil Organic Matter Analysis will be required if requested by the Engineer. The grab samples shall be collected by the Contractor or Wetland Specialist from multiple representative locations in the wetland topsoil mix following the "Umass Soil and Plant Tissue Testing Laboratory Sampling and Collection Protocols" (or equivalent certification paperwork provided by the soil supplier). The lab analysis shall be provided to the Engineer along with written certification from the Contractor or Wetland Specialist that the wetland topsoil was collected per the referenced protocol and meets the desired specification. The analysis and written certification of same shall be provided to the Engineer prior to placing the wetland topsoil in the Replication Area.

Seed Mix

Certificate of Materials from the supplier shall be submitted 30 days prior to seeding and must be approved prior to ordering materials. Seed species listed on the certificate shall include ecotype region (i.e., *Asclepias incarnata*, PA Ecotype).

Seed tag from the bag of seed used shall be submitted to the Engineer at the time of seeding. Seed tag shall include ecotype region and species, guaranteed percentages of purity, weed content and germination of the seed, and the net weight. Seed tag shall match the Certificate of Materials, include the name of the supplier, and date material was sent.

Bill of lading or notarized Certificate of Compliance from the Supplier serving as proof of purchase shall be submitted if requested by the Engineer. Document shall include date of sale,

quantity, lot number, and address of Supplier. This shall match the seed tag. Notary shall not work for either the contractor or seed supplier.

Plant Certification

Plant Certification shall be per the applicable requirements of Subsection 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the Standard Specifications. The nursery source shall certify the provenance or origin of all plants.

MATERIALS

Sediment Control Barrier and Erosion Prevention Measures

Sediment control barriers shall be per Item 767.121.

Erosion prevention measures for disturbed areas adjacent to the Replication Area shall include but not necessarily be limited to compost blankets, jute mesh, seeding, and/or combinations thereof as approved by the Engineer.

Sediment controls and erosion prevention devices and measures shall be compensated under the respective items.

Wetland Soil

Soil appropriate for the Replication Area may be either hydric soil excavated from the impacted wetland, a manufactured mix of compost and on-site borrow, or a combination thereof, as approved by the Engineer.

Hydric soil from the impacted wetland area may be spread on the surface of the constructed Replication Area as an inoculant or can be placed in a bulk fashion in a roughly 1:1 ratio of area and depth. Soil shall be handled such that the original soil structure is preserved and shall not be compacted, screened, or otherwise processed.

Hydric soil from the impacted wetland that is infested with invasive plant species identified on the Massachusetts Invasive Plant Advisory Group (MIPAG) shall not be used in the Replication Area unless approved by the Wetland Specialist and Engineer. To the extent possible, infested soil shall be disposed of within the project limits in an upland area outside of regulated areas and as approved by the Invasive Plant Management Strategy item (if in the contract) or by the Engineer.

A manufactured mix suitable for wetlands shall consist of on-site borrow from the proposed Replication Area (if approved by the Wetland Specialist and Engineer) thoroughly mixed with compost to achieve a target organic carbon content of 10-12% (up to 21% percent organic matter) by dry weight. The organic material used for mixing shall be well or partially decomposed. Clean leaf compost is the preferred soil amendment to achieve these standards though other materials may be used if approved by the Wetland Specialist and Engineer. Note that “clean” refers both to a negligible amount (<1%) of physical contaminants such as plastic

and to the lack of chemical contaminants that might pose a hazard to plants or animals. Off-site borrow may be used for mixing if approved in advance by the Engineer.

No soil or soil amendment shall be brought on site without approval of the material source by the Wetland Specialist and the Engineer. Soils used in the replacement area shall be free of rocks greater than 4 inches in diameter.

Plants

Plant material shall conform to the applicable requirements of Section 771, PLANTING TREES, SHRUBS AND GROUNDCOVER, of the latest edition of the Standard Specifications and as amended below.

Plants shall be native species, not cultivars. To the extent possible, plants shall originate from the applicable EPA Level III Ecoregion.

Plant species and sizes to be included in the Replication Area shall be

- as specified on the plans.

Requests for substitutions shall be submitted in writing to the Engineer for review by the Wetland Specialist, MassDOT Landscape Architect, and, if required, the relevant regulatory agency at least thirty (30) days prior to planting. All proposed substitutes shall be in conformance with the requirements herein and suitable for the site conditions.

Transplanting and plant material collected from the wild is prohibited unless approved in writing by the Engineer. Plants shall be selected from certified nurseries that have been inspected by state and/or federal agencies.

Seed Mix

Seeding shall conform to the Standard Specifications Section M6, ROADSIDE DEVELOPMENT MATERIALS.

Wetland Seed mix shall be:

Mix 765.554 **Wetland – Seasonally Flooded Mix** **LB**

	Botanical Name	Common Name	% PLS By Weight
Grass			
	Elymus riparius	Riverbank Wild Rye	20.00%
	Andropogon gerardii NY Eco	Big Bluestem NY Eco	12.00%
	Carex lupulina	Hop Sedge	10.00%
	Panicum clandestinum 'Tioga'	Deer Tongue 'Tioga'	10.00%
	Carex vulpinoidea	Fox Sedge	10.00%
	Carex scoparia	Broom sedge	8.00%
	Sorghastrum nutans NY Eco	Indiangrass NY Ecotype	8.00%
	Panicum virgatum	Switch Grass	8.00%
	Juncus effusus	Soft Rush	2.00%
	Juncus tenuis	Path Rush	1.00%
			89.00%
Herb/Forb			
	Verbena hastata	Blue Vervain	4.00%
	Desmodium canadense	Showy Tick Trefoil	2.00%
	Eupatorium maculatum	Joe-pye Weed	1.00%
	Asclepias incarnata	Swamp Milkweed	1.00%
	Aster novae-angliae	New England Aster	1.00%
	Eupatorium perfoliatum	Boneset	0.70%
	Helenium autumnale	Common Sneezeweed	0.50%
	Aster puniceus	Aster - Swamp	0.50%
	Mimulus ringens	Monkey Flower	0.20%
	Vernonia noveboracensis	New York Ironweed	0.10%
			11.00%
			100.00%

Upland Seed Mix Surrounding Replication Area shall be:

765.451 Native Seed - Part Shade Roadside Mix LB

Botanical Name	Common Name	% PLS by Weight
Festuca rubra	Creeping Red Fescue	25.70%
Elymus virginicus	Virginia Wild Rye	24.00%
Schizachyrium scoparium	Little Blue Stem	22.50%
Panicum virgatum	Switch Grass	10.00%
Panicum clandestinum 'Tioga'	Deer Tongue 'Tioga'	7.00%
Carex vulpinoidea	Fox Sedge	2.00%
Agrostis perennans	Upland Bentgrass	2.00%
Juncus effusus	Soft Rush	0.20%
		93.40%
Chamaecrista fasciculata	Partridge Pea	3.00%
Penstemon digitalis	Beard-tongue	1.00%
Zizia aurea	Golden Alexanders	0.30%
Desmodium canadense	Showy Tick Trefoil	0.30%
Solidago bicolor	White Goldenrod	0.20%
Solidago caesia	Woodland Goldenrod	0.20%
Rudbeckia hirta-VT ecotype	Black-eyed Susan-VT	0.20%
Aster novae-angliae	New England Aster	0.20%
Solidago odora	Licorice Scented Goldenrod	0.20%
Aster divaricatus	White Wood Aster	0.20%
Heliopsis helianthoides	Ox-Eye Sunflower	0.20%
Pycnanthemum tenuifolium	Slender Mountain Mint	0.20%
Monarda fistulosa	Wild Bergamot	0.10%
Eupatorium perfoliatum	Boneset	0.10%
Aster lateriflorus	Calico Aster	0.10%
Oenothera fruticosa var. fruticosa	Sundrops	0.10%
		6.60%
		100.00%

Seeding Rate: 15.0 lbs PLS/Acre

Fertilizers shall not be used.

Water

The Contractor shall provide water and all equipment required at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plants and wildlife. Water from the adjacent water bodies or waterways shall not be utilized. It is the Contractor's responsibility to correct injury or damage due to the lack of water, too much water, or use of contaminated water.

Mulch/Compost Blanket for Seeding

Hydromulch shall be per the manufacturer's recommendations and shall be wood fiber or straw mulch only. Mulch shall be incidental to seeding.

Compost Blanket may be used in lieu of mulch for seeding. Compost Blanket shall meet the material and submittal requirements of that Item and shall be applied as specified below. Compost Blanket shall be compensated under that item.

CONSTRUCTION METHODS & SEQUENCE

SITE PROTECTION MEASURES

Minimizing Damage

The Contractor shall plan and execute operations in a manner minimizing the amount of excavated and exposed fill or other foreign materials that could be washed or otherwise carried into Replication Area and nearby resource areas.

Construction of and access to the Replication Area shall minimize damage to existing vegetation and soils as specified herein. Damage to soils or vegetation shall be repaired to the satisfaction of the Engineer and at the Contractor's expense. If required for soil remediation, tilling and the addition of compost shall be at the Contractor's expense.

Wetland topsoil shall be deposited and graded in the Replication Area in a manner that minimizes travel and subsequent compaction of the subgrade (including any specified pit and mound topography) to the extent practicable, including use of track mounted excavators as appropriate. Should soils be compacted, they shall be loosened by a method such as disking, spring-tooth harrowing and/or rototilling. The Contractor shall use boards, timber or composite mats, or other approved materials as necessary, to protect existing and/or new wetlands from compaction due to heavy foot traffic or if equipment is required to travel over wetland soil. All labor and materials required for protection and preservation of site shall be incidental to this item.

Stockpiling of Soil

Stockpiling of soil, including hydric soil for replication, shall be at least 100 feet from the edge of the bordering and isolated vegetated wetlands and inland banks, unless approved otherwise by the Engineer. Stockpiled soils shall be securely stabilized and contained. Any areas of exposed soil or stockpiles within and adjacent to the Replication Area that will remain inactive for more than 7 calendar days shall be sown with a mix of rapid germinating annual grasses (e.g., annual rye) covered with a layer of straw mulch applied at a rate of 90 pounds per 1,000 square feet. As

necessary, the mulch shall be anchored with a tacking coat (non-tar) applied by a hydro seeder or other method recommended by the Wetland Specialist in consultation with the Engineer. In the event that there is excess borrow, it shall be disposed of under Excavation, Item 120.1.

Sediment Barriers

Placement: Sediment barriers shall be installed along the downslope perimeter of the Replication Area beginning and ending in the surrounding upland so that no excavated material or disturbed soil can enter adjacent wetlands or waters. Where construction work is immediately upgradient of the wetland, barriers shall be located so as to protect the Replication Area until slopes are stabilized. Sediment barriers shall be in place and approved by the Engineer prior to excavation work. No work shall take place outside the barriers.

Maintenance: The Contractor shall ensure that all sediment barriers function as intended and at all times per the specifications of those respective items.

Existing Trees to Remain

Tree protection shall be per the relevant specifications and as shown on the plans or as required by the Engineer. To protect root systems of existing trees to remain, the limits of the Replication Area may be adjusted, but, the total area of replication required by the permits shall not be reduced. Access route may be adjusted as required.

Trees to be retained as snags (upright dead or dying trees left for wildlife habitat) within or adjacent to the Replication Area shall be as shown on the plans or as directed by the Wetland Specialist or Landscape Architect during the initial site walk. Trees to remain as snags shall be clearly marked prior to clearing. Trees that pose a potential fall hazard (i.e., are near a roadway) should have limbs and trunk cut such that the tree does not pose a fall hazard.

Coarse woody debris in the form of cut trees, stumps, logs, and brush shall be incorporated as shown on the plans or as directed by the Wetland Specialist or Landscape Architect. On site material shall be selected and marked by the Wetland Specialist, retained on the project site, and placed as specified below under Placement of Coarse Woody Debris.

All trees, stumps, or brush not specified to remain shall be removed and shall not be stockpiled in the wetland resource areas while awaiting disposal.

Work shall be coordinated with Clearing or Tree Removal Item and compensated under that Item.

PRE-WETLAND CONSTRUCTION SITE WALK

Delineating the Replication Area and Access Route. The Contractor shall stake out the Replication Area boundaries and the intended access route and set grade stakes for approval by the Wetland Specialist and Engineer. Following staking and demarcation of areas, the Engineer and Wetland Specialist shall approve or modify as necessary the limits of work, the access route, final location and configuration of replication, grade stake elevations, proposed location of sediment barriers, and review proposed construction methods.

As part of the delineation and approval process, the Wetland Specialist shall mark trees to be converted to snags, select course woody debris to be retained for re-use, and select rocks or other elements to be used for habitat features.

Invasive Plants: As part of the initial site walk, the wetland to be impacted and the proposed replication site shall be inspected for the presence of invasive plants. If invasive plants are found they shall be addressed as described herein under Invasive Plants.

SOIL WORK

Final grades in the Replication Area shall meet the target elevations as shown on the Plans or as adjusted by the Wetland Specialist to achieve the desired hydrology and micro-habitat. If adjustments are required, a Request for Information (RFI) shall be submitted to the Engineer for approval. Adjustments shall be documented and included in the As-Built plans (if required) and/or other applicable required documents.

Excavation & Grading

When required by permits, the Wetland Specialist shall notify MADEP and the ACOE (as applicable) at least 72 hours prior to excavation.

Soil in the proposed wetland areas that must be removed for grades to conform to the proposed elevations shall be stripped and disposed of, or, if suitable for reuse, be stockpiled in an approved location. Stockpiled soils shall be kept wet and not allowed to dry out. Procedures for maintaining appropriate moisture levels shall be documented by the Wetland Specialist and provided to the Engineer and the Contractor.

Replication area shall be excavated as shown on the drawings. Where replication area is adjacent to existing reference wetland, finish grade of replication shall generally match existing grades and micro-topography, notwithstanding any deviations that are necessary to achieve the desired hydrology and habitat in the Replication Area.

Prior to placement of backfill, scarify subgrade to a depth of 4 to 6 inches.

Placement of Wetland Soil

Following excavation, scarification, and grading of sub-grade, and after the sub-grade elevations are approved by the Wetland Specialist, suitable soil previously removed or an evenly mixed organic/mineral soil created on-site shall be spread to the design depth and thickness over the proposed wetland areas as shown on the plans and as directed by the Wetland Specialist.

Vehicles used to transport soil from offsite shall be washed or cleaned with air pressure to prevent exotic or invasive seeds or root fragments from contaminating the Replication Area.

Final Grading

The finished grade of the Replication Area shall be at an elevation that will provide an unrestricted hydrologic connection between the Replication Area and adjacent resource areas. The hydrologic connection should be in keeping with restoring the intended function of the replacement wetland relative to the impacted reference wetland. The Contractor shall verify that this elevation is not at a level that could negatively alter the hydrology of an adjacent wetland. Microtopography in the form of hummocks, pits and mounds shall be as shown on the plans or as adjusted by the Wetland Specialist. Final elevations and grading of wetland soil shall be approved by the Wetland Specialist and the Engineer.

To avoid compaction once soil has been placed, no heavy equipment shall travel across placed soil and no work shall occur in wet or moist soil. Soil that is compacted due to construction activities shall be replaced with soil as specified herein and at the Contractor's expense.

Installation of Monitoring Wells in Replication Area

For a constructed Replication Area over 1,000 square feet, a representative number of monitoring wells shall be installed in locations as shown on the Plans. Monitoring wells shall include data loggers. For purposes of this specification, a data logger refers to a battery powered device that records groundwater level. Data shall be collected by the Wetland Specialist and submitted with Monitoring Reports and as required by applicable permits. Wells shall be installed immediately following completion of construction of the Wetland Replication Area. Wells shall be installed in accordance with USDA/NRCS technical report entitled: "Sprecher, S.W. 2008. Installing monitoring wells in soils (Version 1.0). National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, NE." or equivalent methodology approved by Engineer.

RESTORING VEGETATION

Placement of Coarse Woody Material

If specified within this Contract or if directed by the Wetland Specialist or Landscape Architect during the initial site walk, woody debris shall be placed in the Replication Area and/or adjacent upland buffer. Material shall be placed as shown on the plans or as directed following placement of wetland soil and prior to application of compost and/or seed. Woody material shall cover a minimum of 5-20 percent of the Replication Area, depending on whether it is a meadow or woodland wetland and how much wood is available from construction clearing. Where trees are cut for construction purposes, logs of a minimum length of 8 feet must comprise a minimum of 50% of the woody material left on site. Brush shall be included along with logs and stumps as directed. Woody material shall be placed in a deliberate and naturalistic manner.

Planting

Following placement of wetland soil and approval of final grade and conditions, Replication Area shall be planted. Planting shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUNDCOVER of the Division I Standard Specifications and as amended below.

Planting Season shall be May 15-June 15 and September 1-November 1 unless otherwise specified in applicable permit conditions.

Prior to planting, the Wetland Specialist shall approve the condition of the plant material and the method of installation and shall oversee the planting work. Replication Area shall be planted in the dry. Plants shall be placed according to the planting details and within the range of target elevations and at the spacing shown on the Plans or, if spacing is not indicated on the Plans, at the direction of the Wetland Specialist. Unless otherwise noted on the Plans, final plant locations shall be determined on site and located with regard to expected hydrology, plant growth characteristics, habitat desired, and water protection.

Plant material shall be installed as soon as possible after delivery. Plants stored on-site prior to installation shall be stored in the shade and watered twice daily up until time of installation. Plants showing signs of stress or compromised health may be rejected by the Engineer or Wetland Specialist and shall be replaced at the Contractor's expense.

Plant material shall be furnished and installed as indicated including all labor, materials, plants, equipment, incidentals, re-setting of plants (frost heaves, etc), irrigation, re-planting and clean up. If previously approved species are not available at the time of planting, the Wetland Specialist may propose substitutions relative to species, size, and quantities for review and approval by the MassDOT Landscape Architect. Upon approval by MassDOT, substitutions shall be approved by the regulating authority, if and as necessary. Provisions shall be made for a growth warranty of at least two (2) calendar years from the date of Conditional Acceptance as described below or as required by permits.

Seeding

Following placement of wetland soil and planting,the Replication Area shall be seeded using one of the following methods:

- Broadcast by hand or with a hand-held spreader followed by application of straw mulch. If necessary, seed shall be lightly raked to insure good seed-to-soil contact.
- Hydro-seeded with hydro mulch per the Standard Specifications and per the manufacturer's directions.
- Hand broadcast seed with Compost Blanket pneumatically applied at the same time to ensure light cover of soil topdressing over seed.

If spring conditions are drier than usual, supplemental watering may be required. If sowing during the summer months, supplemental watering will likely be required until germination.

If required, seeding limits for different seed mixes shall be determined by the Wetland Specialist.

PLANT ESTABLISHMENT AND INVASIVE MANAGEMENT

Plants shall be watered as necessary to maintain healthy establishment. Plants that fail by September 1 after spring planting or by May 15 after fall planting shall be replaced within the immediate or next planting period and at the Contractor's expense.

Seeding that fails to established according to the conditions of acceptance below shall be over-seeded as required by the Engineer. Washouts and channels shall be repaired and stabilized prior

to overseeding. Excessive weed growth shall be pulled out by the roots or, with approval from the Engineer, cut prior to over-seeding. Soil repair and weed control are incidental to this item.

Invasive Plants: Corrective measures shall be taken to remove or treat invasive plant species in the Replication Areas. Invasive plants shall include those listed as invasive by Massachusetts Invasive Plant Advisory Group (MIPAG) and the US Army Corp of Engineer's New England District's Compensatory Mitigation Guidance

The strategy for chemical and/or manual removal shall be as directed by the Wetland Specialist, shall continue for the duration of the monitoring period, and shall be incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland construction work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist demonstrating that the wetland replication construction work was done according to plans (or how modified) and meets required permit conditions. The narrative shall include, photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Replication Area and surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

- The final finished target elevations have been met and maintained relative to the approved plans and reference wetland. Areas that are too high or too low should be identified along with suggested corrective measures.
- Hydrology meets performance standards.
- Specified seed mix has been seeded. If inspected 30 or more days after seeding, seeded species in the wetland and adjacent upland shall show signs of good germination and healthy growth.
- Planted woody and herbaceous species meet specifications and are establishing well.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- There are no invasive plants visible in the replication area.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Replication work is not approved, MassDOT will issue a rejection letter requiring corrective actions. The Wetland Specialist shall recommend corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

REQUEST FOR CERTIFICATE OF COMPLIANCE

If required, a request for a Certificate of Compliance (Partial or Full) pursuant to the Massachusetts Wetlands Protection Act regulations shall be prepared and submitted to MassDOT within 30 days following Conditional Acceptance.

The Request for Certificate of Compliance shall include the following:

- A brief narrative of the work on company letterhead signed by the Wetland Specialist. Narrative shall be prepared as a MS Word document and shall include substantive explanation that demonstrates compliance with EACH relevant permit condition. Narrative shall note variations from the originally permitted design.
- As-built Drawings signed by the Contractor's PE registered in the Commonwealth of Massachusetts. As-built drawings shall show hydrologic conditions, status of plantings and seeding, and shall include a narrative and minimum of 4 photographs documenting site conditions. Plans should note variations from the originally permitted design.

  When required, drawings shall meet the Army Corp of Engineer's New England District's Compensatory Replication Guidance, including: scale in the range of 1"=20' to 1" = 100', contours at 1' intervals, spot elevations for intermediate elevations, and polygons outlining each Replication Area, and, as applicable, plant community types. The As-built Drawings shall be provided to the Engineer electronically in Portable Document Format (PDF). If requested by the Engineer, the Drawings shall be provided in printed paper format (11" x 17" sheets, unless otherwise directed). Drawings must be scalable.

- Other documents as required.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Contractor, Wetland Specialist and regulatory representative (if required) shall assess the Replication Area. Final Acceptance will initiate the start of the Wetland Monitoring Period.

The following conditions shall be inspected and approved for acceptance and payment.

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover at least 95 percent of the Replication Area, excluding areas of open water areas or planned bare soil.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species are living and establishing well.
- There are no visible invasive plants.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

If the mitigation work does not meet the above condition and is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions. Work not approved will be addressed by the Contractor at no extra cost.

Wetland Specialist shall be compensated under Item 755.75.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended.
- The desired seeded species are establishing well and cover 95 percent of the area, excluding areas of open water areas or planned bare soil.
- No sediments have entered into wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- All planted species (if included) are living and establishing well.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.35 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, equipment, submittals, maintenance, all required soil, site preparation, grading, wetland seeding, planting, mulching, watering, monitoring wells, registered surveyor, as-built plans, Request for Certificate of Compliance, and all incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 60% upon Conditional Acceptance.
- 20% after receipt and acceptance of Certificate of Compliance by the Engineer and once all permit construction requirements have been met and approved.
- 20% upon Final Acceptance.

Excavation will be paid under Item 120.
Compost Blanket will be paid under Item 751.7
Sediment Control Barrier will be paid under Item 767.121
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76

ITEM 755.45 WETLAND RESTORATION SQUARE YARD

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

DESCRIPTION

The work under this item shall conform to the relevant provisions of Subsections 120, 751, 765, 767, and 771 of the Standard Specifications and the following:

The work under this item shall include all labor and furnishing of materials to complete the work specified herein to protect and restore existing inland wetland areas that will be temporarily impacted as shown on the drawings and as required by the Engineer.

Inland Wetland Replication work shall be as specified and compensated under that item. Tidal wetland mitigation shall be as specified under the appropriate item for tidal wetlands.

Restoration Area shall be constructed to meet the requirements of all associated permits and certifications, including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40), Section 401 Water Quality Certification, and Section 404, U.S. Army Corps of Engineers General Permit.

All work shall be in coordination with an approved Wetland Specialist. Wetland Specialist qualifications and requirements shall be per Item 755.75, Wetland Specialist.

SUBMITTALS – DOCUMENTS

Request for Conditional Acceptance: As specified below, a letter requesting Conditional Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Final Acceptance: As specified below, a letter requesting Final Acceptance of the work and the site conditions shall be submitted to the Engineer.

Request for Certificate of Compliance (Partial or Full): If applicable, request for a Certificate of Compliance shall be submitted to the Engineer for distribution to appropriate regulatory agencies as specified below.

Monitoring Reports: Reports shall be submitted to the Engineer as specified below. Reports shall be compensated under Item 755.76 Wetland Monitoring Reports.

ASSOCIATED ITEMS AND MATERIALS

Timber Mat shall be as specified under that Item 767.91.

CONSTRUCTION METHODS & SEQUENCE

Site Protection Prior to Impacts

Prior to any land work, as part of the initial site-walk, the Wetland Specialist shall photo-document the site and provide a summary report of existing conditions as outlined under Item 755.75 Wetland Specialist.

Where and as required vegetation shall be cut flush and area surveyed to establish pre-construction elevations.

Following the cutting and surveying, timber matting shall be placed as required to protect soil and vegetation from compaction, contamination, and/or other damages. Timber mats shall be placed as specified under the respective items and the Engineer shall approval placement.

Restoration Upon Completion of Construction Work

Sediment Barriers

If required for sediment control during Restoration work (i.e, tilling is required to restore soil), sediment barriers shall be installed along the downslope perimeter of the Restoration Area beginning and ending in the surrounding upland so that no disturbed soil can enter adjacent wetlands or waters. Sediment barriers shall be in place and approved by the Engineer prior to any soil disturbance. No work shall take place outside the barriers.

Removal of Fill and Grading

Timber mats shall be removed and disposed of as specified under the respective items.

If required, grades shall be restored to pre-construction elevations as shown in the baseline survey or as required by the Engineer and Wetland Specialist to restore hydrologic functions. Final elevations shall be approved by the Engineer prior to soil preparation and seeding. Grading shall be incidental to this item.

CONDITIONAL ACCEPTANCE OF WORK

Conditional Acceptance shall indicate approval of the wetland restoration work and agreement that work has been done according to plan or modified as approved.

Upon completion of construction, the Contractor shall submit a Request for Conditional Acceptance that includes a brief narrative from the Wetland Specialist (if applicable to project) demonstrating that the wetland restoration work was done according to plans (or how modified) and meets required permit conditions (if applicable). The narrative shall include, photo-documentation of pre-construction conditions as well as soil work, planting, and seeding. Seed tags shall be submitted as part of the Request for Conditional Acceptance.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist, and regulatory representative (if required) shall assess the Restoration Area and the surrounding areas. At a minimum, the following conditions shall be included in the narrative and reviewed as part of the on-site assessment of whether:

- The target elevations have been restored per the survey or adjusted per the Engineer. Areas that are too high or too low should be identified along with suggested corrective measures.
- Soil compaction has been mitigated.
- Soils are stabilized and there is no sediment in the wetland and no channeling of slopes.
- Hydrology meets performance standards and has been adequately restored.
- There are no invasive plants visible in the restored wetland area.
- Silt fence and non-biodegradable sediment barrier materials have been removed.

Upon approval that the work meets the above conditions, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Restoration work is not approved, MassDOT will issue a rejection letter requiring corrective actions. Work not approved shall be addressed by the Contractor at no extra cost.

Erosion of adjacent slopes or the flow of sediments into the wetland between Conditional and Final Acceptance shall be immediately addressed by the Contractor.

FINAL ACCEPTANCE OF WORK

Following one full growing season, the Contractor shall submit a Request for Final Acceptance. Submittal shall include a brief narrative of conditions. Upon receiving the Request, the Engineer, Wetland Specialist and regulatory representative (if required) shall assess the Restoration Area. Final Acceptance will initiate the start of the Monitoring Period (if required).

The following conditions shall be inspected and approved for acceptance and payment:

- Hydrology is functioning as intended.
- No sediments have entered the wetland.
- Adjacent slopes are stabilized with desirable vegetation.
- There are no visible invasive plants.

If the restoration work is not approved, MassDOT will issue a rejection letter requiring corrective action. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation. Work not approved shall be addressed by the Contractor at no extra cost.

MONITORING REPORTS FOR REGULATORY COMPLIANCE

Post wetland construction Monitoring Reports shall be completed and submitted by the Wetland Specialist as specified and compensated under Item 755.76 Wetland Monitoring Reports.

Generally, the following conditions shall be met upon each inspection:

- Hydrology is functioning as intended, relative to the preexisting condition of the restored wetland.
- No sediments have entered into wetland.

- Adjacent slopes are stabilized with desirable vegetation.
- There are no visible invasive plants.

If, at the end of the required monitoring period, the requirements have not been met and success of the wetland replication area has not been achieved as determined by the Monitoring Reports, the Contractor shall provide corrective measures. All costs associated with corrective measures and plant replacement shall be incidental to this item with no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.45 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, compost and amendments, seed, mulch, equipment, submittals, maintenance, grading, and incidental costs necessary to complete the work as required.

Payment shall be as follows:

- 50% upon completion of removal of timber mats and any grading or soil modifications
- 25% upon Conditional Acceptance
- 25% upon Final Acceptance or approval of the Engineer

Sediment Control Barrier will be paid under Item 767.121
Timber Mat will be paid under Item 767.91
Wetland Specialist will be paid under Item 755.75
Wetland Monitoring Reports for follow-up monitoring will be paid under Item 755.76

ITEM 755.75 WETLAND SPECIALIST HOUR

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

Work under this Item shall be for services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications hereafter referred to as the "Wetland Specialist."

"Wetland Mitigation" shall be used herein for applicable wetland work. For this project, applicable wetland work is fo***r:*** **Item 755.35 Inland Wetland Replication Area and Item 755.45 Wetland Restoration Area.**

The Wetland Specialist shall demonstrate knowledge and expertise to coordinate and oversee all work associated with the Wetland Mitigation as defined herein, as shown on the Plans, as required by permits, and as specified under the relevant Wetland Mitigation items.

Regulatory monitoring reports following Final Acceptance of the Wetland Mitigation shall be per Item 755.76, Wetland Monitoring Reports.

For all onsite work, the Wetland Specialist shall sign in and sign out with the Engineer.

The Wetland Specialist shall not be from the same company as the company responsible for planting, seeding, and/or maintaining the wetland.

QUALIFICATIONS

The Wetland Specialist shall have a minimum of five (5) years of experience with construction and monitoring of wetland mitigation areas similar in size, type, and complexity to the Contract mitigation. When required by permits, at least ten (10) years of experience may be required. The Wetland Specialist shall be thoroughly versed in the Commonwealth of Massachusetts Wetlands Protection Act (MGL C.131, s.40), U.S. Army Corps of Engineers New England District Compensatory Mitigation Guidance, and all other relevant regulations of the Massachusetts Department of Environmental Protection and the U.S. Army Corps of Engineers New England District.

SUBMITTALS - QUALIFICATION

Within sixty (60) days following the Notice to Proceed, the Contractor shall provide proof of qualifications for the Wetland Specialist to the Engineer for approval. Submittals shall include, but not be limited to, the following:

- Resume of the individual on-site implementing the Wetland Specialist work. If the Wetland Specialist changes over the course of the project, the new individual shall submit resume and qualifications for approval 30 days prior to doing any work on-site.
- Resume of any personnel working on-site in place of the Wetland Specialist. Individual shall be approved prior to work on-site.
- Narrative describing the company, its expertise, technical qualifications and experience with wetland construction.
- At least three (3) references from prior work of a similar nature completed in the last five (5) years and by the individuals who will perform the work. Provide contact information for each reference including address, phone number and email.
- A summary of each reference project including nature of the work, project size, dates, and period of construction and monitoring, methodologies used, and summary of success (or not) in terms of meeting performance objectives. Summary shall include a minimum of one before and one after photo for each project.

SUBMITTALS – DOCUMENTATION AND REPORTS

<u>Wetland Construction Oversight</u>

Wetland Specialist shall provide documentation of pre-existing conditions and wetland construction as specified below and as part of fulfilling the Scope of Work described below. Documentation shall include photos that are clear and legible. Photos are incidental to this item.

- ***Site Walk Prior to Disturbance and Construction of Wetlands:*** Provide brief assessment with photos, including documentation of the existing wetlands to be impacted (both permanent and temporary), proposed wetland replication area, and reference/model wetland areas (typically an adjacent undisturbed wetland or the existing wetland to be impacted). Photos of existing wetlands that will be temporarily impacted shall include a view from at least 3 angles.

- ***Excavation and Grading:*** Documentation shall include minimum of two photos of the excavated wetland and two photos after final grading prior to planting and seeding. For restoration areas, photos shall show soil preparation (i.e, tilling and grading), if applicable.
- ***Approval of Subgrades****:* The Wetland Specialist shall inspect the sub-grade of the Replication Area to ensure that proper hydrology is likely to be established and shall provide the Engineer with written confirmation and photographs upon completion of subgrade excavation work. Written confirmation shall include recommended field adjustments, based on field observations, to achieve the desired hydrology and designed wetland system.
- ***Planting and Seeding:*** Provide assessment and photos of vegetation upon completion of planting and seeding work.
- ***Data logger output from Monitoring Wells*** shall be submitted with reports, if applicable and requested.

Wetland construction documentation and reports shall be submitted with Request for Conditional Acceptance and for the Order of Conditions, Water Quality Certifications, and other regulatory permits as required.

Requests for Acceptance of Work & Regulatory Compliance

The Wetland Specialist shall submit the following documents if and as specified herein and under Item the relevant Wetland Mitigation items:

- Request for Conditional Acceptance.
- Request for Certificate of Compliance (Partial or Full) when applicable.
- Request for Final Acceptance.

SCOPE OF WORK

In the event of discrepancies with the applicable permits, the Wetland Specialist shall submit a Request for Information (RFI) to the Engineer.

General

The Wetland Specialist shall be responsible for the following:

- Review and have a comprehensive knowledge of the environmental permits relevant to the specific mitigation work being done so as to ensure compliance throughout the duration of the contract.
- Identify and inform the Contractor and Engineer of unique site conditions which may require adjustments to the schedule, design, or construction methods. For example, wildlife nesting, illegal dumping, or rare species.
- Identify and inform the Contractor and Engineer of any sediment or erosion control problems observed within mitigation areas.
- Advise so as to avoid impacts to adjacent areas and regulated wetland resources.
- Participate in necessary meetings as required by permits and when requested by the Engineer.

Inspections & Construction Oversight

The Wetland Specialist shall be responsible for, but not limited to, the following:

- Pre-Construction Site Walk
    - Following surveying, flagging, and staking of all relevant boundaries and elevations by the Contractor, the Wetland Specialist shall walk the site with the Engineer and the Contractor to review existing and proposed conditions, recommend changes if necessary, and approve the following: location and boundaries of the Mitigation Area, target elevations and grades, location of tree protection associated with the Mitigation Area, and final layout and limits of clearing for access route.
    - Select and mark snags, logs, and woody material to be retained for placement in the Wetland Mitigation, as appropriate.
    - Note invasive plants in and adjacent to Wetland Mitigation.
    - Provide summary report if and as specified under Wetland Mitigation items.
- Excavation, Soil Placement, Grading for Replication Areas
    - Approve excavated depth and grading for appropriate wetland hydrology, subsoil preparation, and finished grade of placed wetland soil.
    - Adjust grades as required and approve microtopography. If grades need to be adjusted, submit an RFI to the Engineer.
    - If requested by the Engineer, the Wetland Specialist shall inspect stockpiled wetland soil for moisture content and signs of undesirable weeds.
- Soil Protection and Restoration Measures for Restoration Areas
    - Review and approve methods of soil protection and restoration if required.
    - Confirm decompaction will adequately restore appropriate wetland hydrology. If decompaction measures need to be adjusted, submit an RFI to the Engineer.
- Re-vegetation of Mitigation Area
    - Placement of woody material to be re-used.
    - Verify seed used complies with specifications and site conditions, determine limits for wetland seeding based on elevations, approve seeding and mulching methods, and collect seed tags to submit with Request for Conditional Acceptance.
    - Review planting methods (if applicable) prior to installation and oversee layout of wetland plants.

Conditional Acceptance

Upon completion of construction of the wetland, as part of the Request for Conditional Acceptance, the Wetland Specialist shall provide a brief narrative demonstrating that the wetland construction work was done according to plans (or how modified) and meets the conditions required for acceptance as specified under the Wetland Mitigation items. Submittal shall include a report and photo documention of pre-construction conditions, construction work, seeding, planting, and other work as specified under the Wetland Mitigation items. Photos of completed Wetland Restoration areas shall include the same views as the pre-construction reference photos.

Upon receipt of a Request for Conditional Acceptance, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the Wetland Mitigation items.

Upon approval, MassDOT will issue a letter of Conditional Acceptance. If the Wetland Mitigation work is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

Request for Certificate of Compliance

If required, a Request for Certificate of Compliance shall be prepared and submitted to the Engineer immediately following Conditional Acceptance. Request shall be as specified under the relevant Wetland Mitigation items.

Request for Final Acceptance

Following one full growing season, the Wetland Specialist shall provide a brief narrative of the status of the Wetland Mitigation to be submitted with the Request for Final Acceptance.

Upon receipt of the Request, the Engineer, the Wetland Specialist and regulatory representative (if required) shall assess the Wetland Mitigation and surrounding area to ensure that it meets the conditions specified under the relevant Wetland Mitigation items.

If the Wetland Mitigation is not approved, MassDOT will issue a rejection letter requiring corrective action. The Wetland Specialist shall recommend corrective actions.

METHOD OF MEASUREMENT

Item 755.75 Wetland Specialist shall be measured per hour for on-site service provided by the Wetland Specialist.

Work shall include all inspections, photos, submittals, and associated tasks for construction and restoration oversight, narratives for Conditional and Final Acceptance, Request for Certificate of Compliance (Partial or Full) if required, documentation required for permits, and all other work specified above. Payment shall not include travel time or time spent off-site on reports. Decimal Pay Limits will be 0.25 hours.

BASIS OF PAYMENT

Item 755.75 Wetland Specialist shall be paid at the Contractor bid price for each hour, or fraction thereof, spent on-site to perform the work as described above. Reports and photo documentation are required for payment.

Post wetland construction reports shall be per Item 755.76, Wetland Monitoring Reports.

ITEM 755.76 WETLAND MONITORING REPORTS LUMP SUM

REV. 2022.01.01 (REV. DATE TO BE REMOVED BY MASSDOT CONTRACTS)

Work under this item shall be for the submittal of Wetland Monitoring Reports following the completion of wetland construction and shall include all inspections, photos, and other work required to complete those reports as specified herein.

"Wetland Mitigation" shall be used herein for applicable wetland work, whether Wetland Replication (creation of a new wetland) and/or Wetland Restoration (restoration after temporary impacts).

The Contractor shall retain the services of a Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications, hereafter referred to as the "Wetland Specialist," to complete the Wetland Monitoring reports. Wetland Specialist shall meet requirements specified under Item 755.75 Wetland Specialist.

All on-site Wetland Specialist services required to complete the construction and revegetation of the wetland replication, including preparation and submission of monitoring reports during construction, shall be per Item 755.75 Wetland Specialist.

SCOPE OF WORK

Post-Construction Wetland Monitoring Reports

Final Acceptance of the wetland construction work as specified under item 755.35 and 755.45 shall initiate the beginning of the Monitoring Period.

Inspections and reports shall be performed to ensure compliance with mitigation requirements defined under the relevant Wetland Mitigation items and with all applicable environmental permits. Monitoring reports shall cover the following:

- Identification of all plant species present
- Percent cover for each plant species and overall percent surface area cover by indigenous wetland plant species for replication area and upland
- Description of the viability, health, and vigor of installed plants as well as volunteer plant species within the replication areas
- Description of remedial measures taken to ensure criteria are met
- Depth to apparent water table and/or depth of surface inundation, both as measured from the soil surface and data loggers, as appropriate.
- A conclusion regarding the success of the wetland mitigation area relative to the performance standards at 310 CMR 10.55(4)(b) (unless varied), the design plans, and performance criteria established by MADEP in the variance conditions (when applicable), and the reference wetland.
- Recommendation for a corrective plan of action if needed.

Reports shall be submitted to the Engineer as a digital copy in Portable Document Format (PDF) unless otherwise requested. Hard copies shall be provided as requested by the Engineer. All reports shall be marked with the applicable permit numbers and identifying information as required in the permits. Reports shall include photo documentation of the wetland/s being monitored and shall include a minimum of 3 views from different orientations. Views shall be labeled.

Spring Reports, when required, shall be submitted to the Engineer by July 1 for dispersal to the

appropriate permitting agencies.

End of Year Reports (which may serve as the Fall Report) shall be based on inspections that occur prior to October 15th. Reports shall be submitted to the Engineer no later than November 1 of each year.

Monitoring Reports shall be as follows for ***2*** years:

- *MassDEP: 1 Report - (1 end of year).*
- *ACOE: #1 Report (1 end of year).*
- *Conservation Commission: 4 Reports (1 spring and 1 end of year for two years).*

BASIS OF PAYMENT AND METHOD OF MEASUREMENT

Item 755.76 Wetland Monitoring Reports and associated inspections shall be at the Contract unit price per Lump Sum and shall include all labor, materials, equipment, and all incidental costs required to complete the work. Lump Sum will be paid in equal installments of the Lump Sum divided by the number of reports submitted. Payment shall be upon submittal and acceptance of each report, based on the following schedule:

- Year 1 = ***one spring and one end of year report***
- Year 2 = ***one spring and one end of year report***

ITEM 976.775 **LIVE STAKES** **EACH**

GENERAL

Live stakes shall be planted as shown on the Plans and shall be planted only during dormancy, prior to any growth or blooms.

Live stakes are placed after rip rap. If schedule doesn't allow for installation immediately following rip rap installation, they shall be installed at the next live stake planting window.

Planting Season

Live stakes shall be planted November 1 to December 15; and February 15 to March 31. Stakes shall not be planted in frozen ground.

Live stakes shall be a minimum of four feet in length and a minimum of three-quarter inch (3/4") in diameter. Stakes shall have been harvested locally, within the same physiographic ecoregion and plant hardiness zone. Stakes shall have side branches removed and bark shall be intact. Bottom ends shall be cut with a sharp blade at a 30 to 45-degree angle for insertion into the soil. Top ends of stakes shall be cut square. Stakes shall have at least two (2) bud scars near the top to facilitate branch development.
Stakes must be fresh when brought to site and shall be planted within two (2) weeks of arriving on site. If stored on site after arrival, the stakes shall be cool, moist, and shaded with the bottoms of the stakes soaked in water. Dried stakes shall be rejected. Stakes that have been stored in water shall have the bottom recut, as described above, prior to planting.

CONSTRUCTION METHODS

Care shall be taken to ensure the correct end of the stake is planted in the ground (buds facing upward). One foot of the live stake should be installed into the ground. Prior to planting, pilot holes should be made with a metal bar or re-bar. A rubber mallet should be used to drive the stakes in the ground. Tops that are damaged during insertion shall be cut. Stakes that split during insertion shall be removed and replaced.

Stakes shall be planted at 90-degrees to the slope.

The layout of species shall be as shown on the plans. If not shown, stakes shall be in groupings of three to five plants of the same species (depending on the species used) or shall be as required by the Landscape Architect or Wetland Specialist. Spacing shall be as directed by the Landscape Architect and/or Wetland Specialist, otherwise spacing shall be no farther than four (4) feet apart, and if planted in double rows, stakes shall be in a staggered pattern.

All stakes shall be watered as required for healthy growth.

COMPENSATION

Measurement and payment shall be at the Contract unit price for each stake planted. At a minimum, stakes shall have firmly established roots for acceptance at the time of the one-year warranty period.

ITEM 983.6 NATURAL STREAMBED MATERIAL SQUARE YARD

The work under this heading shall consist of installation of natural streambed material within the channel excavation portion and up to the excavated material to provide a natural streambed for aquatic organisms. The natural streambed construction material is to be placed within the bottom 12" of the channel as depicted on the plans.

The intent of this work is to ensure a natural streambed within the channel, to provide fisheries and wildlife habitat enhancement as part of the wetland replication area and natural wetlands. The natural streambed material shall be comprised of the stones 4 inches and under, that shall meet the following gradation:

Sieve opening	Percent by Mass Passing Through
4"	95
2"	55-65
¾"	30-45
#4	0-5

Partially angular rock is preferred over round and shall be able to lock together to prevent movement during high flows. Crushed stone will not be accepted for any components. The top of streambed elevations shall match existing streambed elevations.

Method of Measurement

Item 983.6 will be measured per Square Yard of natural streambed material, complete in place.

Basis of Payment

Item 983.6 will be paid for at the Contract unit price per Square Yard which price shall include all labor, materials, equipment, and incidentals necessary to complete the work.

ITEM 991.1 CONTROL OF WATER – STRUCTURE NO. P-03-020 (CAK) LUMP SUM

ITEM 991.2 CONTROL OF WATER – STRUCTURE NO. 2 (CULVERT NO. 1) LUMP SUM

ITEM 991.3 CONTROL OF WATER – STRUCTURE NO. 3 (CULVERT NO. 2) LUMP SUM

The work under these Items shall conform to the relevant provisions of Subsection 140.60, amended and/or supplemented as follows:

The work to be done under these Items shall consist of all work required for the control of water and siltation, if necessary, to ensure that all the proposed precast culverts and bridge abutments are installed in the dry as shown on the plans, or as directed by the Engineer. The work shall include all incidental dewatering, pumping, turbidity barriers, sandbagging, filtration or dewatering basins,

or other measures inclusive of sheeting, necessary for sufficient water control to accomplish the construction of the proposed substructure/culvert in the dry.

For demolition purposes, dewatering shall be conducted on an as needed basis as determined by the Contractor. It is the responsibility of the Contractor to assess the site and determine the need and extent of dewatering required and to submit complete working drawings and computations of his/her proposed dewatering scheme to the Engineer for approval in accordance with Subsection 5.02 and these Special Provisions. A Professional Engineer registered in the Commonwealth of Massachusetts shall certify both. The furnishing of such schemes shall not serve to relieve the Contractor of any of his responsibility for the safety of the work or the responsibility for the successful completion of the project. Submittals shall include, but are not limited to, a sequence plan with a timetable and details specific to each of the phases of construction. The submittals shall include working drawings and calculations. Detailing the methods and materials proposed to account for all anticipated loads and construction conditions necessary to permit the work while maintaining a safe work area and protecting property from damage.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of transporting by water any part of the concrete materials being placed. No such pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it is done by a method approved by the Engineer. During dewatering operations, water that is pumped from the interior of any foundation enclosure shall be conveyed into a sedimentation basin or other device or methodology which will cleanse the water before being discharged away from the site or into adjacent wetlands. The locations of any sedimentation basin will be determined by the Contractor based on the selected methods of construction. Placement of the basin shall be in an upland area that is within the existing right of way and temporary easements. At no time shall the Contractor discharge untreated water from the site or into the wetlands. The proposed plan shall include methods and equipment necessary to discharge water from the sedimentation treatment basins.

The Engineer has the right to order the Contractor to stop all excavation operations when in his judgment the Contractor’s water control operations are failing to produce adequate results or are posing a threat to the environment.

Under Items 991.11, 991.12 and 991.13 of the Contract, the Contractor will be paid the Contract Lump Sum price for Control of Water, which price shall include full compensation for the design of the water control schemes, all equipment, materials, tools and labor necessary for the installation, maintenance, operation, removal and disposal of the materials used for water control including placement and/or removal of temporary sheeting or other retaining structures all as outlined above.

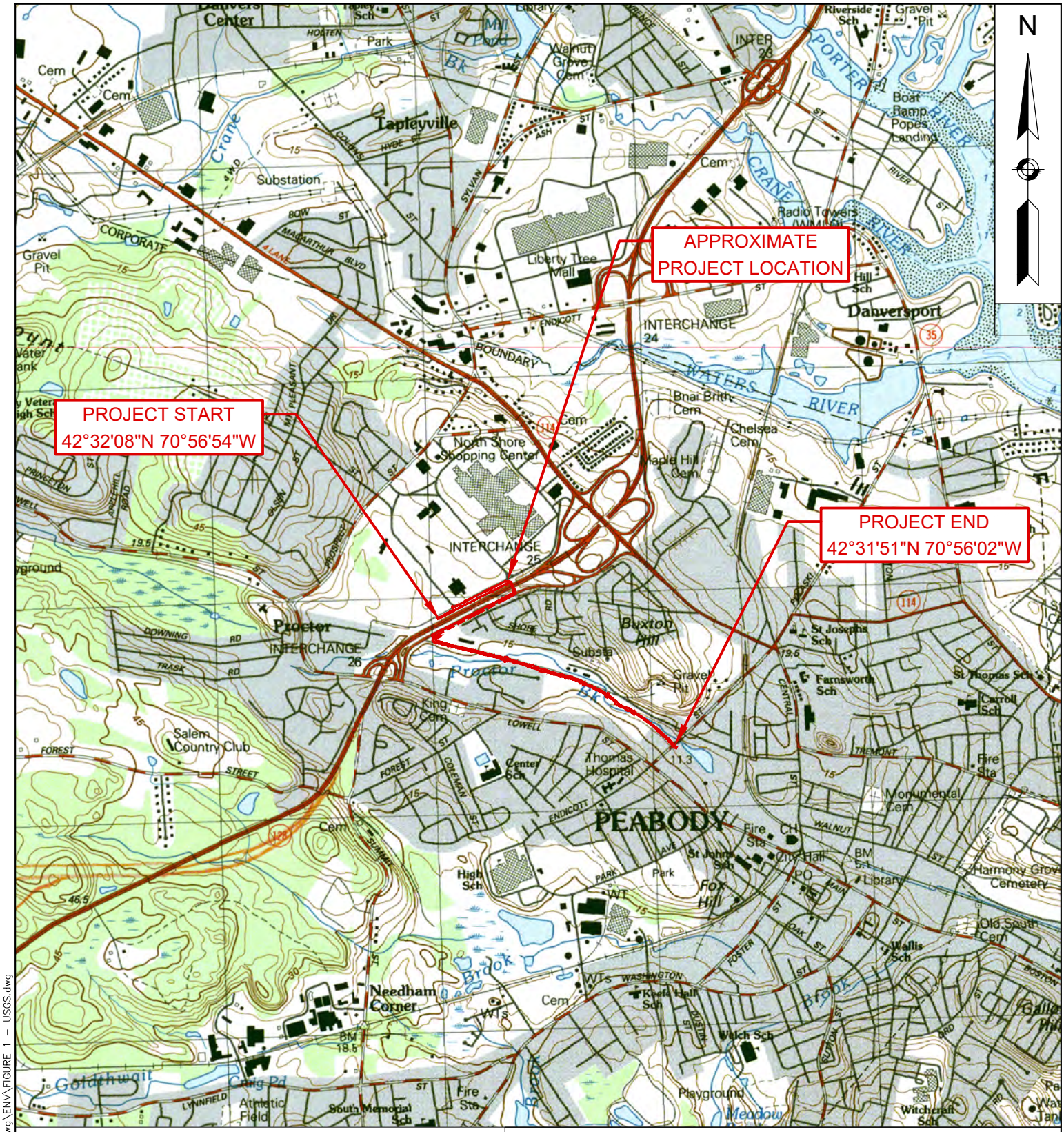
The payment method for Item 991.1 is partial progressive payment of the LUMP SUM Contract Bid Price of this Item. The partial payment schedule will be as follows:

- The first payment of these Items (50% of the Lump Sum bid price) will be made upon complete installation of the water control system to the satisfaction and approval of the Engineer.
- The final payment of these Items (50% of the Lump Sum bid price) will be made upon the satisfactory removal of the water control system after bridge construction is complete.

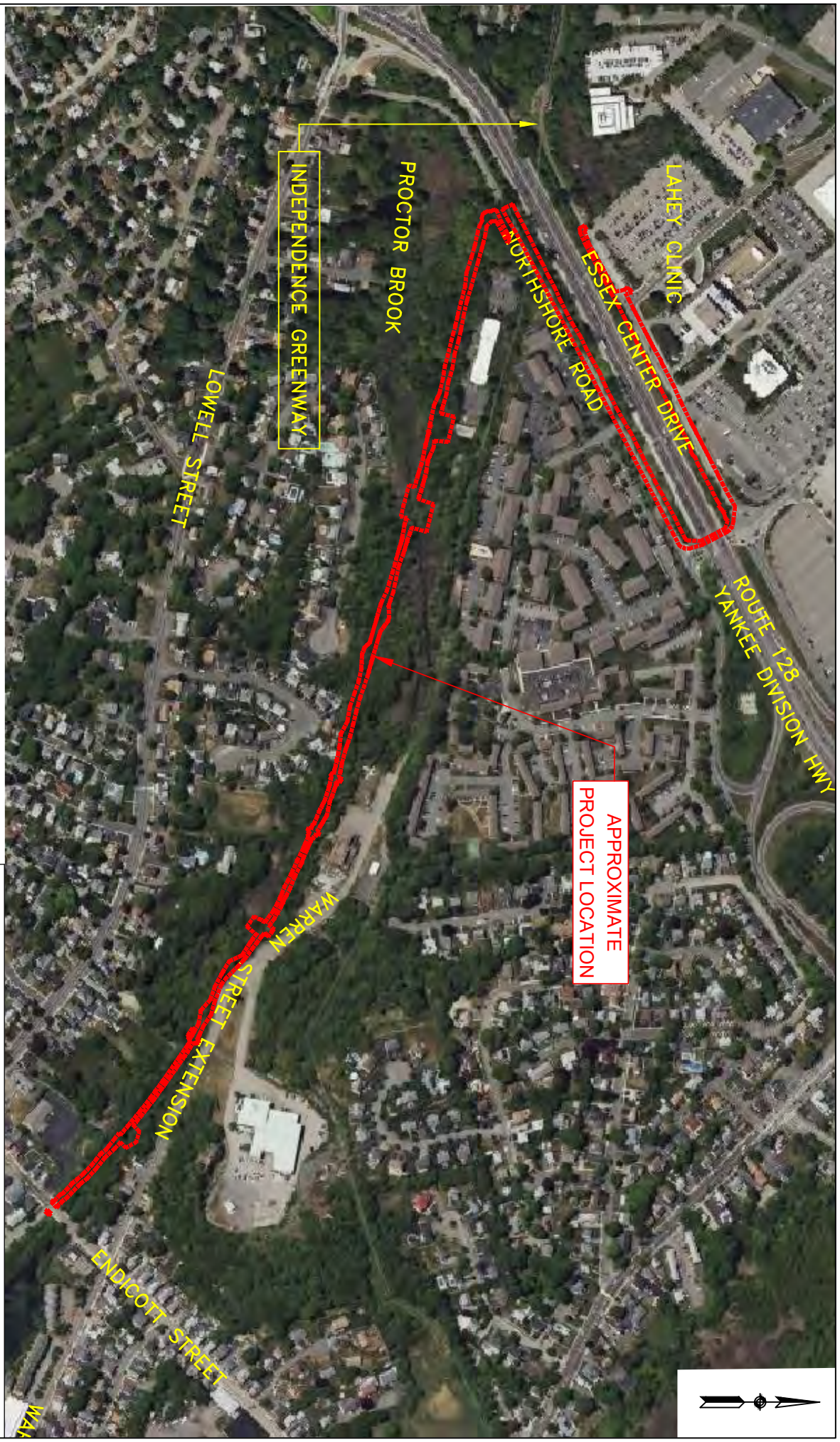
All adjustments and repositioning of water control shall be considered as included under this Item. No separate payment will be made for the removal and disposal of the sediment material collected from the dewatering systems, but all costs in connection therewith shall be included in the Contract unit price bid.

APPENDIX E – FIGURES

Figure 1 – USGS Topographic Map
Figure 2 – Aerial Map
Figure 3 –Protected Resource Area Map
Figure 4 – FEMA Map


APPROXIMATE
PROJECT LOCATION
PROJECT START
42°32'08"N 70°56'54"W
PROJECT END
42°31'51"N 70°56'02"W
N
Danvers Center
Tapleyville
Danversport
Peabody
Proctor
Buxton Hill
Needham Corner
Salem Country Club
Liberty Tree Mall
North Shore Shopping Center
Thomas Hospital
Monumental Cem
Harmony Grove Cemetery
Old South Cem
Walnut Grove Cem
Maple Hill Cem
Chelsea Cem
Bnai Brith Cem
King Cem
Radio Towers
Boat Ramp
Popes Landing
Gravel Pit
Substation
Playground
Meadow
Athletic Field
INTERCHANGE 24
INTERCHANGE 25
INTERCHANGE 26
Crane
Porter
Waters
River
Proctor Brook
Needham Brook
Goldthwait
Craig Rd
Fox Hill
Fox Hill Brook
Center Sch
High Sch
Farnsworth Sch
Carroll Sch
St Josephs Sch
St Thomas Sch
Kiley Sch
Kreft Hall Sch
Welch Sch
Wallis Sch
Witchcraft Sch
South Memorial Sch
Fire Sta
City Hall
Library
PO
CH
BM 18.5
BM 5
WTs
Cem
Park
Substa
Gravel Pit
Riverside Sch
Hill Sch
Tapley Sch
Mill Pond
Mill Bk
Bk
Boundary
Corporate
MacArthur Blvd
4 Lane
Sylvan
Ash
Hyde
Endicott
Lowell
Forest
Coleman
Summer
Walnut
Oak
Foster
Washington
Tremont
Central
Main
Park
Lake
Pleasant
Prospect
Princeton
Apollewa
Broad
Downing
Trask
Shore
Rd
Ave
St
Dr
Blvd
Cir
Pl
Ln
Sq
Way
Ter
Pkwy
Ct
Hwy
Bridge
Brook
Creek
Pond
Hill
Meadow
Field
Park
Cem
Sch
Sta
Substa
Gravel Pit
Playground
Radio Towers
Boat Ramp
Popes Landing

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 2 – AERIAL.dwg



LEGEND:

APPROXIMATE LIMIT OF WORK

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

AERIAL MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION

PEABODY, MA

MASSDOT PROJECT #609211

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:

CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED

DATE: 03/13/2024

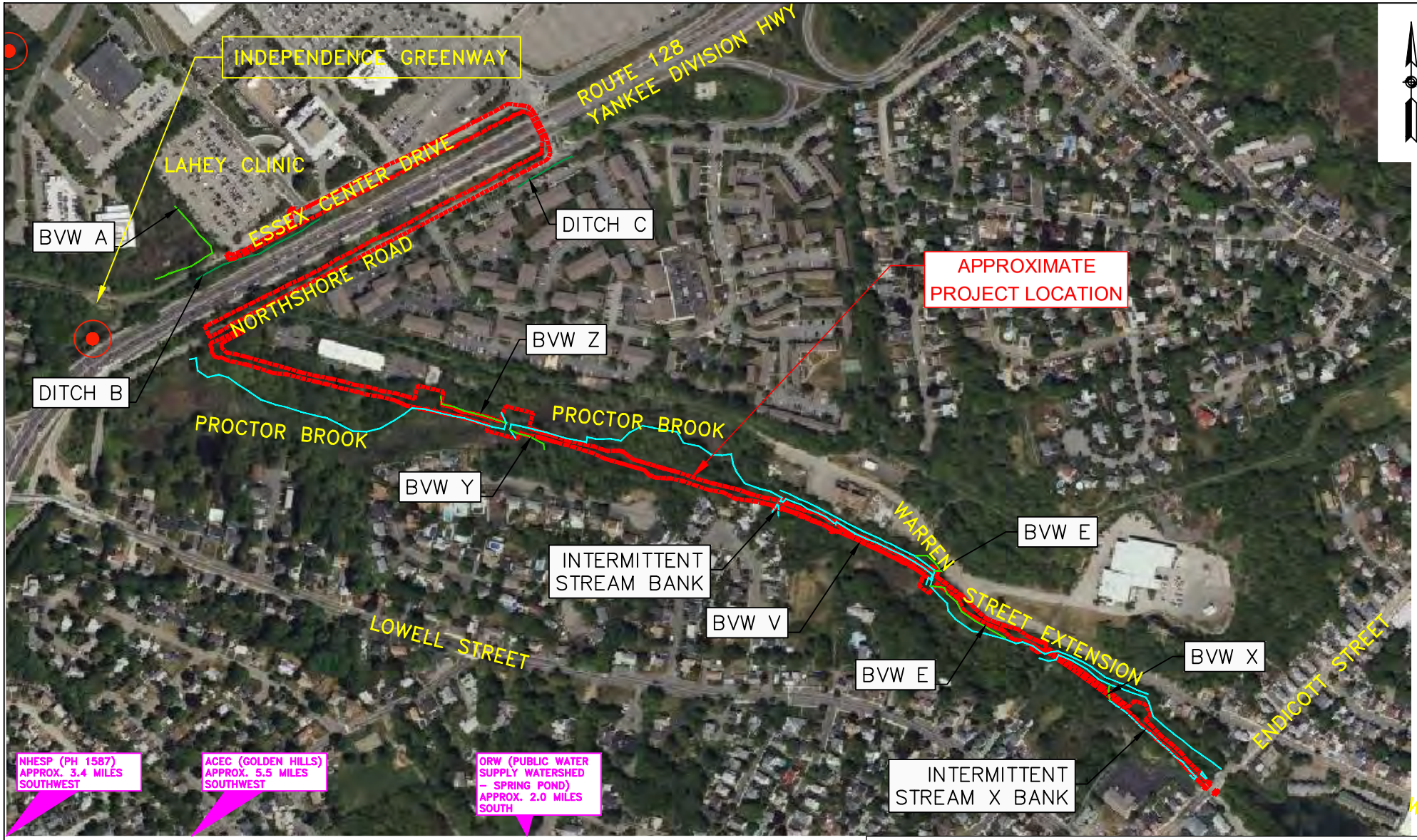
REVISED:

PROJECT NO. 17118

DRAWN BY: JK/VR

CHECKED BY: OF

FIGURE 2



LEGEND:

- APPROXIMATE LIMIT OF WORK
- SURVEYED WETLANDS
- SURVEYED DITCH
- SURVEYED BANK/MAHW/PERENNIAL STREAM
- SURVEYED BANK/INTERMITTENT STREAM
- CERTIFIED VERNAL POOLS
- POTENTIAL VERNAL POOLS

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

ENVIRONMENTAL CONSTRAINTS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

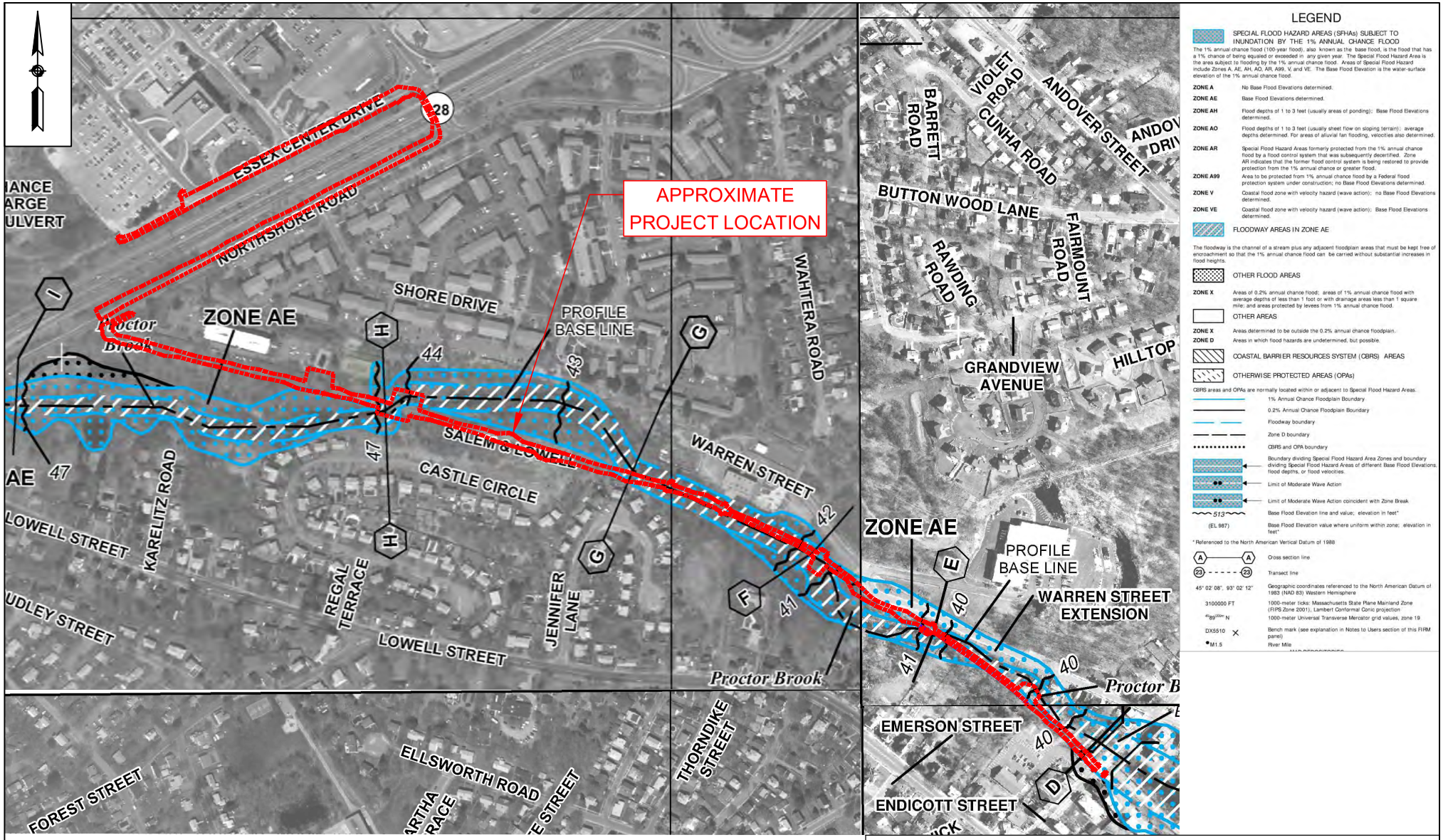
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 05/13/2024
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 3

Proposal No. 609211-132091

\\EgnyteDrive\greenint\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 3 – RESOURCE AREA.dwg

A00829 - 108



LEGEND:

APPROXIMATE LIMIT OF WORK

NOTE:
THE FLOOD ZONE DATA SHOWN IS TAKEN FROM THE (FEDERAL EMERGENCY MANAGEMENT AGENCY) FEMA FOR THE TOWN OF PEABODY, MA (FIRM COMMUNITY PANELS 25009C0412F AND 25009C0414F, DATED 7/3/2012, AND 25009C0416G AND 25009C0418G, DATED 7/16/2014).

SCALE IN FEET
250 0 250 500
1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

FEMA MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118
DATE: 03/13/2024	DRAWN BY: JK/VR
REVISED:	CHECKED BY: OF

FIGURE 4

Proposal No. 609211-132091
Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 4 – FEMA.dwg
A00829 - 109

APPENDIX F – SEDIMENT SAMPLING PLAN APPROVAL & RESULTS

Oxana Fartushnaya

From: Davis, Heidi (DEP) <heidi.davis@mass.gov>
Sent: Tuesday, April 2, 2024 5:20 PM
To: Danielle Spicer
Cc: Lenker, Melissa (DOT); Larner, Erica N. (DOT); Oxana Fartushnaya; Hale, Ryan (DEP)
Subject: RE: Peabody Bikeway (MassDOT 609211) Pre-App Meeting with DEP

Good afternoon, Danielle –

Thank you for the revised sediment sampling plan; via this correspondence, MassDEP approves of the plan.

Best, Heidi

Heidi M. Davis
Senior Wetland Analyst
Highway Unit Supervisor
Wetlands Program, Boston Office
MassDEP
339-225-2332

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

From: Danielle Spicer <dspicer@greenintl.com>
Sent: Tuesday, April 2, 2024 3:37 PM
To: Davis, Heidi (DEP) <heidi.davis@mass.gov>
Cc: Lenker, Melissa (DOT) <Melissa.Lenker@dot.state.ma.us>; Larner, Erica N. (DOT) <erica.n.larner@dot.state.ma.us>; Oxana Fartushnaya <ofartushnaya@greenintl.com>
Subject: Re: Peabody Bikeway (MassDOT 609211) Pre-App Meeting with DEP

CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

We added it (see attached). thank you.

Danielle H. Spicer, P.E.

Office. (978) 923-0400

Direct. (978) 843-5218

February 15, 2024
Revised April 4, 2024

To:	Heidi Davis, MassDEP (heidi.davis@state.ma.us) Tyler Lewis, MassDEP (Tyler.Lewis@mass.gov)
Cc:	Melissa Lenker, MassDOT (melissa.lenker@state.ma.us) Cori Beckwith, MassDOT (corinna.beckwith2@state.ma.us)
From:	Danielle Spicer, P.E., Green International Affiliates, Inc.
Date:	February 15, 2024
Project Name:	Independence Greenway Extension, Peabody, MA MassDOT Project 609211
Project Number:	Green No. 17118.0244
Subject:	**Sediment Sampling Plan for WQC**

1.0 INTRODUCTION AND PURPOSE

Green International Affiliates (Green) has been retained to assist the City of Peabody and Massachusetts Department of Transportation (MassDOT) with the proposed Independence Greenway Extension transportation improvement project in the City of Peabody.

As part of the project, Green has been tasked with obtaining a Water Quality Certification (WQC) for the sediments expected to be disturbed. Green will be tasked with collecting up to three (3) sediment samples via hand-auguring. **Figure 1** depicts the locations of the three (3) proposed exploratory sediment coring locations. Green will utilize TG&B Marine Services (TG&B) to characterize the soil, record field screening, and collect sediment samples at the bottom of exploration. Samples will be submitted to a Massachusetts Certified Laboratory to test for:

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Mercury, Zinc)
- Polychlorinated Biphenyls (PCB's) Pesticides
- Extractable Petroleum Hydrocarbons (EPH)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Semi-Volatile Organic Compounds (SVOCs)
- Total Organic Compounds (TOCs)
- Percent Water
- Grain Size

A Due Diligence Review has been conducted on the site and surrounding area. According to the Massachusetts Hazardous Waste Look-Up Site, there are two closed sites within 500 feet of the project area, RTN 3-0026559 and RTN 3-0023464. Since these are both closed sites and are not located directly within any of the sampling areas, it is not anticipated that these will have any impact on the sampling. The purpose of this plan is to provide the scope of work for the environmental sampling and guidance to the field staff regarding proper sediment sampling and observation and notification procedures in the event of "suspect" contamination.

2.0 SAMPLING PROCEDURE

The work will be done using a coring platform, 3 coring operators, and a petite ponar sampler.

3.0 SITE CONTACTS

TG&B Marine Services
Mark Avakian – (508) 326-3686
mark@tgandbmarine.com

Green International Affiliates
Danielle Spicer – (978) 843-5218
dspicer@greenintl.com

4.0 HEALTH AND SAFETY

The Site is located within an abandoned railroad bed and within a body of water. TG&B Marine Services will take all necessary precautionary measures to assure safety during the duration of work.

The site is located within the Proctor Brook in Peabody, MA.

5.0 SEDIMENT SAMPLING OVERSIGHT

The following is the proposed scope of work for the environmental assessment:

- Three (3) sediment cores will be progressed. The sediment cores will be advanced via hand augur down to the anticipated depth of dredging, a depth of four (4) feet below ground surface (fbgs) as shown on **Figure 1**. When the bottom of exploration is reached, the sediment cores will be terminated. There will be a uniform amount of dredging occurring on the upstream and downstream sides of each stream crossing, therefore only one sample is needed at each of the following sampling locations. The bottom of exploration for sediment coring locations is as follows:
    - "SS-1" (Culvert No. 1 at Sta. 329+85 – North) at 4 fbgs
    - "SS-2" (Culvert No. 2 at Sta. 346+20 – North) at 4 fbgs
    - "SS-3" (Boardwalk Crossing at Sta 358+51 - North) at 4 fbgs
- A TG&B Marine Services engineer will oversee the sediment coring and:
    - Photo-document the sediment conditions for each sample location
    - Prepare field notes documenting the sediment coring activities, sediment descriptions, visual/olfactory observations, and any instances of "suspect" contamination.
    - Observe and screen sediment with a PID at 1-ft intervals

5.1 "Suspect" Contamination Observation Procedures

Considering the nature of the work and limited exposure duration during sediment coring activities, the risk to non-construction and professional personnel is low. However, not all parts of the Site are sampled, and it is crucial for all personnel to be aware of "suspect" contamination.

If "suspect" contamination is observed, TG&B will notify Green/H&H and MassDOT immediately to determine appropriate steps moving forward.

6.0 SAMPLING PLAN

The following sampling procedures are guidelines to be followed during the sediment sampling program to assist with determining where (location and depth) to collect sediment samples for analyses. **Please discuss any changes to the sampling procedures with the MassDOT PM before proceeding with the change.**

6.1 Sampling Procedure

At **each** location, samples will be collected and submitted for analysis of EPHs, PCBs, SVOCs, Metals, Pesticides, TOC, Percent water and grain size.

Augur will be advanced to depths of four (4) fbgs. Sampling will be performed in the following manner.

6.1.1 *Composite Samples (Metals, SVOCs, EPH, PCBs, Pesticides, TOC, % Water, and Grain Size)*

Composite samples will consist of no more than three (3) grab samples, either vertically or horizontally. Composite sampling shall be completed in the following manner:

- At each location, place soils from similar strata into baggies or jars noting location and depth on the container.
- If no "suspect" material is present, collect a composite sample of the suspect material using three (3) grab samples from the same boring, as applicable.
- Composite samples will not to be submitted for VOCs.

FIGURES

LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(j))
- APPROXIMATE LIMIT OF WORK (OUTSIDE LIMITED PROJECT PROVISIONS)
- SURVEYED WETLANDS
- SURVEYED DITCH
- SURVEYED BANK/MAHW/PERENNIAL STREAM
- SURVEYED BANK/INTERMITTENT STREAM
- 200-FOOT RIVERFRONT AREA
- 100-FOOT WETLAND BUFFER
- CERTIFIED VERNAL POOLS
- POTENTIAL VERNAL POOLS

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

PROTECTED RESOURCE AREA MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

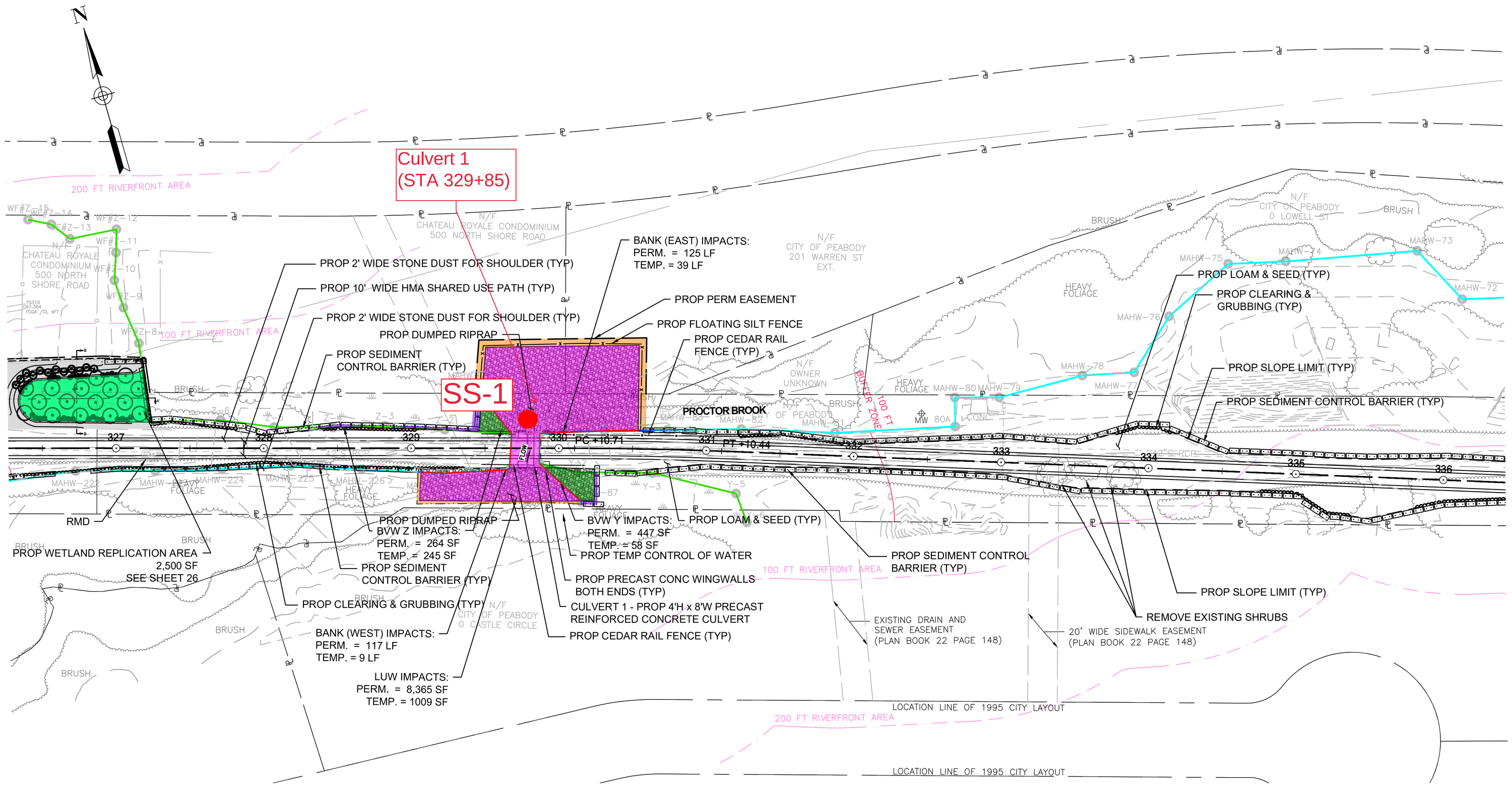
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 12/13/2023
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 3

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 3 - RESOURCE AREA.dwg

A00829 - 116



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)
- WETLAND REPLICATION AREA

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

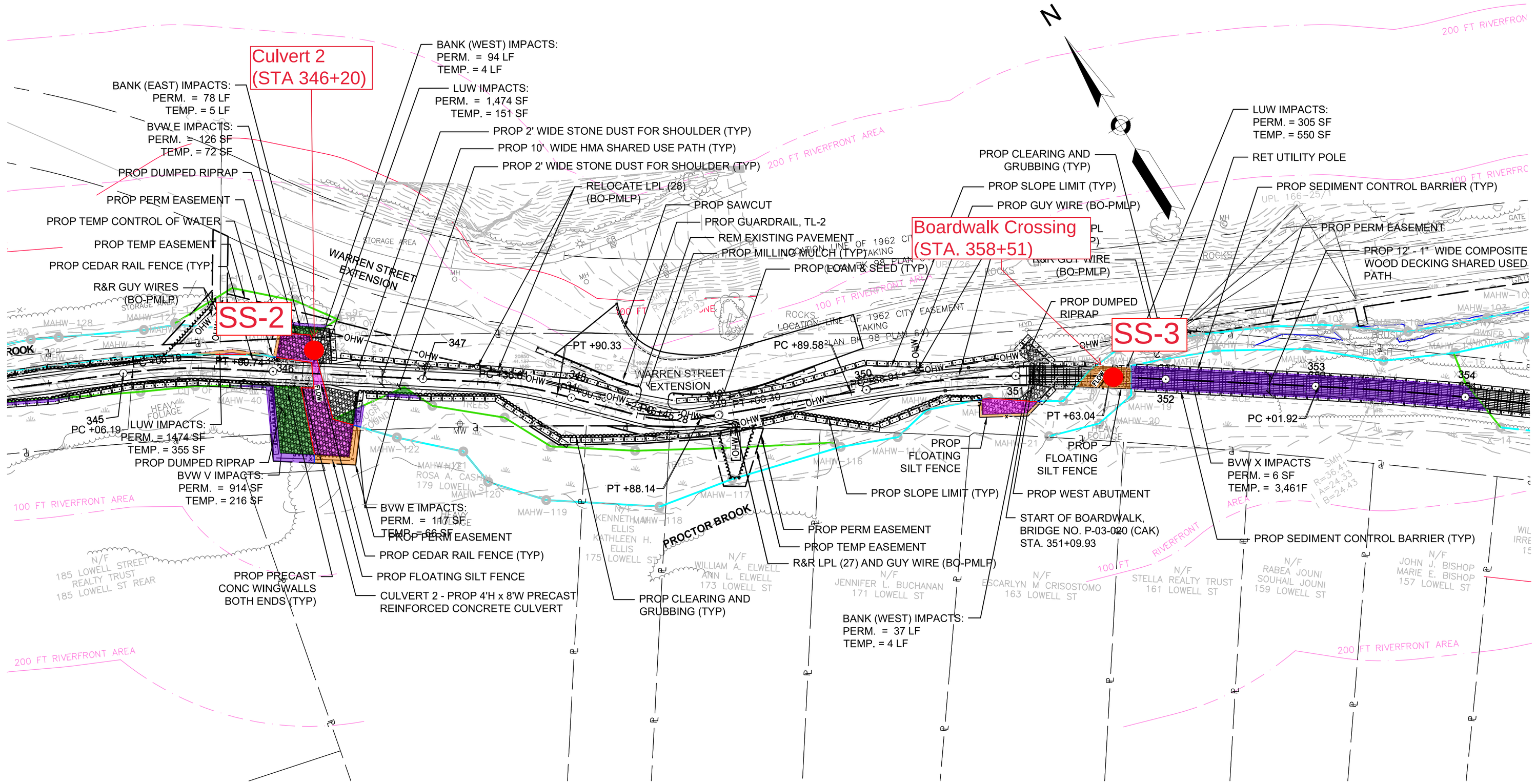
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: | CHECKED BY: DS/OF

FIGURE 6E

Proposal No. 609211-132091
A00829 - 117



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

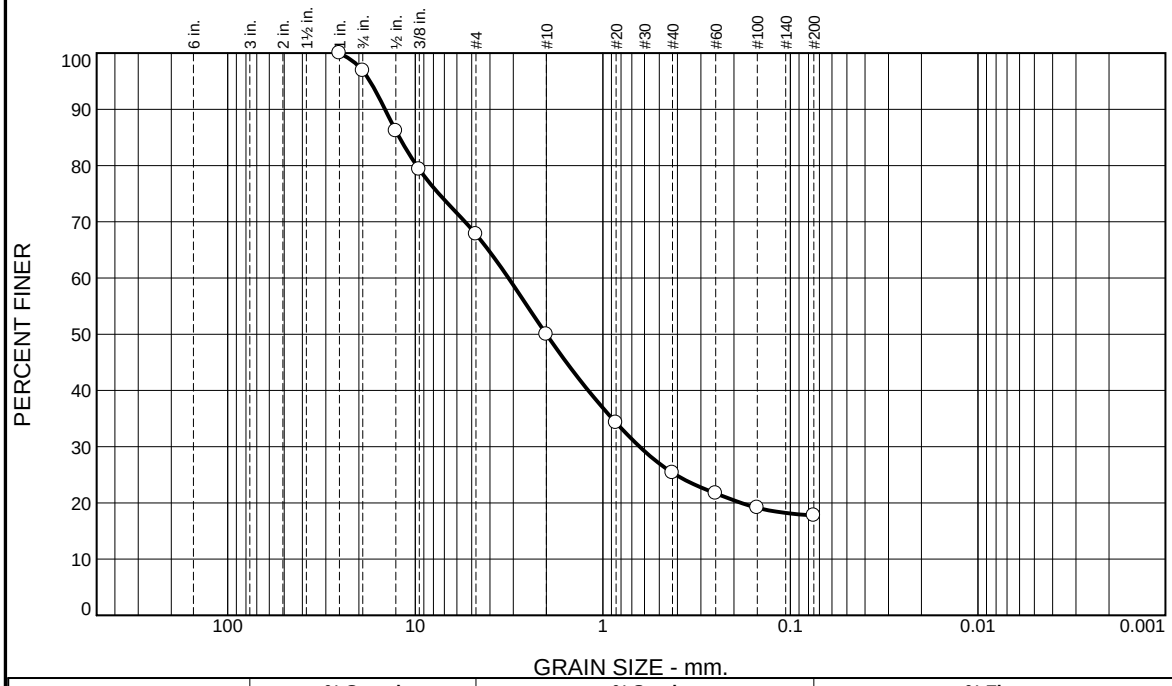
PREPARED BY:	PREPARED FOR:
GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DR. SUITE 200, TEWKSBURY, MA 24 ALBION RD, LINCOLN, RI	CITY OF PEABODY 24 LOWELL STREET PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118	FIGURE 6G
DATE: 09/29/2023 REVISED:	DRAWN BY: JK CHECKED BY: DS/OF	

Proposal No. 609211-132091
A00829 - 118

NOTE: The new sediment samples for WQC in accordance with the DEP Sediment Sampling Analysis approved on 4/2/2024 were taken on 4/30/2024, and the updated Grain Size Analysis and Chemical Analysis of Sediment will be provided to DEP as soon as they are received from the lab.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	29.1	17.8	24.6	7.7	17.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.9		
0.5"	86.2		
0.375"	79.3		
#4	67.8		
#10	50.0		
#20	34.3		
#40	25.4		
#60	21.7		
#100	19.1		
#200	17.7		

* (no specification provided)

Material Description

Black Organic f-c SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.5059 D_{85}= 12.1566 D_{60}= 3.1859
D_{50}= 2.0007 D_{30}= 0.6368 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

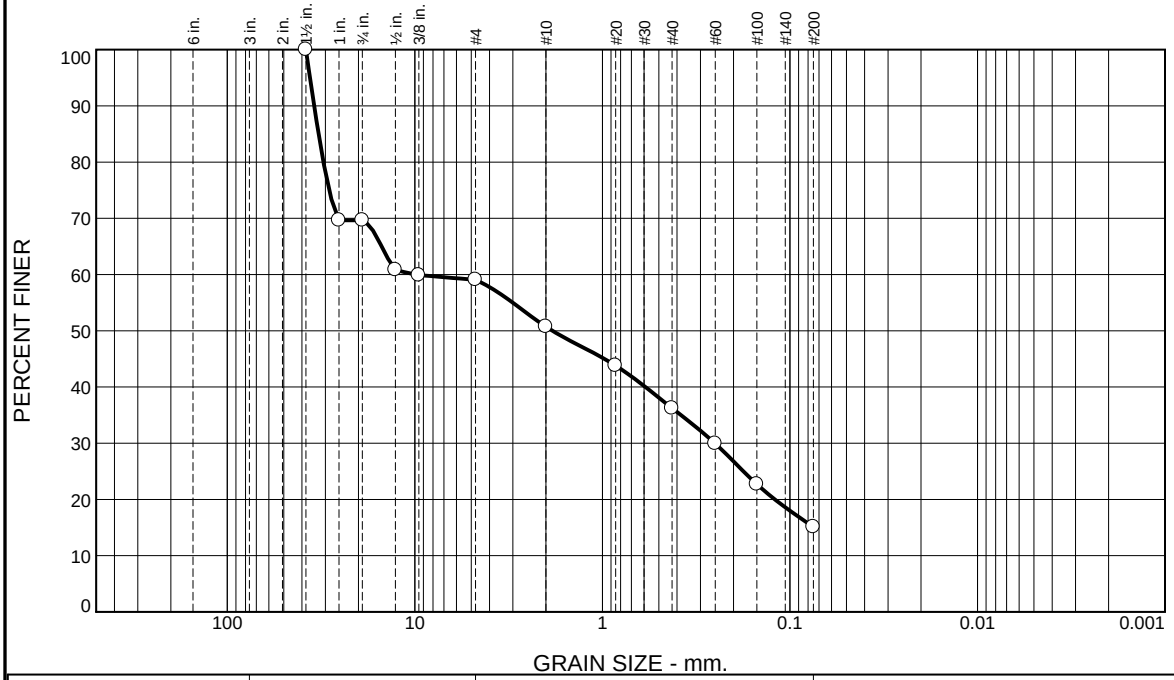
Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B5 / Culvert

Thielsch Engineering Inc.
Cranston, RI

Client: ESS
Project: Peabody Bikeway
Peabody, MA
Project No: 1901077 **Figure** 1901077-03

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.3	10.6	8.4	14.5	21.1	15.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	69.7		
3/4"	69.7		
1/2"	60.8		
3/8"	59.9		
#4	59.1		
#10	50.7		
#20	43.8		
#40	36.2		
#60	29.9		
#100	22.7		
#200	15.1		

* (no specification provided)

Material Description

Black Organic f-c SAND and f-c GRAVEL, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 34.4095 D_{85}= 32.5903 D_{60}= 9.8653
D_{50}= 1.8449 D_{30}= 0.2513 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

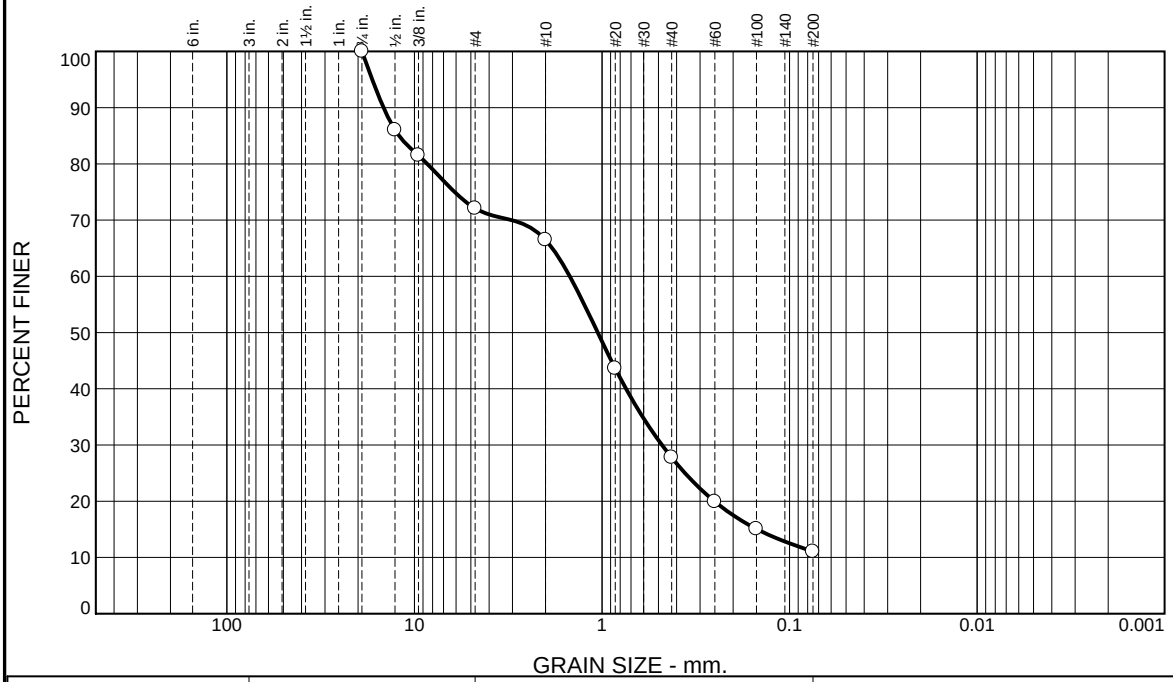
Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B6 / Culvert

Thielsch Engineering Inc.

Cranston, RI

Client: ESS
Project: Peabody Bikeway
Peabody, MA
Project No: 1901077 **Figure** 1901077-04

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	27.9	5.6	38.7	16.8	11.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	86.0		
0.375"	81.5		
#4	72.1		
#10	66.5		
#20	43.6		
#40	27.8		
#60	19.9		
#100	15.1		
#200	11.0		

* (no specification provided)

Material Description

Dark Brown f-m SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.6216 D_{85}= 12.1017 D_{60}= 1.4842
D_{50}= 1.0542 D_{30}= 0.4789 D_{15}= 0.1486
D_{10}= C_u= C_c=

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 8-10' **Date Sampled:**
Sample Number: B-7 / S-5

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-12

NOTE: The new sediment samples for WQC in accordance with the DEP Sediment Sampling Analysis approved on 4/2/2024 were taken on 4/30/2024, and the updated Grain Size Analysis and Chemical Analysis of Sediment will be provided to DEP as soon as they are received from the lab.

Appendix E – Environmental Laboratory Test Results

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Mike P. Smith
GZA GeoEnvironmental, Inc.
144 Elm St
Amesbury, MA 01913

RE: Peabody Bikeway (01.0174019.00)
ESS Laboratory Work Order Number: 1901077

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 4:12 pm, Jan 15, 2019

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses

CTS - Cranston, RI	Grain Size Analysis

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

SAMPLE RECEIPT

The following samples were received on January 04, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has reviewed all QA/QC Requirements and Performance Standards listed in each method. Holding times and preservation have also been reviewed. All CAM requirements have been performed and achieved unless noted in the project narrative.

Each method has been set-up in the laboratory to reach required MCP standards. The methods for aqueous VOA and Soil Methanol VOA have known limitations for certain analytes. The regulatory standards may not be achieved due to these limitations. In addition, for all methods, matrix interferences, dilutions, and %Solids may elevate method reporting limits above regulatory standards. ESS Laboratory can provide, upon request, a Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Low Level VOA vials were frozen by ESS Laboratory on January 04, 2019 at 17:30.

Question I: All samples for EPH and Metals were analyzed for a subset of the required MCP list per the client's request.

Volatile Analysis: The low level run for sample Boring B6-Culvert 0-2FT (1901077-04) had an internal standard outside of QC criteria. The laboratory could not re-analysis at low-level due to a cracked vial. The sample was re-analyzed using the methanol vial. Both the low-level and Methanol have been reported.

Lab Number	Sample Name	Matrix	Analysis
1901077-01	Bridge-Leftblank 0-2ft	Soil	1010, 1311, 1311/6010C, 6010C, 7.3.3.2, 7.3.4.1, 7471B, 8081B, 8082A, 8100M, 8151A, 8260B Low, 8270D, 9045, 9050A, 9060, EPH8270, MADEP-EPH
1901077-02	Bridge-Rightbank 0-2ft	Soil	1010, 6010C, 7.3.3.2, 7.3.4.1, 7471B, 8081B, 8082A, 8100M, 8151A, 8260B Low, 8270D, 9045, 9050A, 9060, EPH8270, MADEP-EPH
1901077-03	Boring B5-Culvert 0-2ft	Soil	1010, 6010C, 7.3.3.2, 7.3.4.1, 7471B, 8081B, 8082A, 8100M, 8151A, 8260B Low, 8270D, 9045, 9050A, 9060, EPH8270, MADEP-EPH, SUB
1901077-04	Boring B6-Culvert 0-2ft	Soil	1010, 6010C, 7.3.3.2, 7.3.4.1, 7471B, 8081B, 8082A, 8100M, 8151A, 8260B, 8260B Low, 8270D, 9045, 9050A, 9060, EPH8270, MADEP-EPH, SUB

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

PROJECT NARRATIVE

5035/8260B Volatile Organic Compounds / Low Level

1901077-01 **Surrogate recovery(ies) above upper control limit (S+).**
1,2-Dichloroethane-d4 (132% @ 70-130%)

1901077-04 **Internal Standard(s) outside of criteria (I).**
1,4-Dichlorobenzene-D4 (49% @ 50-200%)

5035/8260B Volatile Organic Compounds / Methanol

C9A0171-CCV1 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
1,4-Dioxane - Screen (35% @ 20%), 2-Hexanone (33% @ 20%), 4-Methyl-2-Pentanone (32% @ 20%), Acetone (22% @ 20%), Bromoform (23% @ 20%), Tetrahydrofuran (31% @ 20%)

CA91050-BSD1 **Relative percent difference for duplicate is outside of criteria (D+).**
2-Hexanone (24% @ 20%)

8081B Organochlorine Pesticides

C9A0123-CCV5 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
4,4′-DDD (22% @ 20%), 4,4′-DDT (21% @ 20%), alpha-Chlordane (25% @ 20%), Endosulfan I (31% @ 20%), Endosulfan II (26% @ 20%), gamma-Chlordane (23% @ 20%)

8151A Chlorinated Herbicides

1901077-03 **Modified result**
MCPP

1901077-03 **Peaks found in the retention time window for MCPP did not confirm by GC/MS.**

1901077-04 **Lower value is used due to matrix interferences (LC).**
Dicamba [2C]

1901077-04 **Modified result**
MCPP

1901077-04 **Peaks found in the retention time window for MCPP did not confirm by GC/MS.**

1901077-04 **Percent difference between primary and confirmation results exceeds 40% (P).**
Dicamba [2C]

1901077-04 **Surrogate recovery(ies) outside of criteria due to matrix (UCM/coelution/matrix is present) (SM).**
DCAA (155% @ 30-150%), DCAA [2C] (1060% @ 30-150%)

CA90751-BSD1 **Relative percent difference for duplicate is outside of criteria (D+).**
2,4-DB [2C] (36% @ 30%)

8270D Semi-Volatile Organic Compounds

C9A0064-CCV1 **Calibration required quadratic regression (Q).**
2,4-Dinitrophenol (109% @ 80-120%), Pentachlorophenol (115% @ 80-120%)

C9A0064-CCV1 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
Benzo(g,h,i)perylene (21% @ 20%)

C9A0139-CCV1 **Calibration required quadratic regression (Q).**
2,4-Dinitrophenol (114% @ 80-120%), Pentachlorophenol (114% @ 80-120%)

C9A0139-CCV1 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
4-Chloroaniline (23% @ 20%)

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway ESS Laboratory Work Order: 1901077

CA90716-BS1 **Blank Spike recovery is below lower control limit (B-).**
4-Chloroaniline (38% @ 40-140%)

CA90716-BSD1 **Blank Spike recovery is below lower control limit (B-).**
4-Chloroaniline (38% @ 40-140%)

MADEP-EPH Extractable Petroleum Hydrocarbons

C9A0109-CCV4 **Continuing Calibration %Diff/Drift is above control limit (CD+).**
Naphthalene (25% @ 20%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1901077-01 through 1901077-04**

Matrices: ( ) Ground Water/Surface Water (X) Soil/Sediment ( ) Drinking Water ( ) Air ( ) Other:_____

CAM Protocol (check all that apply below):

(X) 8260 VOC CAM II A	(X) 7470/7471 Hg CAM III B	( ) MassDEP VPH (GC/PID/FID) CAM IV A	(X) 8082 PCB CAM V A	( ) 9014 Total Cyanide/PAC CAM VI A	( ) 6860 Perchlorate CAM VIII B
(X) 8270 SVOC CAM II B	( ) 7010 Metals CAM III C	( ) MassDEP VPH (GC/MS) CAM IV C	(X) 8081 Pesticides CAM V B	( ) 7196 Hex Cr CAM VI B	( ) MassDEP APH CAM IX A
(X) 6010 Metals CAM III A	( ) 6020 Metals CAM III D	(X) MassDEP EPH CAM IV B	(X) 8151 Herbicides CAM V C	( ) Explosives CAM VIII A	( ) TO-15 VOC CAM IX B

Affirmative responses to questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	Yes (X) No ( )
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	Yes (X) No ( )
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	Yes (X) No ( )
D	Does the laboratory report comply with all the reporting requirements specified in the CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	Yes (X) No ( )
E	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes (X) No ( )
	b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	Yes ( ) No ( )
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	Yes (X) No ( )

Responses to Questions G, H and I below are required for "'Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)?	Yes (X) No ( )*
	***Data User Note:* Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.**	
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes ( ) No (X)*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes ( ) No (X)*

All negative responses must be addressed in an attached laboratory narrative.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: _____ Date: January 15, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.53** (2.65)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Barium	**85.2** (2.65)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Cadmium	**0.73** (0.53)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Chromium	**130** (1.06)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Lead	**110** (5.30)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Mercury	**0.098** (0.037)		7471B		1	BJV	01/08/19 15:03	0.84	40	CA90753
Selenium	ND (5.30)		6010C		1	BJV	01/08/19 0:58	2.97	100	CA90752
Silver	ND (0.53)		6010C		1	KJK	01/08/19 0:58	2.97	100	CA90752

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/L

Extraction Method: 3005A TCLP

1311 TCLP Metals

Analyte	Results (MRL)	MDL	Method	TCLP Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Chromium	ND (0.020)		1311/6010C		1	KJK	01/10/19 3:20	50	50	CA90839
Lead	ND (0.050)		1311/6010C		1	KJK	01/10/19 3:20	50	50	CA90839

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 6.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1,1-Trichloroethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1,2,2-Tetrachloroethane	ND (0.0025)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1,2-Trichloroethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1-Dichloroethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1-Dichloroethene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,1-Dichloropropene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2,3-Trichlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2,3-Trichloropropane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2,4-Trichlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2,4-Trimethylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2-Dibromo-3-Chloropropane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2-Dibromoethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2-Dichlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2-Dichloroethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,2-Dichloropropane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,3,5-Trimethylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,3-Dichlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,3-Dichloropropane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,4-Dichlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
1,4-Dioxane	ND (0.125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
2,2-Dichloropropane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
2-Butanone	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
2-Chlorotoluene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
2-Hexanone	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
4-Chlorotoluene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
4-Isopropyltoluene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
4-Methyl-2-Pentanone	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Acetone	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Benzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Bromobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Bromochloromethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 6.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Bromoform	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Bromomethane	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Carbon Disulfide	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Carbon Tetrachloride	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Chlorobenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Chloroethane	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Chloroform	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Chloromethane	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
cis-1,2-Dichloroethene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
cis-1,3-Dichloropropene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Dibromochloromethane	ND (0.0025)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Dibromomethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Dichlorodifluoromethane	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Diethyl Ether	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Di-isopropyl ether	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Ethyl tertiary-butyl ether	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Ethylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Hexachlorobutadiene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Isopropylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Methyl tert-Butyl Ether	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Methylene Chloride	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Naphthalene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
n-Butylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
n-Propylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
sec-Butylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Styrene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
tert-Butylbenzene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Tertiary-amyl methyl ether	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Tetrachloroethene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Tetrahydrofuran	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Toluene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 6.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
trans-1,3-Dichloropropene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Trichloroethene	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Trichlorofluoromethane	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Vinyl Chloride	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Xylene O	ND (0.0062)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Xylene P,M	ND (0.0125)		8260B Low		1	01/07/19 16:53	C9A0076	CA90706
Xylenes (Total)	ND (0.0125)		8260B Low		1	01/07/19 16:53		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*132 %*	*S+*	*70-130*
Surrogate: 4-Bromofluorobenzene	*92 %*		*70-130*
Surrogate: Dibromofluoromethane	*119 %*		*70-130*
Surrogate: Toluene-d8	*97 %*		*70-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 19
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 14:15

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
4,4´-DDE	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
4,4´-DDT	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Aldrin	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
alpha-BHC	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
alpha-Chlordane [2C]	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
beta-BHC	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Chlordane (Total) [2C]	ND (0.0331)		8081B		1	01/12/19 9:27	C9A0200	CA90714
delta-BHC	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Dieldrin	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Endosulfan I	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Endosulfan II	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Endosulfan Sulfate	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Endrin	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Endrin Ketone	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
gamma-BHC (Lindane)	ND (0.0025)		8081B		1	01/12/19 9:27	C9A0200	CA90714
gamma-Chlordane	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Heptachlor	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Heptachlor Epoxide	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Hexachlorobenzene	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Methoxychlor	ND (0.0041)		8081B		1	01/12/19 9:27	C9A0200	CA90714
Toxaphene	ND (0.207)		8081B		1	01/12/19 9:27	C9A0200	CA90714

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*70 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*85 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*64 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*69 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 20.2
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: CAD
Prepared: 1/7/19 15:45

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1221	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1232	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1242	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1248	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1254	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1260	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1262	ND (0.08)		8082A		1	01/08/19 12:59		CA90710
Aroclor 1268	ND (0.08)		8082A		1	01/08/19 12:59		CA90710

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*68 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*72 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*69 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*75 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 20.2
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: SMR
Prepared: 1/7/19 11:08

8100M Total Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Total Petroleum Hydrocarbons	**41.4** (15.6)		8100M		1	01/07/19 22:44	C9A0078	CA90717

	%Recovery	Qualifier	Limits
Surrogate: O-Terphenyl	*84 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 10.1
Final Volume: 4
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 17:50

8151A Chlorinated Herbicides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
2,4,5-T	ND (0.015)		8151A		1	01/10/19 6:07	C9A0131	CA90751
2,4,5-TP (Silvex)	ND (0.015)		8151A		1	01/10/19 6:07	C9A0131	CA90751
2,4-D	ND (0.073)		8151A		1	01/10/19 6:07	C9A0131	CA90751
2,4-DB	ND (0.074)		8151A		1	01/10/19 6:07	C9A0131	CA90751
Dalapon	ND (0.071)		8151A		1	01/10/19 6:07	C9A0131	CA90751
Dicamba	ND (0.015)		8151A		1	01/10/19 6:07	C9A0131	CA90751
Dichlorprop	ND (0.073)		8151A		1	01/10/19 6:07	C9A0131	CA90751
Dinoseb	ND (0.074)		8151A		1	01/10/19 6:07	C9A0131	CA90751
MCPA	ND (3.62)		8151A		1	01/10/19 6:07	C9A0131	CA90751
MCPP [2C]	ND (3.66)		8151A		1	01/10/19 6:07	C9A0131	CA90751

	%Recovery	Qualifier	Limits
Surrogate: DCAA	*99 %*		*30-150*
Surrogate: DCAA [2C]	*100 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 15.4
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
1,2-Dichlorobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
1,3-Dichlorobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
1,4-Dichlorobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4,5-Trichlorophenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4,6-Trichlorophenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4-Dichlorophenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4-Dimethylphenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4-Dinitrophenol	ND (2.56)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,4-Dinitrotoluene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2,6-Dinitrotoluene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2-Chloronaphthalene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2-Chlorophenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2-Methylnaphthalene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2-Methylphenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
2-Nitrophenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
3,3´-Dichlorobenzidine	ND (1.02)		8270D		1	01/08/19 0:07	C9A0064	CA90716
3+4-Methylphenol	ND (1.02)		8270D		1	01/08/19 0:07	C9A0064	CA90716
4-Bromophenyl-phenylether	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
4-Chloroaniline	ND (1.02)		8270D		1	01/08/19 0:07	C9A0064	CA90716
4-Nitrophenol	ND (2.56)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Acenaphthene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Acenaphthylene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Acetophenone	ND (1.02)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Aniline	ND (2.56)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Anthracene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Azobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Benzo(a)anthracene	**0.573** (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Benzo(a)pyrene	**0.518** (0.256)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Benzo(b)fluoranthene	**0.577** (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Benzo(g,h,i)perylene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Benzo(k)fluoranthene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 15.4
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
bis(2-Chloroethyl)ether	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
bis(2-chloroisopropyl)Ether	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
bis(2-Ethylhexyl)phthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Butylbenzylphthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Chrysene	**0.647** (0.256)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Dibenzo(a,h)Anthracene	ND (0.256)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Dibenzofuran	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Diethylphthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Dimethylphthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Di-n-butylphthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Di-n-octylphthalate	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Fluoranthene	**1.41** (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Fluorene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Hexachlorobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Hexachlorobutadiene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Hexachloroethane	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Indeno(1,2,3-cd)Pyrene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Isophorone	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Naphthalene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Nitrobenzene	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
N-Nitrosodimethylamine	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Pentachlorophenol	ND (2.56)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Phenanthrene	**0.647** (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Phenol	ND (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Pyrene	**0.955** (0.510)		8270D		1	01/08/19 0:07	C9A0064	CA90716
Pyridine	ND (2.56)		8270D		1	01/08/19 0:07	C9A0064	CA90716

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*54 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*83 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*64 %*		*30-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 15.4
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorobiphenyl		*65 %*		*30-130*				
Surrogate: 2-Fluorophenol		*65 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*61 %*		*30-130*				
Surrogate: Phenol-d6		*66 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*71 %*		*30-130*				

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Conductivity	**WL 306** (5)		9050A		1	JLK	01/04/19 21:21	umhos/cm	CA90430
Corrosivity (pH)	**6.68** (N/A)		9045		1	CCP	01/04/19 18:06	S.U.	CA90417
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 19 ºC.**								
Flashpoint	**> 200** (N/A)		1010		1	EEM	01/07/19 13:15	°F	CA90722
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	01/07/19 21:43	mg/kg	CA90745
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	01/07/19 21:43	mg/kg	CA90745
Total Organic Carbon (Average)	**54200** (362)		9060		1	CCP	01/09/19 14:19	mg/kg dry wt	[CALC]

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 25
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 1/8/19 14:35

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (23.6)		MADEP-EPH		1	CAD	01/09/19 2:20	C9A0146	CA90804
C19-C36 Aliphatics1	ND (23.6)		MADEP-EPH		1	CAD	01/09/19 2:20	C9A0146	CA90804
C11-C22 Unadjusted Aromatics1	**29.6** (23.6)		EPH8270		1	VSC	01/09/19 1:08	C9A0109	CA90804
C11-C22 Aromatics1,2	**26.7** (23.6)		EPH8270			VSC	01/09/19 1:08		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*72 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*64 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*78 %*		*40-140*
Surrogate: O-Terphenyl	*72 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Leftblank 0-2ft
Date Sampled: 01/04/19 08:00
Percent Solids: 64
Initial Volume: 100
Final Volume: 2000
Extraction Method: 1311

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-01
Sample Matrix: Soil
Units: °C
Analyst: BJV
Prepared: 1/8/19 17:00

TCLP Extraction by 1311

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Batch
Temperature (Min C)	**20.9** (N/A)		1311		1	BJV	01/09/19 10:51	CA90838
Temperature (Max C)	**22.1** (N/A)		1311		1	BJV	01/09/19 10:51	CA90838
Temperature (Range)	**Temperature is not within 23 +/-2 °C.** (N/A)							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**3.05** (1.00)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Barium	**16.4** (1.00)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Cadmium	ND (0.20)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Chromium	**18.5** (0.40)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Lead	**14.5** (1.99)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Mercury	**0.045** (0.009)		7471B		1	BJV	01/08/19 15:05	2.49	40	CA90753
Selenium	ND (1.99)		6010C		1	BJV	01/08/19 1:02	5.96	100	CA90752
Silver	ND (0.40)		6010C		2	KJK	01/08/19 15:32	5.96	100	CA90752

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 7.1
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1,1-Trichloroethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1,2,2-Tetrachloroethane	ND (0.0017)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1,2-Trichloroethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1-Dichloroethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1-Dichloroethene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,1-Dichloropropene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2,3-Trichlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2,3-Trichloropropane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2,4-Trichlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2,4-Trimethylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2-Dibromo-3-Chloropropane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2-Dibromoethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2-Dichlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2-Dichloroethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,2-Dichloropropane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,3,5-Trimethylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,3-Dichlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,3-Dichloropropane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,4-Dichlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
1,4-Dioxane	ND (0.0837)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
2,2-Dichloropropane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
2-Butanone	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
2-Chlorotoluene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
2-Hexanone	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
4-Chlorotoluene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
4-Isopropyltoluene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
4-Methyl-2-Pentanone	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Acetone	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Benzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Bromobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Bromochloromethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 7.1
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Bromoform	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Bromomethane	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Carbon Disulfide	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Carbon Tetrachloride	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Chlorobenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Chloroethane	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Chloroform	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Chloromethane	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
cis-1,2-Dichloroethene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
cis-1,3-Dichloropropene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Dibromochloromethane	ND (0.0017)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Dibromomethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Dichlorodifluoromethane	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Diethyl Ether	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Di-isopropyl ether	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Ethyl tertiary-butyl ether	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Ethylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Hexachlorobutadiene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Isopropylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Methyl tert-Butyl Ether	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Methylene Chloride	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Naphthalene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
n-Butylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
n-Propylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
sec-Butylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Styrene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
tert-Butylbenzene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Tertiary-amyl methyl ether	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Tetrachloroethene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Tetrahydrofuran	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Toluene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 7.1
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
trans-1,3-Dichloropropene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Trichloroethene	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Trichlorofluoromethane	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Vinyl Chloride	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Xylene O	ND (0.0042)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Xylene P,M	ND (0.0084)		8260B Low		1	01/07/19 17:18	C9A0076	CA90706
Xylenes (Total)	ND (0.0084)		8260B Low		1	01/07/19 17:18		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*130 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*94 %*		*70-130*
Surrogate: Dibromofluoromethane	*116 %*		*70-130*
Surrogate: Toluene-d8	*96 %*		*70-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 19.1
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 14:15

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
4,4´-DDE	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
4,4´-DDT	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Aldrin	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
alpha-BHC	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
alpha-Chlordane	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
beta-BHC	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Chlordane (Total)	ND (0.0249)		8081B		1	01/12/19 9:58	C9A0200	CA90714
delta-BHC	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Dieldrin	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Endosulfan I	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Endosulfan II	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Endosulfan Sulfate	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Endrin	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Endrin Ketone	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
gamma-BHC (Lindane)	ND (0.0019)		8081B		1	01/12/19 9:58	C9A0200	CA90714
gamma-Chlordane	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Heptachlor	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Heptachlor Epoxide	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Hexachlorobenzene	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Methoxychlor	ND (0.0031)		8081B		1	01/12/19 9:58	C9A0200	CA90714
Toxaphene	ND (0.156)		8081B		1	01/12/19 9:58	C9A0200	CA90714

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*77 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*83 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*71 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*77 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 19.2
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: CAD
Prepared: 1/7/19 15:45

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1221	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1232	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1242	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1248	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1254	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1260	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1262	ND (0.06)		8082A		1	01/08/19 13:16		CA90710
Aroclor 1268	ND (0.06)		8082A		1	01/08/19 13:16		CA90710

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*73 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*80 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*76 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*85 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 19.7
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: SMR
Prepared: 1/7/19 11:08

8100M Total Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Total Petroleum Hydrocarbons	**12.9** (12.1)		8100M		1	01/07/19 23:16	C9A0078	CA90717

	%Recovery	Qualifier	Limits
Surrogate: O-Terphenyl	*87 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 10.4
Final Volume: 4
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 17:50

8151A Chlorinated Herbicides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
2,4,5-T	ND (0.011)		8151A		1	01/10/19 6:40	C9A0131	CA90751
2,4,5-TP (Silvex)	ND (0.011)		8151A		1	01/10/19 6:40	C9A0131	CA90751
2,4-D	ND (0.054)		8151A		1	01/10/19 6:40	C9A0131	CA90751
2,4-DB	ND (0.054)		8151A		1	01/10/19 6:40	C9A0131	CA90751
Dalapon	ND (0.052)		8151A		1	01/10/19 6:40	C9A0131	CA90751
Dicamba	ND (0.011)		8151A		1	01/10/19 6:40	C9A0131	CA90751
Dichlorprop	ND (0.054)		8151A		1	01/10/19 6:40	C9A0131	CA90751
Dinoseb	ND (0.054)		8151A		1	01/10/19 6:40	C9A0131	CA90751
MCPA	ND (2.66)		8151A		1	01/10/19 6:40	C9A0131	CA90751
MCPP	ND (2.69)		8151A		1	01/10/19 6:40	C9A0131	CA90751

	%Recovery	Qualifier	Limits
Surrogate: DCAA	*89 %*		*30-150*
Surrogate: DCAA [2C]	*86 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 15
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
1,2-Dichlorobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
1,3-Dichlorobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
1,4-Dichlorobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4,5-Trichlorophenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4,6-Trichlorophenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4-Dichlorophenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4-Dimethylphenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4-Dinitrophenol	ND (1.98)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,4-Dinitrotoluene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2,6-Dinitrotoluene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2-Chloronaphthalene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2-Chlorophenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2-Methylnaphthalene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2-Methylphenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
2-Nitrophenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
3,3´-Dichlorobenzidine	ND (0.793)		8270D		1	01/08/19 20:56	C9A0139	CA90716
3+4-Methylphenol	ND (0.793)		8270D		1	01/08/19 20:56	C9A0139	CA90716
4-Bromophenyl-phenylether	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
4-Chloroaniline	ND (0.793)		8270D		1	01/08/19 20:56	C9A0139	CA90716
4-Nitrophenol	ND (1.98)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Acenaphthene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Acenaphthylene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Acetophenone	ND (0.793)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Aniline	ND (1.98)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Anthracene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Azobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Benzo(a)anthracene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Benzo(a)pyrene	ND (0.198)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Benzo(b)fluoranthene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Benzo(g,h,i)perylene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Benzo(k)fluoranthene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 15
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
bis(2-Chloroethyl)ether	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
bis(2-chloroisopropyl)Ether	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
bis(2-Ethylhexyl)phthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Butylbenzylphthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Chrysene	ND (0.198)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Dibenzo(a,h)Anthracene	ND (0.198)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Dibenzofuran	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Diethylphthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Dimethylphthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Di-n-butylphthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Di-n-octylphthalate	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Fluoranthene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Fluorene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Hexachlorobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Hexachlorobutadiene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Hexachloroethane	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Indeno(1,2,3-cd)Pyrene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Isophorone	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Naphthalene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Nitrobenzene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
N-Nitrosodimethylamine	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Pentachlorophenol	ND (1.98)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Phenanthrene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Phenol	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Pyrene	ND (0.396)		8270D		1	01/08/19 20:56	C9A0139	CA90716
Pyridine	ND (1.98)		8270D		1	01/08/19 20:56	C9A0139	CA90716

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*60 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*84 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*72 %*		*30-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 15
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorobiphenyl		*66 %*		*30-130*				
Surrogate: 2-Fluorophenol		*74 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*65 %*		*30-130*				
Surrogate: Phenol-d6		*75 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*95 %*		*30-130*				

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Conductivity	**WL 170** (5)		9050A		1	JLK	01/04/19 21:21	umhos/cm	CA90430
Corrosivity (pH)	**6.63** (N/A)		9045		1	CCP	01/04/19 18:06	S.U.	CA90417
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 19.5 ºC.**								
Flashpoint	**> 200** (N/A)		1010		1	EEM	01/07/19 13:15	°F	CA90722
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	01/07/19 21:43	mg/kg	CA90745
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	01/07/19 21:43	mg/kg	CA90745
Total Organic Carbon (Average)	**12900** (308)		9060		1	CCP	01/09/19 14:52	mg/kg dry wt	[CALC]

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Bridge-Rightbank 0-2ft
Date Sampled: 01/04/19 08:45
Percent Solids: 84
Initial Volume: 25.5
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-02
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 1/8/19 14:35

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (17.5)		MADEP-EPH		1	CAD	01/09/19 3:07	C9A0146	CA90804
C19-C36 Aliphatics1	ND (17.5)		MADEP-EPH		1	CAD	01/09/19 3:07	C9A0146	CA90804
C11-C22 Unadjusted Aromatics1	ND (17.5)		EPH8270		1	VSC	01/09/19 1:45	C9A0109	CA90804
C11-C22 Aromatics1,2	ND (17.5)		EPH8270			VSC	01/09/19 1:45		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*73 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*75 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*93 %*		*40-140*
Surrogate: O-Terphenyl	*74 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2.66** (1.20)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Barium	**19.5** (1.20)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Cadmium	**0.31** (0.24)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Chromium	**14.9** (0.48)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Lead	**17.2** (2.40)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Mercury	**0.011** (0.011)		7471B		1	BJV	01/08/19 15:11	2.27	40	CA90753
Selenium	ND (2.40)		6010C		1	BJV	01/08/19 1:07	5.08	100	CA90752
Silver	ND (0.48)		6010C		2	KJK	01/08/19 15:35	5.08	100	CA90752

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 7.6
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1,1-Trichloroethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1,2,2-Tetrachloroethane	ND (0.0016)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1,2-Trichloroethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1-Dichloroethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1-Dichloroethene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,1-Dichloropropene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2,3-Trichlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2,3-Trichloropropane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2,4-Trichlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2,4-Trimethylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2-Dibromo-3-Chloropropane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2-Dibromoethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2-Dichlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2-Dichloroethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,2-Dichloropropane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,3,5-Trimethylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,3-Dichlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,3-Dichloropropane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,4-Dichlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
1,4-Dioxane	ND (0.0803)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
2,2-Dichloropropane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
2-Butanone	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
2-Chlorotoluene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
2-Hexanone	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
4-Chlorotoluene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
4-Isopropyltoluene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
4-Methyl-2-Pentanone	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Acetone	**0.0360** (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Benzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Bromobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Bromochloromethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 7.6
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Bromoform	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Bromomethane	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Carbon Disulfide	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Carbon Tetrachloride	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Chlorobenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Chloroethane	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Chloroform	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Chloromethane	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
cis-1,2-Dichloroethene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
cis-1,3-Dichloropropene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Dibromochloromethane	ND (0.0016)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Dibromomethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Dichlorodifluoromethane	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Diethyl Ether	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Di-isopropyl ether	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Ethyl tertiary-butyl ether	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Ethylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Hexachlorobutadiene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Isopropylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Methyl tert-Butyl Ether	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Methylene Chloride	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Naphthalene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
n-Butylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
n-Propylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
sec-Butylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Styrene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
tert-Butylbenzene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Tertiary-amyl methyl ether	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Tetrachloroethene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Tetrahydrofuran	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Toluene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 7.6
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
trans-1,3-Dichloropropene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Trichloroethene	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Trichlorofluoromethane	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Vinyl Chloride	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Xylene O	ND (0.0040)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Xylene P,M	ND (0.0080)		8260B Low		1	01/07/19 17:44	C9A0076	CA90706
Xylenes (Total)	ND (0.0080)		8260B Low		1	01/07/19 17:44		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*125 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*90 %*		*70-130*
Surrogate: Dibromofluoromethane	*116 %*		*70-130*
Surrogate: Toluene-d8	*99 %*		*70-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 20.9
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 14:15

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
4,4´-DDE	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
4,4´-DDT	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Aldrin	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
alpha-BHC	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
alpha-Chlordane	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
beta-BHC	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Chlordane (Total)	ND (0.0234)		8081B		1	01/12/19 10:29	C9A0200	CA90714
delta-BHC	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Dieldrin	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Endosulfan I	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Endosulfan II	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Endosulfan Sulfate	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Endrin	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Endrin Ketone	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
gamma-BHC (Lindane)	ND (0.0018)		8081B		1	01/12/19 10:29	C9A0200	CA90714
gamma-Chlordane	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Heptachlor	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Heptachlor Epoxide	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Hexachlorobenzene	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Methoxychlor	ND (0.0029)		8081B		1	01/12/19 10:29	C9A0200	CA90714
Toxaphene	ND (0.146)		8081B		1	01/12/19 10:29	C9A0200	CA90714

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*73 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*80 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*64 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*71 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 20.2
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: CAD
Prepared: 1/7/19 15:45

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1221	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1232	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1242	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1248	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1254	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1260	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1262	ND (0.06)		8082A		1	01/08/19 13:35		CA90710
Aroclor 1268	ND (0.06)		8082A		1	01/08/19 13:35		CA90710

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*69 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*74 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*77 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*80 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 20.9
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: SMR
Prepared: 1/7/19 11:08

8100M Total Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Total Petroleum Hydrocarbons	**29.2** (11.7)		8100M		1	01/07/19 23:48	C9A0078	CA90717

	%Recovery	Qualifier	Limits
Surrogate: O-Terphenyl	*85 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 10.4
Final Volume: 4
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 17:50

8151A Chlorinated Herbicides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
2,4,5-T	ND (0.011)		8151A		1	01/10/19 7:11	C9A0131	CA90751
2,4,5-TP (Silvex)	ND (0.011)		8151A		1	01/10/19 7:11	C9A0131	CA90751
2,4-D	ND (0.055)		8151A		1	01/10/19 7:11	C9A0131	CA90751
2,4-DB	ND (0.056)		8151A		1	01/10/19 7:11	C9A0131	CA90751
Dalapon	ND (0.053)		8151A		1	01/10/19 7:11	C9A0131	CA90751
Dicamba	ND (0.011)		8151A		1	01/10/19 7:11	C9A0131	CA90751
Dichlorprop	ND (0.055)		8151A		1	01/10/19 7:11	C9A0131	CA90751
Dinoseb	ND (0.056)		8151A		1	01/10/19 7:11	C9A0131	CA90751
MCPA	ND (2.73)		8151A		1	01/10/19 7:11	C9A0131	CA90751
MCPP	# ND (2.76)		8151A		1	01/10/19 7:11	C9A0131	CA90751

	%Recovery	Qualifier	Limits
Surrogate: DCAA	*83 %*		*30-150*
Surrogate: DCAA [2C]	*91 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 14.6
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
1,2-Dichlorobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
1,3-Dichlorobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
1,4-Dichlorobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4,5-Trichlorophenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4,6-Trichlorophenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4-Dichlorophenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4-Dimethylphenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4-Dinitrophenol	ND (2.10)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,4-Dinitrotoluene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2,6-Dinitrotoluene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2-Chloronaphthalene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2-Chlorophenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2-Methylnaphthalene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2-Methylphenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
2-Nitrophenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
3,3´-Dichlorobenzidine	ND (0.837)		8270D		1	01/08/19 21:30	C9A0139	CA90716
3+4-Methylphenol	ND (0.837)		8270D		1	01/08/19 21:30	C9A0139	CA90716
4-Bromophenyl-phenylether	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
4-Chloroaniline	ND (0.837)		8270D		1	01/08/19 21:30	C9A0139	CA90716
4-Nitrophenol	ND (2.10)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Acenaphthene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Acenaphthylene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Acetophenone	ND (0.837)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Aniline	ND (2.10)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Anthracene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Azobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Benzo(a)anthracene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Benzo(a)pyrene	ND (0.210)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Benzo(b)fluoranthene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Benzo(g,h,i)perylene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Benzo(k)fluoranthene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 14.6
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
bis(2-Chloroethyl)ether	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
bis(2-chloroisopropyl)Ether	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
bis(2-Ethylhexyl)phthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Butylbenzylphthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Chrysene	ND (0.210)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Dibenzo(a,h)Anthracene	ND (0.210)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Dibenzofuran	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Diethylphthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Dimethylphthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Di-n-butylphthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Di-n-octylphthalate	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Fluoranthene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Fluorene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Hexachlorobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Hexachlorobutadiene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Hexachloroethane	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Indeno(1,2,3-cd)Pyrene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Isophorone	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Naphthalene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Nitrobenzene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
N-Nitrosodimethylamine	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Pentachlorophenol	ND (2.10)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Phenanthrene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Phenol	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Pyrene	ND (0.418)		8270D		1	01/08/19 21:30	C9A0139	CA90716
Pyridine	ND (2.10)		8270D		1	01/08/19 21:30	C9A0139	CA90716

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*66 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*82 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*78 %*		*30-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 14.6
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorobiphenyl		*76 %*		*30-130*				
Surrogate: 2-Fluorophenol		*80 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*74 %*		*30-130*				
Surrogate: Phenol-d6		*80 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*94 %*		*30-130*				

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Conductivity	**WL 240** (5)		9050A		1	JLK	01/04/19 21:21	umhos/cm	CA90430
Corrosivity (pH)	**6.38** (N/A)		9045		1	CCP	01/04/19 18:06	S.U.	CA90417
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 19.6 ºC.**								
Flashpoint	**> 200** (N/A)		1010		1	EEM	01/07/19 13:15	°F	CA90722
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	01/07/19 21:43	mg/kg	CA90745
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	01/07/19 21:43	mg/kg	CA90745
Total Organic Carbon (Average)	**53300** (378)		9060		1	CCP	01/09/19 15:42	mg/kg dry wt	[CALC]

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30
Percent Solids: 82
Initial Volume: 24.1
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 1/8/19 14:35

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (19.0)		MADEP-EPH		1	CAD	01/09/19 3:54	C9A0146	CA90804
C19-C36 Aliphatics1	ND (19.0)		MADEP-EPH		1	CAD	01/09/19 3:54	C9A0146	CA90804
C11-C22 Unadjusted Aromatics1	ND (19.0)		EPH8270		1	VSC	01/09/19 2:21	C9A0109	CA90804
C11-C22 Aromatics1,2	ND (19.0)		EPH8270			VSC	01/09/19 2:21		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*69 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*59 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*84 %*		*40-140*
Surrogate: O-Terphenyl	*69 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B5-Culvert 0-2ft
Date Sampled: 01/04/19 09:30

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-03
Sample Matrix: Soil

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Grain Size	**See Attached** (N/A)								

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**4.84** (1.67)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Barium	**38.3** (1.67)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Cadmium	**0.48** (0.33)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Chromium	**96.7** (0.67)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Lead	**50.6** (3.34)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Mercury	**0.085** (0.017)		7471B		1	BJV	01/08/19 15:13	2.1	40	CA90753
Selenium	ND (3.34)		6010C		1	BJV	01/08/19 1:13	5.43	100	CA90752
Silver	ND (0.67)		6010C		2	KJK	01/08/19 15:39	5.43	100	CA90752

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 15.5
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1,1-Trichloroethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1,2,2-Tetrachloroethane	ND (0.0012)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1,2-Trichloroethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1-Dichloroethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1-Dichloroethene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,1-Dichloropropene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2,3-Trichlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2,3-Trichloropropane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2,4-Trichlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2,4-Trimethylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2-Dibromo-3-Chloropropane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2-Dibromoethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2-Dichlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2-Dichloroethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,2-Dichloropropane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,3,5-Trimethylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,3-Dichlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,3-Dichloropropane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,4-Dichlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
1,4-Dioxane	ND (0.0586)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
2,2-Dichloropropane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
2-Butanone	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
2-Chlorotoluene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
2-Hexanone	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
4-Chlorotoluene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
4-Isopropyltoluene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
4-Methyl-2-Pentanone	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Acetone	**0.0933** (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Benzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Bromobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Bromochloromethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 15.5
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Bromoform	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Bromomethane	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Carbon Disulfide	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Carbon Tetrachloride	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Chlorobenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Chloroethane	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Chloroform	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Chloromethane	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
cis-1,2-Dichloroethene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
cis-1,3-Dichloropropene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Dibromochloromethane	ND (0.0012)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Dibromomethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Dichlorodifluoromethane	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Diethyl Ether	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Di-isopropyl ether	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Ethyl tertiary-butyl ether	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Ethylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Hexachlorobutadiene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Isopropylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Methyl tert-Butyl Ether	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Methylene Chloride	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Naphthalene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
n-Butylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
n-Propylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
sec-Butylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Styrene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
tert-Butylbenzene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Tertiary-amyl methyl ether	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Tetrachloroethene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Tetrahydrofuran	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Toluene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 15.5
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
trans-1,3-Dichloropropene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Trichloroethene	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Trichlorofluoromethane	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Vinyl Chloride	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Xylene O	ND (0.0029)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Xylene P,M	ND (0.0059)		8260B Low		1	01/07/19 18:09	C9A0076	CA90706
Xylenes (Total)	ND (0.0059)		8260B Low		1	01/07/19 18:09		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*116 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*80 %*		*70-130*
Surrogate: Dibromofluoromethane	*116 %*		*70-130*
Surrogate: Toluene-d8	*109 %*		*70-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 16
Final Volume: 15
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1,1-Trichloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1,2,2-Tetrachloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1,2-Trichloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1-Dichloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1-Dichloroethene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,1-Dichloropropene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2,3-Trichlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2,3-Trichloropropane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2,4-Trichlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2,4-Trimethylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2-Dibromo-3-Chloropropane	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2-Dibromoethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2-Dichlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2-Dichloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,2-Dichloropropane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,3,5-Trimethylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,3-Dichlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,3-Dichloropropane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,4-Dichlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
1,4-Dioxane - Screen	ND (101)		8260B		1	01/10/19 15:14	C9A0171	CA91050
2,2-Dichloropropane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
2-Butanone	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
2-Chlorotoluene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
2-Hexanone	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
4-Chlorotoluene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
4-Isopropyltoluene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
4-Methyl-2-Pentanone	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Acetone	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Benzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Bromobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Bromochloromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 16
Final Volume: 15
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Bromoform	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Bromomethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Carbon Disulfide	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Carbon Tetrachloride	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Chlorobenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Chloroethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Chloroform	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Chloromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
cis-1,2-Dichloroethene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
cis-1,3-Dichloropropene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Dibromochloromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Dibromomethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Dichlorodifluoromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Diethyl Ether	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Di-isopropyl ether	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Ethyl tertiary-butyl ether	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Ethylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Hexachlorobutadiene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Isopropylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Methyl tert-Butyl Ether	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Methylene Chloride	ND (1.01)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Naphthalene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
n-Butylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
n-Propylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
sec-Butylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Styrene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
tert-Butylbenzene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Tertiary-amyl methyl ether	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Tetrachloroethene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Tetrahydrofuran	ND (2.52)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Toluene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 16
Final Volume: 15
Extraction Method: 5035

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
trans-1,3-Dichloropropene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Trichloroethene	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Trichlorofluoromethane	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Vinyl Chloride	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Xylene O	ND (0.503)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Xylene P,M	ND (1.01)		8260B		1	01/10/19 15:14	C9A0171	CA91050
Xylenes (Total)	ND (1.01)		8260B		1	01/10/19 15:14		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*108 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*75 %*		*70-130*
Surrogate: Dibromofluoromethane	*99 %*		*70-130*
Surrogate: Toluene-d8	*87 %*		*70-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 19
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 14:15

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
4,4´-DDE	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
4,4´-DDT	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Aldrin	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
alpha-BHC	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
alpha-Chlordane	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
beta-BHC	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Chlordane (Total)	ND (0.0382)		8081B		1	01/12/19 11:01	C9A0200	CA90714
delta-BHC	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Dieldrin	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Endosulfan I	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Endosulfan II	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Endosulfan Sulfate	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Endrin	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Endrin Ketone	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
gamma-BHC (Lindane)	ND (0.0029)		8081B		1	01/12/19 11:01	C9A0200	CA90714
gamma-Chlordane	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Heptachlor	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Heptachlor Epoxide	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Hexachlorobenzene	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Methoxychlor	ND (0.0048)		8081B		1	01/12/19 11:01	C9A0200	CA90714
Toxaphene	ND (0.239)		8081B		1	01/12/19 11:01	C9A0200	CA90714

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*70 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*78 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*65 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*70 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 19.3
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: CAD
Prepared: 1/8/19 13:09

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1221	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1232	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1242	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1248	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1254	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1260	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1262	ND (0.09)		8082A		1	01/09/19 13:01		CA91001
Aroclor 1268	ND (0.09)		8082A		1	01/09/19 13:01		CA91001

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*62 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*70 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*69 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*78 %*		*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 19.5
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: SMR
Prepared: 1/7/19 11:08

8100M Total Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Total Petroleum Hydrocarbons	**43.4** (18.6)		8100M		1	01/08/19 0:20	C9A0078	CA90717

	%Recovery	Qualifier	Limits
Surrogate: O-Terphenyl	*82 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 10.2
Final Volume: 4
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/7/19 17:50

8151A Chlorinated Herbicides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
2,4,5-T	ND (0.017)		8151A		1	01/10/19 7:43	C9A0131	CA90751
2,4,5-TP (Silvex)	ND (0.017)		8151A		1	01/10/19 7:43	C9A0131	CA90751
2,4-D	ND (0.084)		8151A		1	01/10/19 7:43	C9A0131	CA90751
2,4-DB	ND (0.085)		8151A		1	01/10/19 7:43	C9A0131	CA90751
Dalapon	ND (0.081)		8151A		1	01/10/19 7:43	C9A0131	CA90751
Dicamba [2C]	**LC, P 0.126** (0.067)		8151A		4	01/10/19 10:55	C9A0131	CA90751
Dichlorprop	ND (0.084)		8151A		1	01/10/19 7:43	C9A0131	CA90751
Dinoseb	ND (0.085)		8151A		1	01/10/19 7:43	C9A0131	CA90751
MCPA	ND (4.14)		8151A		1	01/10/19 7:43	C9A0131	CA90751
MCPP	# ND (4.18)		8151A		1	01/10/19 7:43	C9A0131	CA90751

	%Recovery	Qualifier	Limits
Surrogate: DCAA	*155 %*	*SM*	*30-150*
Surrogate: DCAA [2C]	*1060 %*	*SM*	*30-150*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 20.9
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
1,2-Dichlorobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
1,3-Dichlorobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
1,4-Dichlorobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4,5-Trichlorophenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4,6-Trichlorophenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4-Dichlorophenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4-Dimethylphenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4-Dinitrophenol	ND (2.18)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,4-Dinitrotoluene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2,6-Dinitrotoluene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2-Chloronaphthalene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2-Chlorophenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2-Methylnaphthalene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2-Methylphenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
2-Nitrophenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
3,3′-Dichlorobenzidine	ND (0.869)		8270D		1	01/08/19 22:05	C9A0139	CA90716
3+4-Methylphenol	ND (0.869)		8270D		1	01/08/19 22:05	C9A0139	CA90716
4-Bromophenyl-phenylether	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
4-Chloroaniline	ND (0.869)		8270D		1	01/08/19 22:05	C9A0139	CA90716
4-Nitrophenol	ND (2.18)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Acenaphthene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Acenaphthylene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Acetophenone	ND (0.869)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Aniline	ND (2.18)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Anthracene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Azobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Benzo(a)anthracene	**0.459** (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Benzo(a)pyrene	**0.499** (0.218)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Benzo(b)fluoranthene	**0.684** (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Benzo(g,h,i)perylene	**0.488** (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Benzo(k)fluoranthene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 20.9
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
bis(2-Chloroethyl)ether	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
bis(2-chloroisopropyl)Ether	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
bis(2-Ethylhexyl)phthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Butylbenzylphthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Chrysene	**0.666** (0.218)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Dibenzo(a,h)Anthracene	ND (0.218)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Dibenzofuran	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Diethylphthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Dimethylphthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Di-n-butylphthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Di-n-octylphthalate	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Fluoranthene	**1.14** (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Fluorene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Hexachlorobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Hexachlorobutadiene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Hexachloroethane	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Indeno(1,2,3-cd)Pyrene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Isophorone	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Naphthalene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Nitrobenzene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
N-Nitrosodimethylamine	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Pentachlorophenol	ND (2.18)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Phenanthrene	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Phenol	ND (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Pyrene	**1.01** (0.434)		8270D		1	01/08/19 22:05	C9A0139	CA90716
Pyridine	ND (2.18)		8270D		1	01/08/19 22:05	C9A0139	CA90716

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*63 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*84 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*75 %*		*30-130*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 20.9
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 1/7/19 11:52

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorobiphenyl		*72 %*		*30-130*				
Surrogate: 2-Fluorophenol		*77 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*69 %*		*30-130*				
Surrogate: Phenol-d6		*78 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*97 %*		*30-130*				

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Conductivity	**WL 262** (5)		9050A		1	JLK	01/04/19 21:21	umhos/cm	CA90430
Corrosivity (pH)	**6.70** (N/A)		9045		1	CCP	01/04/19 18:06	S.U.	CA90417
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 19.2 ºC.**								
Flashpoint	**> 200** (N/A)		1010		1	EEM	01/07/19 13:15	°F	CA90722
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	01/07/19 21:43	mg/kg	CA90745
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	01/07/19 21:43	mg/kg	CA90745
Total Organic Carbon (Average)	**60100** (274)		9060		1	CCP	01/09/19 13:46	mg/kg dry wt	[CALC]

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00
Percent Solids: 55
Initial Volume: 25.9
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 1/8/19 14:35

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (26.3)		MADEP-EPH		1	CAD	01/09/19 4:41	C9A0146	CA90804
C19-C36 Aliphatics1	**40.5** (26.3)		MADEP-EPH		1	CAD	01/09/19 4:41	C9A0146	CA90804
C11-C22 Unadjusted Aromatics1	**57.0** (26.3)		EPH8270		1	VSC	01/09/19 2:58	C9A0109	CA90804
C11-C22 Aromatics1,2	**49.4** (26.3)		EPH8270			VSC	01/09/19 2:58		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*61 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*64 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*87 %*		*40-140*
Surrogate: O-Terphenyl	*69 %*		*40-140*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway
Client Sample ID: Boring B6-Culvert 0-2ft
Date Sampled: 01/04/19 10:00

ESS Laboratory Work Order: 1901077
ESS Laboratory Sample ID: 1901077-04
Sample Matrix: Soil

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Grain Size	**See Attached** (N/A)								

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CA90752 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
LCS										
Arsenic	130	8.93	mg/kg wet	128.0		101	85-114			
Barium	492	8.93	mg/kg wet	536.0		92	82-118			
Cadmium	92.3	1.79	mg/kg wet	99.00		93	87-113			
Chromium	118	3.57	mg/kg wet	116.0		102	82-118			
Lead	296	17.9	mg/kg wet	277.0		107	84-116			
Selenium	235	17.9	mg/kg wet	242.0		97	80-120			
Silver	64.9	1.79	mg/kg wet	64.30		101	86-114			
LCS Dup										
Arsenic	126	9.09	mg/kg wet	128.0		98	85-114	3	20	
Barium	499	9.09	mg/kg wet	536.0		93	82-118	1	20	
Cadmium	95.7	1.82	mg/kg wet	99.00		97	87-113	4	20	
Chromium	116	3.64	mg/kg wet	116.0		100	82-118	2	20	
Lead	287	18.2	mg/kg wet	277.0		104	84-116	3	20	
Selenium	231	18.2	mg/kg wet	242.0		95	80-120	2	20	
Silver	63.3	1.82	mg/kg wet	64.30		99	86-114	2	20	
Batch CA90753 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.60	0.388	mg/kg wet	4.850		74	50-103			
LCS Dup										
Mercury	3.61	0.347	mg/kg wet	4.850		74	50-103	0.4	20	
1311 TCLP Metals										
Batch CA90839 - 3005A_TCLP										
Blank										
Chromium	ND	0.020	mg/L							
Lead	ND	0.050	mg/L							
Blank										
Lead	ND	0.050	mg/L							
Blank										
Chromium	ND	0.020	mg/L							
Lead	ND	0.050	mg/L							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
1311 TCLP Metals										
Batch CA90839 - 3005A_TCLP										
LCS										
Chromium	0.461	0.020	mg/L	0.5000		92	80-120			
Lead	0.440	0.050	mg/L	0.5000		88	80-120			
LCS Dup										
Chromium	0.448	0.020	mg/L	0.5000		90	80-120	3	20	
Lead	0.426	0.050	mg/L	0.5000		85	80-120	3	20	
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
Blank										
1,1,1,2-Tetrachloroethane	ND	0.0050	mg/kg wet							
1,1,1-Trichloroethane	ND	0.0050	mg/kg wet							
1,1,2,2-Tetrachloroethane	ND	0.0020	mg/kg wet							
1,1,2-Trichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethene	ND	0.0050	mg/kg wet							
1,1-Dichloropropene	ND	0.0050	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,3-Trichloropropane	ND	0.0050	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	0.0050	mg/kg wet							
1,2-Dibromoethane	ND	0.0050	mg/kg wet							
1,2-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,2-Dichloroethane	ND	0.0050	mg/kg wet							
1,2-Dichloropropane	ND	0.0050	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,3-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,3-Dichloropropane	ND	0.0050	mg/kg wet							
1,4-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,4-Dioxane	ND	0.100	mg/kg wet							
2,2-Dichloropropane	ND	0.0050	mg/kg wet							
2-Butanone	ND	0.0100	mg/kg wet							
2-Chlorotoluene	ND	0.0050	mg/kg wet							
2-Hexanone	ND	0.0100	mg/kg wet							
4-Chlorotoluene	ND	0.0050	mg/kg wet							
4-Isopropyltoluene	ND	0.0050	mg/kg wet							
4-Methyl-2-Pentanone	ND	0.0100	mg/kg wet							
Acetone	ND	0.0100	mg/kg wet							
Benzene	ND	0.0050	mg/kg wet							
Bromobenzene	ND	0.0050	mg/kg wet							
Bromochloromethane	ND	0.0050	mg/kg wet							
Bromodichloromethane	ND	0.0050	mg/kg wet							
Bromoform	ND	0.0050	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
Bromomethane	ND	0.0100	mg/kg wet							
Carbon Disulfide	ND	0.0050	mg/kg wet							
Carbon Tetrachloride	ND	0.0050	mg/kg wet							
Chlorobenzene	ND	0.0050	mg/kg wet							
Chloroethane	ND	0.0100	mg/kg wet							
Chloroform	ND	0.0050	mg/kg wet							
Chloromethane	ND	0.0100	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Dibromochloromethane	ND	0.0020	mg/kg wet							
Dibromomethane	ND	0.0050	mg/kg wet							
Dichlorodifluoromethane	ND	0.0100	mg/kg wet							
Diethyl Ether	ND	0.0050	mg/kg wet							
Di-isopropyl ether	ND	0.0050	mg/kg wet							
Ethyl tertiary-butyl ether	ND	0.0050	mg/kg wet							
Ethylbenzene	ND	0.0050	mg/kg wet							
Hexachlorobutadiene	ND	0.0050	mg/kg wet							
Isopropylbenzene	ND	0.0050	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.0050	mg/kg wet							
Methylene Chloride	ND	0.0100	mg/kg wet							
Naphthalene	ND	0.0050	mg/kg wet							
n-Butylbenzene	ND	0.0050	mg/kg wet							
n-Propylbenzene	ND	0.0050	mg/kg wet							
sec-Butylbenzene	ND	0.0050	mg/kg wet							
Styrene	ND	0.0050	mg/kg wet							
tert-Butylbenzene	ND	0.0050	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.0050	mg/kg wet							
Tetrachloroethene	ND	0.0050	mg/kg wet							
Tetrahydrofuran	ND	0.0050	mg/kg wet							
Toluene	ND	0.0050	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Trichloroethene	ND	0.0050	mg/kg wet							
Trichlorofluoromethane	ND	0.0050	mg/kg wet							
Vinyl Chloride	ND	0.0100	mg/kg wet							
Xylene O	ND	0.0050	mg/kg wet							
Xylene P,M	ND	0.0100	mg/kg wet							
Xylenes (Total)	ND	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0581*		mg/kg wet	*0.05000*		*116*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0471*		mg/kg wet	*0.05000*		*94*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0542*		mg/kg wet	*0.05000*		*108*	*70-130*			
Surrogate: Toluene-d8	*0.0487*		mg/kg wet	*0.05000*		*97*	*70-130*			
LCS										
1,1,1,2-Tetrachloroethane	0.0476	0.0050	mg/kg wet	0.05000		95	70-130			
1,1,1-Trichloroethane	0.0599	0.0050	mg/kg wet	0.05000		120	70-130			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
1,1,2,2-Tetrachloroethane	0.0522	0.0020	mg/kg wet	0.05000		104	70-130			
1,1,2-Trichloroethane	0.0561	0.0050	mg/kg wet	0.05000		112	70-130			
1,1-Dichloroethane	0.0554	0.0050	mg/kg wet	0.05000		111	70-130			
1,1-Dichloroethene	0.0589	0.0050	mg/kg wet	0.05000		118	70-130			
1,1-Dichloropropene	0.0581	0.0050	mg/kg wet	0.05000		116	70-130			
1,2,3-Trichlorobenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130			
1,2,3-Trichloropropane	0.0504	0.0050	mg/kg wet	0.05000		101	70-130			
1,2,4-Trichlorobenzene	0.0546	0.0050	mg/kg wet	0.05000		109	70-130			
1,2,4-Trimethylbenzene	0.0533	0.0050	mg/kg wet	0.05000		107	70-130			
1,2-Dibromo-3-Chloropropane	0.0477	0.0050	mg/kg wet	0.05000		95	70-130			
1,2-Dibromoethane	0.0519	0.0050	mg/kg wet	0.05000		104	70-130			
1,2-Dichlorobenzene	0.0510	0.0050	mg/kg wet	0.05000		102	70-130			
1,2-Dichloroethane	0.0575	0.0050	mg/kg wet	0.05000		115	70-130			
1,2-Dichloropropane	0.0558	0.0050	mg/kg wet	0.05000		112	70-130			
1,3,5-Trimethylbenzene	0.0537	0.0050	mg/kg wet	0.05000		107	70-130			
1,3-Dichlorobenzene	0.0502	0.0050	mg/kg wet	0.05000		100	70-130			
1,3-Dichloropropane	0.0532	0.0050	mg/kg wet	0.05000		106	70-130			
1,4-Dichlorobenzene	0.0522	0.0050	mg/kg wet	0.05000		104	70-130			
1,4-Dioxane	1.21	0.100	mg/kg wet	1.000		121	70-130			
2,2-Dichloropropane	0.0642	0.0050	mg/kg wet	0.05000		128	70-130			
2-Butanone	0.311	0.0100	mg/kg wet	0.2500		124	70-130			
2-Chlorotoluene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130			
2-Hexanone	0.247	0.0100	mg/kg wet	0.2500		99	70-130			
4-Chlorotoluene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
4-Isopropyltoluene	0.0531	0.0050	mg/kg wet	0.05000		106	70-130			
4-Methyl-2-Pentanone	0.268	0.0100	mg/kg wet	0.2500		107	70-130			
Acetone	0.300	0.0100	mg/kg wet	0.2500		120	70-130			
Benzene	0.0570	0.0050	mg/kg wet	0.05000		114	70-130			
Bromobenzene	0.0506	0.0050	mg/kg wet	0.05000		101	70-130			
Bromochloromethane	0.0554	0.0050	mg/kg wet	0.05000		111	70-130			
Bromodichloromethane	0.0544	0.0050	mg/kg wet	0.05000		109	70-130			
Bromoform	0.0458	0.0050	mg/kg wet	0.05000		92	70-130			
Bromomethane	0.0539	0.0100	mg/kg wet	0.05000		108	70-130			
Carbon Disulfide	0.0615	0.0050	mg/kg wet	0.05000		123	70-130			
Carbon Tetrachloride	0.0624	0.0050	mg/kg wet	0.05000		125	70-130			
Chlorobenzene	0.0510	0.0050	mg/kg wet	0.05000		102	70-130			
Chloroethane	0.0575	0.0100	mg/kg wet	0.05000		115	70-130			
Chloroform	0.0569	0.0050	mg/kg wet	0.05000		114	70-130			
Chloromethane	0.0515	0.0100	mg/kg wet	0.05000		103	70-130			
cis-1,2-Dichloroethene	0.0576	0.0050	mg/kg wet	0.05000		115	70-130			
cis-1,3-Dichloropropene	0.0502	0.0050	mg/kg wet	0.05000		100	70-130			
Dibromochloromethane	0.0434	0.0020	mg/kg wet	0.05000		87	70-130			
Dibromomethane	0.0581	0.0050	mg/kg wet	0.05000		116	70-130			
Dichlorodifluoromethane	0.0522	0.0100	mg/kg wet	0.05000		104	70-130			
Diethyl Ether	0.0592	0.0050	mg/kg wet	0.05000		118	70-130			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
Di-isopropyl ether	0.0572	0.0050	mg/kg wet	0.05000		114	70-130			
Ethyl tertiary-butyl ether	0.0548	0.0050	mg/kg wet	0.05000		110	70-130			
Ethylbenzene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
Hexachlorobutadiene	0.0518	0.0050	mg/kg wet	0.05000		104	70-130			
Isopropylbenzene	0.0524	0.0050	mg/kg wet	0.05000		105	70-130			
Methyl tert-Butyl Ether	0.0581	0.0050	mg/kg wet	0.05000		116	70-130			
Methylene Chloride	0.0555	0.0100	mg/kg wet	0.05000		111	70-130			
Naphthalene	0.0485	0.0050	mg/kg wet	0.05000		97	70-130			
n-Butylbenzene	0.0554	0.0050	mg/kg wet	0.05000		111	70-130			
n-Propylbenzene	0.0533	0.0050	mg/kg wet	0.05000		107	70-130			
sec-Butylbenzene	0.0522	0.0050	mg/kg wet	0.05000		104	70-130			
Styrene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130			
tert-Butylbenzene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
Tertiary-amyl methyl ether	0.0575	0.0050	mg/kg wet	0.05000		115	70-130			
Tetrachloroethene	0.0504	0.0050	mg/kg wet	0.05000		101	70-130			
Tetrahydrofuran	0.0584	0.0050	mg/kg wet	0.05000		117	70-130			
Toluene	0.0568	0.0050	mg/kg wet	0.05000		114	70-130			
trans-1,2-Dichloroethene	0.0543	0.0050	mg/kg wet	0.05000		109	70-130			
trans-1,3-Dichloropropene	0.0455	0.0050	mg/kg wet	0.05000		91	70-130			
Trichloroethene	0.0556	0.0050	mg/kg wet	0.05000		111	70-130			
Trichlorofluoromethane	0.0579	0.0050	mg/kg wet	0.05000		116	70-130			
Vinyl Chloride	0.0573	0.0100	mg/kg wet	0.05000		115	70-130			
Xylene O	0.0555	0.0050	mg/kg wet	0.05000		111	70-130			
Xylene P,M	0.111	0.0100	mg/kg wet	0.1000		111	70-130			
Xylenes (Total)	0.167	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0536*		mg/kg wet	*0.05000*		*107*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0503*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0537*		mg/kg wet	*0.05000*		*107*	*70-130*			
Surrogate: Toluene-d8	*0.0478*		mg/kg wet	*0.05000*		*96*	*70-130*			
LCS Dup										
1,1,1,2-Tetrachloroethane	0.0497	0.0050	mg/kg wet	0.05000		99	70-130	4	20	
1,1,1-Trichloroethane	0.0594	0.0050	mg/kg wet	0.05000		119	70-130	0.7	20	
1,1,2,2-Tetrachloroethane	0.0539	0.0020	mg/kg wet	0.05000		108	70-130	3	20	
1,1,2-Trichloroethane	0.0560	0.0050	mg/kg wet	0.05000		112	70-130	0.2	20	
1,1-Dichloroethane	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	0.4	20	
1,1-Dichloroethene	0.0586	0.0050	mg/kg wet	0.05000		117	70-130	0.5	20	
1,1-Dichloropropene	0.0573	0.0050	mg/kg wet	0.05000		115	70-130	2	20	
1,2,3-Trichlorobenzene	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	1	20	
1,2,3-Trichloropropane	0.0517	0.0050	mg/kg wet	0.05000		103	70-130	3	20	
1,2,4-Trichlorobenzene	0.0555	0.0050	mg/kg wet	0.05000		111	70-130	2	20	
1,2,4-Trimethylbenzene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	2	20	
1,2-Dibromo-3-Chloropropane	0.0462	0.0050	mg/kg wet	0.05000		92	70-130	3	20	
1,2-Dibromoethane	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	5	20	
1,2-Dichlorobenzene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130	2	20	
1,2-Dichloroethane	0.0572	0.0050	mg/kg wet	0.05000		114	70-130	0.5	20	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
1,2-Dichloropropane	0.0559	0.0050	mg/kg wet	0.05000		112	70-130	0.07	20	
1,3,5-Trimethylbenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	2	20	
1,3-Dichlorobenzene	0.0526	0.0050	mg/kg wet	0.05000		105	70-130	5	20	
1,3-Dichloropropane	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	4	20	
1,4-Dichlorobenzene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130	0.5	20	
1,4-Dioxane	1.19	0.100	mg/kg wet	1.000		119	70-130	2	20	
2,2-Dichloropropane	0.0647	0.0050	mg/kg wet	0.05000		129	70-130	0.8	20	
2-Butanone	0.301	0.0100	mg/kg wet	0.2500		120	70-130	3	20	
2-Chlorotoluene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
2-Hexanone	0.245	0.0100	mg/kg wet	0.2500		98	70-130	0.7	20	
4-Chlorotoluene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130	2	20	
4-Isopropyltoluene	0.0539	0.0050	mg/kg wet	0.05000		108	70-130	1	20	
4-Methyl-2-Pentanone	0.259	0.0100	mg/kg wet	0.2500		103	70-130	4	20	
Acetone	0.272	0.0100	mg/kg wet	0.2500		109	70-130	10	20	
Benzene	0.0567	0.0050	mg/kg wet	0.05000		113	70-130	0.6	20	
Bromobenzene	0.0526	0.0050	mg/kg wet	0.05000		105	70-130	4	20	
Bromochloromethane	0.0555	0.0050	mg/kg wet	0.05000		111	70-130	0.1	20	
Bromodichloromethane	0.0543	0.0050	mg/kg wet	0.05000		109	70-130	0.07	20	
Bromoform	0.0474	0.0050	mg/kg wet	0.05000		95	70-130	3	20	
Bromomethane	0.0525	0.0100	mg/kg wet	0.05000		105	70-130	3	20	
Carbon Disulfide	0.0601	0.0050	mg/kg wet	0.05000		120	70-130	2	20	
Carbon Tetrachloride	0.0616	0.0050	mg/kg wet	0.05000		123	70-130	1	20	
Chlorobenzene	0.0522	0.0050	mg/kg wet	0.05000		104	70-130	2	20	
Chloroethane	0.0560	0.0100	mg/kg wet	0.05000		112	70-130	3	20	
Chloroform	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	1	20	
Chloromethane	0.0501	0.0100	mg/kg wet	0.05000		100	70-130	3	20	
cis-1,2-Dichloroethene	0.0574	0.0050	mg/kg wet	0.05000		115	70-130	0.4	20	
cis-1,3-Dichloropropene	0.0513	0.0050	mg/kg wet	0.05000		103	70-130	2	20	
Dibromochloromethane	0.0453	0.0020	mg/kg wet	0.05000		91	70-130	4	20	
Dibromomethane	0.0573	0.0050	mg/kg wet	0.05000		115	70-130	1	20	
Dichlorodifluoromethane	0.0509	0.0100	mg/kg wet	0.05000		102	70-130	3	20	
Diethyl Ether	0.0600	0.0050	mg/kg wet	0.05000		120	70-130	1	20	
Di-isopropyl ether	0.0578	0.0050	mg/kg wet	0.05000		116	70-130	1	20	
Ethyl tertiary-butyl ether	0.0562	0.0050	mg/kg wet	0.05000		112	70-130	2	20	
Ethylbenzene	0.0539	0.0050	mg/kg wet	0.05000		108	70-130	2	20	
Hexachlorobutadiene	0.0530	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
Isopropylbenzene	0.0541	0.0050	mg/kg wet	0.05000		108	70-130	3	20	
Methyl tert-Butyl Ether	0.0593	0.0050	mg/kg wet	0.05000		119	70-130	2	20	
Methylene Chloride	0.0551	0.0100	mg/kg wet	0.05000		110	70-130	0.8	20	
Naphthalene	0.0489	0.0050	mg/kg wet	0.05000		98	70-130	0.8	20	
n-Butylbenzene	0.0558	0.0050	mg/kg wet	0.05000		112	70-130	0.7	20	
n-Propylbenzene	0.0547	0.0050	mg/kg wet	0.05000		109	70-130	3	20	
sec-Butylbenzene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
Styrene	0.0551	0.0050	mg/kg wet	0.05000		110	70-130	2	20	
tert-Butylbenzene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130	2	20	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA90706 - 5035										
Tertiary-amyl methyl ether	0.0592	0.0050	mg/kg wet	0.05000		118	70-130	3	20	
Tetrachloroethene	0.0512	0.0050	mg/kg wet	0.05000		102	70-130	2	20	
Tetrahydrofuran	0.0565	0.0050	mg/kg wet	0.05000		113	70-130	3	20	
Toluene	0.0561	0.0050	mg/kg wet	0.05000		112	70-130	1	20	
trans-1,2-Dichloroethene	0.0541	0.0050	mg/kg wet	0.05000		108	70-130	0.3	20	
trans-1,3-Dichloropropene	0.0465	0.0050	mg/kg wet	0.05000		93	70-130	2	20	
Trichloroethene	0.0558	0.0050	mg/kg wet	0.05000		112	70-130	0.2	20	
Trichlorofluoromethane	0.0569	0.0050	mg/kg wet	0.05000		114	70-130	2	20	
Vinyl Chloride	0.0556	0.0100	mg/kg wet	0.05000		111	70-130	3	20	
Xylene O	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	1	20	
Xylene P,M	0.113	0.0100	mg/kg wet	0.1000		113	70-130	1	20	
Xylenes (Total)	0.169	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0524*		mg/kg wet	*0.05000*		*105*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0503*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0527*		mg/kg wet	*0.05000*		*105*	*70-130*			
Surrogate: Toluene-d8	*0.0496*		mg/kg wet	*0.05000*		*99*	*70-130*			
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
Blank										
1,1,1,2-Tetrachloroethane	ND	0.200	mg/kg wet							
1,1,1-Trichloroethane	ND	0.200	mg/kg wet							
1,1,2,2-Tetrachloroethane	ND	0.200	mg/kg wet							
1,1,2-Trichloroethane	ND	0.200	mg/kg wet							
1,1-Dichloroethane	ND	0.200	mg/kg wet							
1,1-Dichloroethene	ND	0.200	mg/kg wet							
1,1-Dichloropropene	ND	0.200	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.200	mg/kg wet							
1,2,3-Trichloropropane	ND	0.200	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.200	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.200	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	1.00	mg/kg wet							
1,2-Dibromoethane	ND	0.200	mg/kg wet							
1,2-Dichlorobenzene	ND	0.200	mg/kg wet							
1,2-Dichloroethane	ND	0.200	mg/kg wet							
1,2-Dichloropropane	ND	0.200	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.200	mg/kg wet							
1,3-Dichlorobenzene	ND	0.200	mg/kg wet							
1,3-Dichloropropane	ND	0.200	mg/kg wet							
1,4-Dichlorobenzene	ND	0.200	mg/kg wet							
1,4-Dioxane - Screen	ND	40.0	mg/kg wet							
2,2-Dichloropropane	ND	0.200	mg/kg wet							
2-Butanone	ND	1.00	mg/kg wet							
2-Chlorotoluene	ND	0.200	mg/kg wet							
2-Hexanone	ND	1.00	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
4-Chlorotoluene	ND	0.200	mg/kg wet							
4-Isopropyltoluene	ND	0.200	mg/kg wet							
4-Methyl-2-Pentanone	ND	1.00	mg/kg wet							
Acetone	ND	1.00	mg/kg wet							
Benzene	ND	0.200	mg/kg wet							
Bromobenzene	ND	0.200	mg/kg wet							
Bromochloromethane	ND	0.200	mg/kg wet							
Bromodichloromethane	ND	0.200	mg/kg wet							
Bromoform	ND	0.200	mg/kg wet							
Bromomethane	ND	0.200	mg/kg wet							
Carbon Disulfide	ND	0.200	mg/kg wet							
Carbon Tetrachloride	ND	0.200	mg/kg wet							
Chlorobenzene	ND	0.200	mg/kg wet							
Chloroethane	ND	0.200	mg/kg wet							
Chloroform	ND	0.200	mg/kg wet							
Chloromethane	ND	0.200	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.200	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.200	mg/kg wet							
Dibromochloromethane	ND	0.200	mg/kg wet							
Dibromomethane	ND	0.200	mg/kg wet							
Dichlorodifluoromethane	ND	0.200	mg/kg wet							
Diethyl Ether	ND	0.200	mg/kg wet							
Di-isopropyl ether	ND	0.200	mg/kg wet							
Ethyl tertiary-butyl ether	ND	0.200	mg/kg wet							
Ethylbenzene	ND	0.200	mg/kg wet							
Hexachlorobutadiene	ND	0.200	mg/kg wet							
Isopropylbenzene	ND	0.200	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.200	mg/kg wet							
Methylene Chloride	ND	0.400	mg/kg wet							
Naphthalene	ND	0.200	mg/kg wet							
n-Butylbenzene	ND	0.200	mg/kg wet							
n-Propylbenzene	ND	0.200	mg/kg wet							
sec-Butylbenzene	ND	0.200	mg/kg wet							
Styrene	ND	0.200	mg/kg wet							
tert-Butylbenzene	ND	0.200	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.200	mg/kg wet							
Tetrachloroethene	ND	0.200	mg/kg wet							
Tetrahydrofuran	ND	1.00	mg/kg wet							
Toluene	ND	0.200	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.200	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.200	mg/kg wet							
Trichloroethene	ND	0.200	mg/kg wet							
Trichlorofluoromethane	ND	0.200	mg/kg wet							
Vinyl Chloride	ND	0.200	mg/kg wet							
Xylene O	ND	0.200	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
Xylene P,M	ND	0.400	mg/kg wet							
Xylenes (Total)	ND	0.400	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*5.48*		mg/kg wet	*5.000*		*110*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*4.74*		mg/kg wet	*5.000*		*95*	*70-130*			
Surrogate: Dibromofluoromethane	*5.17*		mg/kg wet	*5.000*		*103*	*70-130*			
Surrogate: Toluene-d8	*5.10*		mg/kg wet	*5.000*		*102*	*70-130*			
LCS										
1,1,1,2-Tetrachloroethane	1.68	0.200	mg/kg wet	2.000		84	70-130			
1,1,1-Trichloroethane	2.10	0.200	mg/kg wet	2.000		105	70-130			
1,1,2,2-Tetrachloroethane	1.82	0.200	mg/kg wet	2.000		91	70-130			
1,1,2-Trichloroethane	1.92	0.200	mg/kg wet	2.000		96	70-130			
1,1-Dichloroethane	1.89	0.200	mg/kg wet	2.000		95	70-130			
1,1-Dichloroethene	1.96	0.200	mg/kg wet	2.000		98	70-130			
1,1-Dichloropropene	1.98	0.200	mg/kg wet	2.000		99	70-130			
1,2,3-Trichlorobenzene	2.03	0.200	mg/kg wet	2.000		101	70-130			
1,2,3-Trichloropropane	1.65	0.200	mg/kg wet	2.000		82	70-130			
1,2,4-Trichlorobenzene	1.92	0.200	mg/kg wet	2.000		96	70-130			
1,2,4-Trimethylbenzene	1.89	0.200	mg/kg wet	2.000		95	70-130			
1,2-Dibromo-3-Chloropropane	1.74	1.00	mg/kg wet	2.000		87	70-130			
1,2-Dibromoethane	1.89	0.200	mg/kg wet	2.000		95	70-130			
1,2-Dichlorobenzene	1.91	0.200	mg/kg wet	2.000		95	70-130			
1,2-Dichloroethane	2.03	0.200	mg/kg wet	2.000		102	70-130			
1,2-Dichloropropane	1.83	0.200	mg/kg wet	2.000		91	70-130			
1,3,5-Trimethylbenzene	2.06	0.200	mg/kg wet	2.000		103	70-130			
1,3-Dichlorobenzene	1.94	0.200	mg/kg wet	2.000		97	70-130			
1,3-Dichloropropane	1.87	0.200	mg/kg wet	2.000		94	70-130			
1,4-Dichlorobenzene	1.95	0.200	mg/kg wet	2.000		98	70-130			
1,4-Dioxane - Screen	65.6	40.0	mg/kg wet	40.00		164	44-241			
2,2-Dichloropropane	2.07	0.200	mg/kg wet	2.000		104	70-130			
2-Butanone	8.84	1.00	mg/kg wet	10.00		88	70-130			
2-Chlorotoluene	1.86	0.200	mg/kg wet	2.000		93	70-130			
2-Hexanone	7.26	1.00	mg/kg wet	10.00		73	70-130			
4-Chlorotoluene	1.88	0.200	mg/kg wet	2.000		94	70-130			
4-Isopropyltoluene	2.01	0.200	mg/kg wet	2.000		100	70-130			
4-Methyl-2-Pentanone	8.09	1.00	mg/kg wet	10.00		81	70-130			
Acetone	8.78	1.00	mg/kg wet	10.00		88	70-130			
Benzene	1.96	0.200	mg/kg wet	2.000		98	70-130			
Bromobenzene	1.93	0.200	mg/kg wet	2.000		96	70-130			
Bromochloromethane	2.10	0.200	mg/kg wet	2.000		105	70-130			
Bromodichloromethane	2.03	0.200	mg/kg wet	2.000		102	70-130			
Bromoform	1.44	0.200	mg/kg wet	2.000		72	70-130			
Bromomethane	1.80	0.200	mg/kg wet	2.000		90	70-130			
Carbon Disulfide	2.02	0.200	mg/kg wet	2.000		101	70-130			
Carbon Tetrachloride	2.00	0.200	mg/kg wet	2.000		100	70-130			
Chlorobenzene	1.90	0.200	mg/kg wet	2.000		95	70-130			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
Chloroethane	1.98	0.200	mg/kg wet	2.000		99	70-130			
Chloroform	2.15	0.200	mg/kg wet	2.000		108	70-130			
Chloromethane	1.63	0.200	mg/kg wet	2.000		82	70-130			
cis-1,2-Dichloroethene	2.06	0.200	mg/kg wet	2.000		103	70-130			
cis-1,3-Dichloropropene	1.86	0.200	mg/kg wet	2.000		93	70-130			
Dibromochloromethane	1.60	0.200	mg/kg wet	2.000		80	70-130			
Dibromomethane	2.00	0.200	mg/kg wet	2.000		100	70-130			
Dichlorodifluoromethane	1.90	0.200	mg/kg wet	2.000		95	70-130			
Diethyl Ether	1.74	0.200	mg/kg wet	2.000		87	70-130			
Di-isopropyl ether	1.89	0.200	mg/kg wet	2.000		94	70-130			
Ethyl tertiary-butyl ether	1.77	0.200	mg/kg wet	2.000		88	70-130			
Ethylbenzene	1.93	0.200	mg/kg wet	2.000		97	70-130			
Hexachlorobutadiene	1.90	0.200	mg/kg wet	2.000		95	70-130			
Isopropylbenzene	1.97	0.200	mg/kg wet	2.000		98	70-130			
Methyl tert-Butyl Ether	1.96	0.200	mg/kg wet	2.000		98	70-130			
Methylene Chloride	2.02	0.400	mg/kg wet	2.000		101	70-130			
Naphthalene	1.93	0.200	mg/kg wet	2.000		96	70-130			
n-Butylbenzene	1.99	0.200	mg/kg wet	2.000		100	70-130			
n-Propylbenzene	1.92	0.200	mg/kg wet	2.000		96	70-130			
sec-Butylbenzene	1.98	0.200	mg/kg wet	2.000		99	70-130			
Styrene	1.82	0.200	mg/kg wet	2.000		91	70-130			
tert-Butylbenzene	1.89	0.200	mg/kg wet	2.000		95	70-130			
Tertiary-amyl methyl ether	1.85	0.200	mg/kg wet	2.000		92	70-130			
Tetrachloroethene	1.77	0.200	mg/kg wet	2.000		89	70-130			
Tetrahydrofuran	1.68	1.00	mg/kg wet	2.000		84	70-130			
Toluene	1.99	0.200	mg/kg wet	2.000		100	70-130			
trans-1,2-Dichloroethene	1.88	0.200	mg/kg wet	2.000		94	70-130			
trans-1,3-Dichloropropene	1.48	0.200	mg/kg wet	2.000		74	70-130			
Trichloroethene	2.02	0.200	mg/kg wet	2.000		101	70-130			
Trichlorofluoromethane	2.16	0.200	mg/kg wet	2.000		108	70-130			
Vinyl Chloride	1.57	0.200	mg/kg wet	2.000		79	70-130			
Xylene O	1.92	0.200	mg/kg wet	2.000		96	70-130			
Xylene P,M	3.96	0.400	mg/kg wet	4.000		99	70-130			
Xylenes (Total)	5.88	0.400	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*5.39*		mg/kg wet	*5.000*		*108*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*4.82*		mg/kg wet	*5.000*		*96*	*70-130*			
Surrogate: Dibromofluoromethane	*5.11*		mg/kg wet	*5.000*		*102*	*70-130*			
Surrogate: Toluene-d8	*4.86*		mg/kg wet	*5.000*		*97*	*70-130*			
LCS Dup										
1,1,1,2-Tetrachloroethane	1.76	0.200	mg/kg wet	2.000		88	70-130	4	20	
1,1,1-Trichloroethane	2.19	0.200	mg/kg wet	2.000		110	70-130	4	20	
1,1,2,2-Tetrachloroethane	2.02	0.200	mg/kg wet	2.000		101	70-130	10	20	
1,1,2-Trichloroethane	2.10	0.200	mg/kg wet	2.000		105	70-130	9	20	
1,1-Dichloroethane	1.93	0.200	mg/kg wet	2.000		97	70-130	2	20	
1,1-Dichloroethene	2.04	0.200	mg/kg wet	2.000		102	70-130	4	20	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
1,1-Dichloropropene	2.16	0.200	mg/kg wet	2.000		108	70-130	9	20	
1,2,3-Trichlorobenzene	1.94	0.200	mg/kg wet	2.000		97	70-130	4	20	
1,2,3-Trichloropropane	1.79	0.200	mg/kg wet	2.000		90	70-130	8	20	
1,2,4-Trichlorobenzene	2.05	0.200	mg/kg wet	2.000		102	70-130	6	20	
1,2,4-Trimethylbenzene	1.95	0.200	mg/kg wet	2.000		98	70-130	3	20	
1,2-Dibromo-3-Chloropropane	1.92	1.00	mg/kg wet	2.000		96	70-130	9	20	
1,2-Dibromoethane	2.01	0.200	mg/kg wet	2.000		101	70-130	6	20	
1,2-Dichlorobenzene	1.94	0.200	mg/kg wet	2.000		97	70-130	2	20	
1,2-Dichloroethane	2.13	0.200	mg/kg wet	2.000		107	70-130	5	20	
1,2-Dichloropropane	1.87	0.200	mg/kg wet	2.000		93	70-130	2	20	
1,3,5-Trimethylbenzene	2.02	0.200	mg/kg wet	2.000		101	70-130	2	20	
1,3-Dichlorobenzene	1.96	0.200	mg/kg wet	2.000		98	70-130	1	20	
1,3-Dichloropropane	1.95	0.200	mg/kg wet	2.000		97	70-130	4	20	
1,4-Dichlorobenzene	2.00	0.200	mg/kg wet	2.000		100	70-130	2	20	
1,4-Dioxane - Screen	60.6	40.0	mg/kg wet	40.00		152	44-241	8	200	
2,2-Dichloropropane	2.18	0.200	mg/kg wet	2.000		109	70-130	5	20	
2-Butanone	9.87	1.00	mg/kg wet	10.00		99	70-130	11	20	
2-Chlorotoluene	1.90	0.200	mg/kg wet	2.000		95	70-130	2	20	
2-Hexanone	9.23	1.00	mg/kg wet	10.00		92	70-130	24	20	D+
4-Chlorotoluene	1.97	0.200	mg/kg wet	2.000		98	70-130	4	20	
4-Isopropyltoluene	2.04	0.200	mg/kg wet	2.000		102	70-130	2	20	
4-Methyl-2-Pentanone	9.34	1.00	mg/kg wet	10.00		93	70-130	14	20	
Acetone	10.6	1.00	mg/kg wet	10.00		106	70-130	18	20	
Benzene	2.05	0.200	mg/kg wet	2.000		103	70-130	4	20	
Bromobenzene	1.97	0.200	mg/kg wet	2.000		99	70-130	2	20	
Bromochloromethane	2.17	0.200	mg/kg wet	2.000		108	70-130	3	20	
Bromodichloromethane	2.05	0.200	mg/kg wet	2.000		102	70-130	0.8	20	
Bromoform	1.53	0.200	mg/kg wet	2.000		77	70-130	6	20	
Bromomethane	1.75	0.200	mg/kg wet	2.000		88	70-130	3	20	
Carbon Disulfide	2.09	0.200	mg/kg wet	2.000		105	70-130	3	20	
Carbon Tetrachloride	2.08	0.200	mg/kg wet	2.000		104	70-130	4	20	
Chlorobenzene	1.92	0.200	mg/kg wet	2.000		96	70-130	1	20	
Chloroethane	1.91	0.200	mg/kg wet	2.000		95	70-130	4	20	
Chloroform	2.19	0.200	mg/kg wet	2.000		110	70-130	2	20	
Chloromethane	1.64	0.200	mg/kg wet	2.000		82	70-130	0.5	20	
cis-1,2-Dichloroethene	2.11	0.200	mg/kg wet	2.000		106	70-130	3	20	
cis-1,3-Dichloropropene	1.94	0.200	mg/kg wet	2.000		97	70-130	4	20	
Dibromochloromethane	1.73	0.200	mg/kg wet	2.000		86	70-130	8	20	
Dibromomethane	2.15	0.200	mg/kg wet	2.000		107	70-130	7	20	
Dichlorodifluoromethane	1.80	0.200	mg/kg wet	2.000		90	70-130	6	20	
Diethyl Ether	1.97	0.200	mg/kg wet	2.000		98	70-130	12	20	
Di-isopropyl ether	2.00	0.200	mg/kg wet	2.000		100	70-130	6	20	
Ethyl tertiary-butyl ether	1.91	0.200	mg/kg wet	2.000		95	70-130	8	20	
Ethylbenzene	2.00	0.200	mg/kg wet	2.000		100	70-130	3	20	
Hexachlorobutadiene	1.82	0.200	mg/kg wet	2.000		91	70-130	4	20	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Methanol										
Batch CA91050 - 5035										
Isopropylbenzene	2.01	0.200	mg/kg wet	2.000		100	70-130	2	20	
Methyl tert-Butyl Ether	2.07	0.200	mg/kg wet	2.000		103	70-130	5	20	
Methylene Chloride	2.00	0.400	mg/kg wet	2.000		100	70-130	0.9	20	
Naphthalene	2.05	0.200	mg/kg wet	2.000		102	70-130	6	20	
n-Butylbenzene	1.99	0.200	mg/kg wet	2.000		99	70-130	0.3	20	
n-Propylbenzene	1.97	0.200	mg/kg wet	2.000		99	70-130	3	20	
sec-Butylbenzene	2.03	0.200	mg/kg wet	2.000		101	70-130	2	20	
Styrene	1.80	0.200	mg/kg wet	2.000		90	70-130	1	20	
tert-Butylbenzene	1.94	0.200	mg/kg wet	2.000		97	70-130	2	20	
Tertiary-amyl methyl ether	1.97	0.200	mg/kg wet	2.000		99	70-130	6	20	
Tetrachloroethene	1.73	0.200	mg/kg wet	2.000		87	70-130	2	20	
Tetrahydrofuran	1.67	1.00	mg/kg wet	2.000		84	70-130	0.2	20	
Toluene	2.05	0.200	mg/kg wet	2.000		103	70-130	3	20	
trans-1,2-Dichloroethene	1.97	0.200	mg/kg wet	2.000		98	70-130	4	20	
trans-1,3-Dichloropropene	1.62	0.200	mg/kg wet	2.000		81	70-130	9	20	
Trichloroethene	2.08	0.200	mg/kg wet	2.000		104	70-130	3	20	
Trichlorofluoromethane	2.27	0.200	mg/kg wet	2.000		114	70-130	5	20	
Vinyl Chloride	1.62	0.200	mg/kg wet	2.000		81	70-130	3	20	
Xylene O	2.01	0.200	mg/kg wet	2.000		101	70-130	5	20	
Xylene P,M	4.04	0.400	mg/kg wet	4.000		101	70-130	2	20	
Xylenes (Total)	6.06	0.400	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*5.84*		mg/kg wet	*5.000*		*117*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*4.79*		mg/kg wet	*5.000*		*96*	*70-130*			
Surrogate: Dibromofluoromethane	*5.49*		mg/kg wet	*5.000*		*110*	*70-130*			
Surrogate: Toluene-d8	*5.12*		mg/kg wet	*5.000*		*102*	*70-130*			
8081B Organochlorine Pesticides										
Batch CA90714 - 3546										
Blank										
4,4´-DDD	ND	0.0025	mg/kg wet							
4,4´-DDD [2C]	ND	0.0025	mg/kg wet							
4,4´-DDE	ND	0.0025	mg/kg wet							
4,4´-DDE [2C]	ND	0.0025	mg/kg wet							
4,4´-DDT	ND	0.0025	mg/kg wet							
4,4´-DDT [2C]	ND	0.0025	mg/kg wet							
Aldrin	ND	0.0025	mg/kg wet							
Aldrin [2C]	ND	0.0025	mg/kg wet							
alpha-BHC	ND	0.0025	mg/kg wet							
alpha-BHC [2C]	ND	0.0025	mg/kg wet							
alpha-Chlordane	ND	0.0025	mg/kg wet							
alpha-Chlordane [2C]	ND	0.0025	mg/kg wet							
beta-BHC	ND	0.0025	mg/kg wet							
beta-BHC [2C]	ND	0.0025	mg/kg wet							
delta-BHC	ND	0.0025	mg/kg wet							
delta-BHC [2C]	ND	0.0025	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA90714 - 3546										
Dieldrin	ND	0.0025	mg/kg wet							
Dieldrin [2C]	ND	0.0025	mg/kg wet							
Endosulfan I	ND	0.0025	mg/kg wet							
Endosulfan I [2C]	ND	0.0025	mg/kg wet							
Endosulfan II	ND	0.0025	mg/kg wet							
Endosulfan II [2C]	ND	0.0025	mg/kg wet							
Endosulfan Sulfate	ND	0.0025	mg/kg wet							
Endosulfan Sulfate [2C]	ND	0.0025	mg/kg wet							
Endrin	ND	0.0025	mg/kg wet							
Endrin [2C]	ND	0.0025	mg/kg wet							
Endrin Ketone	ND	0.0025	mg/kg wet							
Endrin Ketone [2C]	ND	0.0025	mg/kg wet							
gamma-BHC (Lindane)	ND	0.0015	mg/kg wet							
gamma-BHC (Lindane) [2C]	ND	0.0015	mg/kg wet							
gamma-Chlordane	ND	0.0025	mg/kg wet							
gamma-Chlordane [2C]	ND	0.0025	mg/kg wet							
Heptachlor	ND	0.0025	mg/kg wet							
Heptachlor [2C]	ND	0.0025	mg/kg wet							
Heptachlor Epoxide	ND	0.0025	mg/kg wet							
Heptachlor Epoxide [2C]	ND	0.0025	mg/kg wet							
Hexachlorobenzene	ND	0.0025	mg/kg wet							
Hexachlorobenzene [2C]	ND	0.0025	mg/kg wet							
Methoxychlor	ND	0.0025	mg/kg wet							
Methoxychlor [2C]	ND	0.0025	mg/kg wet							
Toxaphene	ND	0.125	mg/kg wet							
Toxaphene [2C]	ND	0.125	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0120*		mg/kg wet	*0.01250*		*96*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0106*		mg/kg wet	*0.01250*		*85*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0104*		mg/kg wet	*0.01250*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0105*		mg/kg wet	*0.01250*		*84*	*30-150*			
LCS										
4,4´-DDD	0.0114	0.0025	mg/kg wet	0.01250		92	40-140			
4,4´-DDD [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140			
4,4´-DDE	0.0119	0.0025	mg/kg wet	0.01250		95	40-140			
4,4´-DDE [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140			
4,4´-DDT	0.0129	0.0025	mg/kg wet	0.01250		103	40-140			
4,4´-DDT [2C]	0.0127	0.0025	mg/kg wet	0.01250		101	40-140			
Aldrin	0.0116	0.0025	mg/kg wet	0.01250		92	40-140			
Aldrin [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140			
alpha-BHC	0.0116	0.0025	mg/kg wet	0.01250		92	40-140			
alpha-BHC [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140			
alpha-Chlordane	0.0113	0.0025	mg/kg wet	0.01250		90	40-140			
alpha-Chlordane [2C]	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
beta-BHC	0.0113	0.0025	mg/kg wet	0.01250		91	40-140			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA90714 - 3546										
beta-BHC [2C]	0.0119	0.0025	mg/kg wet	0.01250		95	40-140			
delta-BHC	0.0096	0.0025	mg/kg wet	0.01250		77	40-140			
delta-BHC [2C]	0.0099	0.0025	mg/kg wet	0.01250		79	40-140			
Dieldrin	0.0133	0.0025	mg/kg wet	0.01250		106	40-140			
Dieldrin [2C]	0.0128	0.0025	mg/kg wet	0.01250		102	40-140			
Endosulfan I	0.0116	0.0025	mg/kg wet	0.01250		93	40-140			
Endosulfan I [2C]	0.0113	0.0025	mg/kg wet	0.01250		91	40-140			
Endosulfan II	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Endosulfan II [2C]	0.0117	0.0025	mg/kg wet	0.01250		94	40-140			
Endosulfan Sulfate	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Endosulfan Sulfate [2C]	0.0110	0.0025	mg/kg wet	0.01250		88	40-140			
Endrin	0.0120	0.0025	mg/kg wet	0.01250		96	40-140			
Endrin [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140			
Endrin Ketone	0.0125	0.0025	mg/kg wet	0.01250		100	40-140			
Endrin Ketone [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140			
gamma-BHC (Lindane)	0.0122	0.0015	mg/kg wet	0.01250		97	40-140			
gamma-BHC (Lindane) [2C]	0.0122	0.0015	mg/kg wet	0.01250		97	40-140			
gamma-Chlordane	0.0114	0.0025	mg/kg wet	0.01250		91	40-140			
gamma-Chlordane [2C]	0.0117	0.0025	mg/kg wet	0.01250		94	40-140			
Heptachlor	0.0124	0.0025	mg/kg wet	0.01250		99	40-140			
Heptachlor [2C]	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Heptachlor Epoxide	0.0134	0.0025	mg/kg wet	0.01250		108	40-140			
Heptachlor Epoxide [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140			
Hexachlorobenzene	0.0114	0.0025	mg/kg wet	0.01250		91	40-140			
Hexachlorobenzene [2C]	0.0114	0.0025	mg/kg wet	0.01250		91	40-140			
Methoxychlor	0.0130	0.0025	mg/kg wet	0.01250		104	40-140			
Methoxychlor [2C]	0.0112	0.0025	mg/kg wet	0.01250		90	40-140			
Surrogate: Decachlorobiphenyl	*0.0120*		mg/kg wet	*0.01250*		*96*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0104*		mg/kg wet	*0.01250*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0111*		mg/kg wet	*0.01250*		*89*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0105*		mg/kg wet	*0.01250*		*84*	*30-150*			
LCS Dup										
4,4´-DDD	0.0122	0.0025	mg/kg wet	0.01250		97	40-140	6	30	
4,4´-DDD [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140	6	30	
4,4´-DDE	0.0128	0.0025	mg/kg wet	0.01250		103	40-140	7	30	
4,4´-DDE [2C]	0.0133	0.0025	mg/kg wet	0.01250		106	40-140	9	30	
4,4´-DDT	0.0137	0.0025	mg/kg wet	0.01250		110	40-140	6	30	
4,4´-DDT [2C]	0.0132	0.0025	mg/kg wet	0.01250		105	40-140	4	30	
Aldrin	0.0124	0.0025	mg/kg wet	0.01250		99	40-140	7	30	
Aldrin [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140	7	30	
alpha-BHC	0.0124	0.0025	mg/kg wet	0.01250		99	40-140	7	30	
alpha-BHC [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140	6	30	
alpha-Chlordane	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	7	30	
alpha-Chlordane [2C]	0.0124	0.0025	mg/kg wet	0.01250		100	40-140	8	30	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA90714 - 3546										
beta-BHC	0.0122	0.0025	mg/kg wet	0.01250		97	40-140	7	30	
beta-BHC [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140	6	30	
delta-BHC	0.0102	0.0025	mg/kg wet	0.01250		81	40-140	6	30	
delta-BHC [2C]	0.0105	0.0025	mg/kg wet	0.01250		84	40-140	6	30	
Dieldrin	0.0144	0.0025	mg/kg wet	0.01250		115	40-140	8	30	
Dieldrin [2C]	0.0139	0.0025	mg/kg wet	0.01250		111	40-140	8	30	
Endosulfan I	0.0125	0.0025	mg/kg wet	0.01250		100	40-140	7	30	
Endosulfan I [2C]	0.0123	0.0025	mg/kg wet	0.01250		98	40-140	8	30	
Endosulfan II	0.0124	0.0025	mg/kg wet	0.01250		99	40-140	7	30	
Endosulfan II [2C]	0.0127	0.0025	mg/kg wet	0.01250		101	40-140	8	30	
Endosulfan Sulfate	0.0120	0.0025	mg/kg wet	0.01250		96	40-140	5	30	
Endosulfan Sulfate [2C]	0.0117	0.0025	mg/kg wet	0.01250		93	40-140	6	30	
Endrin	0.0128	0.0025	mg/kg wet	0.01250		102	40-140	7	30	
Endrin [2C]	0.0132	0.0025	mg/kg wet	0.01250		105	40-140	7	30	
Endrin Ketone	0.0132	0.0025	mg/kg wet	0.01250		106	40-140	5	30	
Endrin Ketone [2C]	0.0129	0.0025	mg/kg wet	0.01250		104	40-140	7	30	
gamma-BHC (Lindane)	0.0131	0.0015	mg/kg wet	0.01250		105	40-140	7	30	
gamma-BHC (Lindane) [2C]	0.0129	0.0015	mg/kg wet	0.01250		103	40-140	6	30	
gamma-Chlordane	0.0123	0.0025	mg/kg wet	0.01250		99	40-140	8	30	
gamma-Chlordane [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140	8	30	
Heptachlor	0.0132	0.0025	mg/kg wet	0.01250		106	40-140	6	30	
Heptachlor [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	6	30	
Heptachlor Epoxide	0.0146	0.0025	mg/kg wet	0.01250		116	40-140	8	30	
Heptachlor Epoxide [2C]	0.0131	0.0025	mg/kg wet	0.01250		105	40-140	7	30	
Hexachlorobenzene	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	6	30	
Hexachlorobenzene [2C]	0.0120	0.0025	mg/kg wet	0.01250		96	40-140	6	30	
Methoxychlor	0.0134	0.0025	mg/kg wet	0.01250		107	40-140	3	30	
Methoxychlor [2C]	0.0116	0.0025	mg/kg wet	0.01250		93	40-140	4	30	
Surrogate: Decachlorobiphenyl	*0.0119*		mg/kg wet	*0.01250*		*95*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0103*		mg/kg wet	*0.01250*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0113*		mg/kg wet	*0.01250*		*90*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0106*		mg/kg wet	*0.01250*		*85*	*30-150*			
8082A Polychlorinated Biphenyls (PCB)										
Batch CA90710 - 3540C										
Blank										
Aroclor 1016	ND	0.05	mg/kg wet							
Aroclor 1016 [2C]	ND	0.05	mg/kg wet							
Aroclor 1221	ND	0.05	mg/kg wet							
Aroclor 1221 [2C]	ND	0.05	mg/kg wet							
Aroclor 1232	ND	0.05	mg/kg wet							
Aroclor 1232 [2C]	ND	0.05	mg/kg wet							
Aroclor 1242	ND	0.05	mg/kg wet							
Aroclor 1242 [2C]	ND	0.05	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CA90710 - 3540C										
Aroclor 1248	ND	0.05	mg/kg wet							
Aroclor 1248 [2C]	ND	0.05	mg/kg wet							
Aroclor 1254	ND	0.05	mg/kg wet							
Aroclor 1254 [2C]	ND	0.05	mg/kg wet							
Aroclor 1260	ND	0.05	mg/kg wet							
Aroclor 1260 [2C]	ND	0.05	mg/kg wet							
Aroclor 1262	ND	0.05	mg/kg wet							
Aroclor 1262 [2C]	ND	0.05	mg/kg wet							
Aroclor 1268	ND	0.05	mg/kg wet							
Aroclor 1268 [2C]	ND	0.05	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0178*		mg/kg wet	*0.02500*		*71*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0182*		mg/kg wet	*0.02500*		*73*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0176*		mg/kg wet	*0.02500*		*70*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0182*		mg/kg wet	*0.02500*		*73*	*30-150*			
LCS										
Aroclor 1016	0.4	0.05	mg/kg wet	0.5000		86	40-140			
Aroclor 1016 [2C]	0.4	0.05	mg/kg wet	0.5000		86	40-140			
Aroclor 1260	0.4	0.05	mg/kg wet	0.5000		85	40-140			
Aroclor 1260 [2C]	0.4	0.05	mg/kg wet	0.5000		83	40-140			
Surrogate: Decachlorobiphenyl	*0.0196*		mg/kg wet	*0.02500*		*79*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0207*		mg/kg wet	*0.02500*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0194*		mg/kg wet	*0.02500*		*77*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0195*		mg/kg wet	*0.02500*		*78*	*30-150*			
LCS Dup										
Aroclor 1016	0.4	0.05	mg/kg wet	0.5000		82	40-140	5	30	
Aroclor 1016 [2C]	0.4	0.05	mg/kg wet	0.5000		80	40-140	7	30	
Aroclor 1260	0.4	0.05	mg/kg wet	0.5000		80	40-140	5	30	
Aroclor 1260 [2C]	0.4	0.05	mg/kg wet	0.5000		78	40-140	6	30	
Surrogate: Decachlorobiphenyl	*0.0184*		mg/kg wet	*0.02500*		*74*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0193*		mg/kg wet	*0.02500*		*77*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0176*		mg/kg wet	*0.02500*		*70*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0178*		mg/kg wet	*0.02500*		*71*	*30-150*			
Batch CA91001 - 3540C										
Blank										
Aroclor 1016	ND	0.05	mg/kg wet							
Aroclor 1016 [2C]	ND	0.05	mg/kg wet							
Aroclor 1221	ND	0.05	mg/kg wet							
Aroclor 1221 [2C]	ND	0.05	mg/kg wet							
Aroclor 1232	ND	0.05	mg/kg wet							
Aroclor 1232 [2C]	ND	0.05	mg/kg wet							
Aroclor 1242	ND	0.05	mg/kg wet							
Aroclor 1242 [2C]	ND	0.05	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CA91001 - 3540C										
Aroclor 1248	ND	0.05	mg/kg wet							
Aroclor 1248 [2C]	ND	0.05	mg/kg wet							
Aroclor 1254	ND	0.05	mg/kg wet							
Aroclor 1254 [2C]	ND	0.05	mg/kg wet							
Aroclor 1260	ND	0.05	mg/kg wet							
Aroclor 1260 [2C]	ND	0.05	mg/kg wet							
Aroclor 1262	ND	0.05	mg/kg wet							
Aroclor 1262 [2C]	ND	0.05	mg/kg wet							
Aroclor 1268	ND	0.05	mg/kg wet							
Aroclor 1268 [2C]	ND	0.05	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0182*		mg/kg wet	*0.02500*		*73*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0186*		mg/kg wet	*0.02500*		*74*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0193*		mg/kg wet	*0.02500*		*77*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0204*		mg/kg wet	*0.02500*		*82*	*30-150*			
LCS										
Aroclor 1016	0.5	0.05	mg/kg wet	0.5000		92	40-140			
Aroclor 1016 [2C]	0.5	0.05	mg/kg wet	0.5000		91	40-140			
Aroclor 1260	0.4	0.05	mg/kg wet	0.5000		86	40-140			
Aroclor 1260 [2C]	0.4	0.05	mg/kg wet	0.5000		82	40-140			
Surrogate: Decachlorobiphenyl	*0.0195*		mg/kg wet	*0.02500*		*78*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0203*		mg/kg wet	*0.02500*		*81*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0211*		mg/kg wet	*0.02500*		*84*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0210*		mg/kg wet	*0.02500*		*84*	*30-150*			
LCS Dup										
Aroclor 1016	0.4	0.05	mg/kg wet	0.5000		87	40-140	6	30	
Aroclor 1016 [2C]	0.4	0.05	mg/kg wet	0.5000		86	40-140	6	30	
Aroclor 1260	0.4	0.05	mg/kg wet	0.5000		83	40-140	4	30	
Aroclor 1260 [2C]	0.4	0.05	mg/kg wet	0.5000		79	40-140	3	30	
Surrogate: Decachlorobiphenyl	*0.0185*		mg/kg wet	*0.02500*		*74*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0190*		mg/kg wet	*0.02500*		*76*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0190*		mg/kg wet	*0.02500*		*76*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0192*		mg/kg wet	*0.02500*		*77*	*30-150*			
8100M Total Petroleum Hydrocarbons										
Batch CA90717 - 3546										
Blank										
Decane (C10)	ND	0.2	mg/kg wet							
Docosane (C22)	ND	0.2	mg/kg wet							
Dodecane (C12)	ND	0.2	mg/kg wet							
Eicosane (C20)	ND	0.2	mg/kg wet							
Hexacosane (C26)	ND	0.2	mg/kg wet							
Hexadecane (C16)	ND	0.2	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8100M Total Petroleum Hydrocarbons										
Batch CA90717 - 3546										
Hexatriacontane (C36)	ND	0.2	mg/kg wet							
Nonadecane (C19)	ND	0.2	mg/kg wet							
Nonane (C9)	ND	0.2	mg/kg wet							
Octacosane (C28)	ND	0.2	mg/kg wet							
Octadecane (C18)	ND	0.2	mg/kg wet							
Tetracosane (C24)	ND	0.2	mg/kg wet							
Tetradecane (C14)	ND	0.2	mg/kg wet							
Total Petroleum Hydrocarbons	ND	10.0	mg/kg wet							
Triacontane (C30)	ND	0.2	mg/kg wet							
Surrogate: O-Terphenyl	*4.34*		mg/kg wet	*5.000*		*87*	*40-140*			
LCS										
Decane (C10)	2.0	0.2	mg/kg wet	2.500		82	40-140			
Docosane (C22)	2.3	0.2	mg/kg wet	2.500		93	40-140			
Dodecane (C12)	2.2	0.2	mg/kg wet	2.500		86	40-140			
Eicosane (C20)	2.3	0.2	mg/kg wet	2.500		92	40-140			
Hexacosane (C26)	2.3	0.2	mg/kg wet	2.500		93	40-140			
Hexadecane (C16)	2.2	0.2	mg/kg wet	2.500		89	40-140			
Hexatriacontane (C36)	2.6	0.2	mg/kg wet	2.500		103	40-140			
Nonadecane (C19)	2.5	0.2	mg/kg wet	2.500		101	40-140			
Nonane (C9)	1.8	0.2	mg/kg wet	2.500		71	30-140			
Octacosane (C28)	2.3	0.2	mg/kg wet	2.500		94	40-140			
Octadecane (C18)	2.2	0.2	mg/kg wet	2.500		90	40-140			
Tetracosane (C24)	2.3	0.2	mg/kg wet	2.500		93	40-140			
Tetradecane (C14)	2.2	0.2	mg/kg wet	2.500		87	40-140			
Total Petroleum Hydrocarbons	32.1	10.0	mg/kg wet	35.00		92	40-140			
Triacontane (C30)	2.3	0.2	mg/kg wet	2.500		94	40-140			
Surrogate: O-Terphenyl	*4.36*		mg/kg wet	*5.000*		*87*	*40-140*			
LCS Dup										
Decane (C10)	1.8	0.2	mg/kg wet	2.500		72	40-140	13	25	
Docosane (C22)	2.3	0.2	mg/kg wet	2.500		94	40-140	1	25	
Dodecane (C12)	2.2	0.2	mg/kg wet	2.500		86	40-140	0.02	25	
Eicosane (C20)	2.3	0.2	mg/kg wet	2.500		93	40-140	0.3	25	
Hexacosane (C26)	2.4	0.2	mg/kg wet	2.500		94	40-140	1	25	
Hexadecane (C16)	2.3	0.2	mg/kg wet	2.500		90	40-140	0.7	25	
Hexatriacontane (C36)	2.6	0.2	mg/kg wet	2.500		103	40-140	0.7	25	
Nonadecane (C19)	2.5	0.2	mg/kg wet	2.500		101	40-140	0.6	25	
Nonane (C9)	1.7	0.2	mg/kg wet	2.500		69	30-140	3	25	
Octacosane (C28)	2.4	0.2	mg/kg wet	2.500		95	40-140	1	25	
Octadecane (C18)	2.3	0.2	mg/kg wet	2.500		91	40-140	0.9	25	
Tetracosane (C24)	2.4	0.2	mg/kg wet	2.500		95	40-140	1	25	
Tetradecane (C14)	2.2	0.2	mg/kg wet	2.500		87	40-140	0.2	25	
Total Petroleum Hydrocarbons	32.0	10.0	mg/kg wet	35.00		92	40-140	0.07	25	
Triacontane (C30)	2.4	0.2	mg/kg wet	2.500		95	40-140	1	25	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8100M Total Petroleum Hydrocarbons										
Batch CA90717 - 3546										
Surrogate: O-Terphenyl	*4.25*		mg/kg wet	*5.000*		*85*	*40-140*			
8151A Chlorinated Herbicides										
Batch CA90751 - 3546										
Blank										
2,4,5-T	ND	0.010	mg/kg wet							
2,4,5-T [2C]	ND	0.010	mg/kg wet							
2,4,5-TP (Silvex)	ND	0.010	mg/kg wet							
2,4,5-TP (Silvex) [2C]	ND	0.010	mg/kg wet							
2,4-D	ND	0.047	mg/kg wet							
2,4-D [2C]	ND	0.047	mg/kg wet							
2,4-DB	ND	0.048	mg/kg wet							
2,4-DB [2C]	ND	0.048	mg/kg wet							
Dalapon	ND	0.046	mg/kg wet							
Dalapon [2C]	ND	0.046	mg/kg wet							
Dicamba	ND	0.009	mg/kg wet							
Dicamba [2C]	ND	0.009	mg/kg wet							
Dichlorprop	ND	0.047	mg/kg wet							
Dichlorprop [2C]	ND	0.047	mg/kg wet							
Dinoseb	ND	0.048	mg/kg wet							
Dinoseb [2C]	ND	0.048	mg/kg wet							
MCPA	ND	2.32	mg/kg wet							
MCPA [2C]	ND	2.32	mg/kg wet							
MCPP	ND	2.35	mg/kg wet							
MCPP [2C]	ND	2.35	mg/kg wet							
Surrogate: DCAA	*0.202*		mg/kg wet	*0.2000*		*101*	*30-150*			
Surrogate: DCAA [2C]	*0.185*		mg/kg wet	*0.2000*		*92*	*30-150*			
LCS										
2,4,5-T	0.016	0.010	mg/kg wet	0.01900		82	40-140			
2,4,5-T [2C]	0.014	0.010	mg/kg wet	0.01900		76	40-140			
2,4,5-TP (Silvex)	0.014	0.010	mg/kg wet	0.01900		76	40-140			
2,4,5-TP (Silvex) [2C]	0.014	0.010	mg/kg wet	0.01900		74	40-140			
2,4-D	0.168	0.047	mg/kg wet	0.1880		89	40-140			
2,4-D [2C]	0.156	0.047	mg/kg wet	0.1880		83	40-140			
2,4-DB	0.092	0.048	mg/kg wet	0.1900		48	40-140			
2,4-DB [2C]	0.084	0.048	mg/kg wet	0.1900		44	40-140			
Dalapon	0.337	0.046	mg/kg wet	0.4550		74	40-140			
Dalapon [2C]	0.384	0.046	mg/kg wet	0.4550		84	40-140			
Dicamba	0.017	0.009	mg/kg wet	0.01880		90	40-140			
Dicamba [2C]	0.017	0.009	mg/kg wet	0.01880		90	40-140			
Dichlorprop	0.156	0.047	mg/kg wet	0.1880		83	40-140			
Dichlorprop [2C]	0.155	0.047	mg/kg wet	0.1880		82	40-140			
Dinoseb	0.017	0.048	mg/kg wet	0.09500		18	10-100			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8151A Chlorinated Herbicides										
Batch CA90751 - 3546										
Dinoseb [2C]	0.017	0.048	mg/kg wet	0.09500		18	10-100			
MCPA	17.3	2.32	mg/kg wet	18.60		93	40-140			
MCPA [2C]	16.0	2.32	mg/kg wet	18.60		86	40-140			
MCPP	14.0	2.35	mg/kg wet	18.80		75	40-140			
MCPP [2C]	14.9	2.35	mg/kg wet	18.80		79	40-140			
Surrogate: DCAA	*0.207*		mg/kg wet	*0.2000*		*104*	*30-150*			
Surrogate: DCAA [2C]	*0.193*		mg/kg wet	*0.2000*		*96*	*30-150*			
LCS Dup										
2,4,5-T	0.017	0.010	mg/kg wet	0.01900		88	40-140	7	30	
2,4,5-T [2C]	0.016	0.010	mg/kg wet	0.01900		82	40-140	8	30	
2,4,5-TP (Silvex)	0.016	0.010	mg/kg wet	0.01900		82	40-140	8	30	
2,4,5-TP (Silvex) [2C]	0.016	0.010	mg/kg wet	0.01900		82	40-140	10	30	
2,4-D	0.201	0.047	mg/kg wet	0.1880		107	40-140	18	30	
2,4-D [2C]	0.177	0.047	mg/kg wet	0.1880		94	40-140	12	30	
2,4-DB	0.124	0.048	mg/kg wet	0.1900		65	40-140	30	30	
2,4-DB [2C]	0.121	0.048	mg/kg wet	0.1900		64	40-140	36	30	D+
Dalapon	0.345	0.046	mg/kg wet	0.4550		76	40-140	2	30	
Dalapon [2C]	0.399	0.046	mg/kg wet	0.4550		88	40-140	4	30	
Dicamba	0.017	0.009	mg/kg wet	0.01880		88	40-140	2	30	
Dicamba [2C]	0.018	0.009	mg/kg wet	0.01880		94	40-140	4	30	
Dichlorprop	0.170	0.047	mg/kg wet	0.1880		91	40-140	9	30	
Dichlorprop [2C]	0.170	0.047	mg/kg wet	0.1880		91	40-140	10	30	
Dinoseb	0.019	0.048	mg/kg wet	0.09500		20	10-100	12	30	
Dinoseb [2C]	0.021	0.048	mg/kg wet	0.09500		22	10-100	18	30	
MCPA	18.1	2.32	mg/kg wet	18.60		97	40-140	4	30	
MCPA [2C]	17.1	2.32	mg/kg wet	18.60		92	40-140	7	30	
MCPP	17.6	2.35	mg/kg wet	18.80		94	40-140	23	30	
MCPP [2C]	18.1	2.35	mg/kg wet	18.80		96	40-140	20	30	
Surrogate: DCAA	*0.203*		mg/kg wet	*0.2000*		*102*	*30-150*			
Surrogate: DCAA [2C]	*0.193*		mg/kg wet	*0.2000*		*96*	*30-150*			
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
Blank										
1,2,4-Trichlorobenzene	ND	0.333	mg/kg wet							
1,2-Dichlorobenzene	ND	0.333	mg/kg wet							
1,3-Dichlorobenzene	ND	0.333	mg/kg wet							
1,4-Dichlorobenzene	ND	0.333	mg/kg wet							
2,4,5-Trichlorophenol	ND	0.333	mg/kg wet							
2,4,6-Trichlorophenol	ND	0.333	mg/kg wet							
2,4-Dichlorophenol	ND	0.333	mg/kg wet							
2,4-Dimethylphenol	ND	0.333	mg/kg wet							
2,4-Dinitrophenol	ND	1.67	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
2,4-Dinitrotoluene	ND	0.333	mg/kg wet							
2,6-Dinitrotoluene	ND	0.333	mg/kg wet							
2-Chloronaphthalene	ND	0.333	mg/kg wet							
2-Chlorophenol	ND	0.333	mg/kg wet							
2-Methylnaphthalene	ND	0.333	mg/kg wet							
2-Methylphenol	ND	0.333	mg/kg wet							
2-Nitrophenol	ND	0.333	mg/kg wet							
3,3´-Dichlorobenzidine	ND	0.667	mg/kg wet							
3+4-Methylphenol	ND	0.667	mg/kg wet							
4-Bromophenyl-phenylether	ND	0.333	mg/kg wet							
4-Chloroaniline	ND	0.667	mg/kg wet							
4-Nitrophenol	ND	1.67	mg/kg wet							
Acenaphthene	ND	0.333	mg/kg wet							
Acenaphthylene	ND	0.333	mg/kg wet							
Acetophenone	ND	0.667	mg/kg wet							
Aniline	ND	1.67	mg/kg wet							
Anthracene	ND	0.333	mg/kg wet							
Azobenzene	ND	0.333	mg/kg wet							
Benzo(a)anthracene	ND	0.333	mg/kg wet							
Benzo(a)pyrene	ND	0.167	mg/kg wet							
Benzo(b)fluoranthene	ND	0.333	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.333	mg/kg wet							
Benzo(k)fluoranthene	ND	0.333	mg/kg wet							
bis(2-Chloroethoxy)methane	ND	0.333	mg/kg wet							
bis(2-Chloroethyl)ether	ND	0.333	mg/kg wet							
bis(2-chloroisopropyl)Ether	ND	0.333	mg/kg wet							
bis(2-Ethylhexyl)phthalate	ND	0.333	mg/kg wet							
Butylbenzylphthalate	ND	0.333	mg/kg wet							
Chrysene	ND	0.167	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.167	mg/kg wet							
Dibenzofuran	ND	0.333	mg/kg wet							
Diethylphthalate	ND	0.333	mg/kg wet							
Dimethylphthalate	ND	0.333	mg/kg wet							
Di-n-butylphthalate	ND	0.333	mg/kg wet							
Di-n-octylphthalate	ND	0.333	mg/kg wet							
Fluoranthene	ND	0.333	mg/kg wet							
Fluorene	ND	0.333	mg/kg wet							
Hexachlorobenzene	ND	0.333	mg/kg wet							
Hexachlorobutadiene	ND	0.333	mg/kg wet							
Hexachloroethane	ND	0.333	mg/kg wet							
Indeno(1,2,3-cd)Pyrene	ND	0.333	mg/kg wet							
Isophorone	ND	0.333	mg/kg wet							
Naphthalene	ND	0.333	mg/kg wet							
Nitrobenzene	ND	0.333	mg/kg wet							
N-Nitrosodimethylamine	ND	0.333	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
Pentachlorophenol	ND	1.67	mg/kg wet							
Phenanthrene	ND	0.333	mg/kg wet							
Phenol	ND	0.333	mg/kg wet							
Pyrene	ND	0.333	mg/kg wet							
Pyridine	ND	1.67	mg/kg wet							
Surrogate: 1,2-Dichlorobenzene-d4	*2.47*		mg/kg wet	*3.333*		*74*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*3.44*		mg/kg wet	*5.000*		*69*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*4.26*		mg/kg wet	*5.000*		*85*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.55*		mg/kg wet	*3.333*		*76*	*30-130*			
Surrogate: 2-Fluorophenol	*4.28*		mg/kg wet	*5.000*		*86*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.61*		mg/kg wet	*3.333*		*78*	*30-130*			
Surrogate: Phenol-d6	*4.41*		mg/kg wet	*5.000*		*88*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.27*		mg/kg wet	*3.333*		*98*	*30-130*			
LCS										
1,2,4-Trichlorobenzene	2.28	0.333	mg/kg wet	3.333		68	40-140			
1,2-Dichlorobenzene	2.34	0.333	mg/kg wet	3.333		70	40-140			
1,3-Dichlorobenzene	2.28	0.333	mg/kg wet	3.333		68	40-140			
1,4-Dichlorobenzene	2.27	0.333	mg/kg wet	3.333		68	40-140			
2,4,5-Trichlorophenol	2.58	0.333	mg/kg wet	3.333		78	30-130			
2,4,6-Trichlorophenol	2.56	0.333	mg/kg wet	3.333		77	30-130			
2,4-Dichlorophenol	2.49	0.333	mg/kg wet	3.333		75	30-130			
2,4-Dimethylphenol	2.56	0.333	mg/kg wet	3.333		77	30-130			
2,4-Dinitrophenol	2.49	1.67	mg/kg wet	3.333		75	30-130			
2,4-Dinitrotoluene	2.42	0.333	mg/kg wet	3.333		73	40-140			
2,6-Dinitrotoluene	2.41	0.333	mg/kg wet	3.333		72	40-140			
2-Chloronaphthalene	2.50	0.333	mg/kg wet	3.333		75	40-140			
2-Chlorophenol	2.47	0.333	mg/kg wet	3.333		74	30-130			
2-Methylnaphthalene	2.34	0.333	mg/kg wet	3.333		70	40-140			
2-Methylphenol	2.42	0.333	mg/kg wet	3.333		73	30-130			
2-Nitrophenol	2.31	0.333	mg/kg wet	3.333		69	30-130			
3,3´-Dichlorobenzidine	1.70	0.667	mg/kg wet	3.333		51	40-140			
3+4-Methylphenol	5.51	0.667	mg/kg wet	6.667		83	30-130			
4-Bromophenyl-phenylether	2.91	0.333	mg/kg wet	3.333		87	40-140			
4-Chloroaniline	1.28	0.667	mg/kg wet	3.333		38	40-140			B-
4-Nitrophenol	2.46	1.67	mg/kg wet	3.333		74	30-130			
Acenaphthene	2.40	0.333	mg/kg wet	3.333		72	40-140			
Acenaphthylene	2.18	0.333	mg/kg wet	3.333		66	40-140			
Acetophenone	2.82	0.667	mg/kg wet	3.333		85	40-140			
Aniline	1.50	1.67	mg/kg wet	3.333		45	40-140			
Anthracene	2.65	0.333	mg/kg wet	3.333		79	40-140			
Azobenzene	3.00	0.333	mg/kg wet	3.333		90	40-140			
Benzo(a)anthracene	2.66	0.333	mg/kg wet	3.333		80	40-140			
Benzo(a)pyrene	2.59	0.167	mg/kg wet	3.333		78	40-140			
Benzo(b)fluoranthene	2.58	0.333	mg/kg wet	3.333		77	40-140			
Benzo(g,h,i)perylene	2.83	0.333	mg/kg wet	3.333		85	40-140			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
Benzo(k)fluoranthene	2.87	0.333	mg/kg wet	3.333		86	40-140			
bis(2-Chloroethoxy)methane	2.53	0.333	mg/kg wet	3.333		76	40-140			
bis(2-Chloroethyl)ether	2.46	0.333	mg/kg wet	3.333		74	40-140			
bis(2-chloroisopropyl)Ether	2.30	0.333	mg/kg wet	3.333		69	40-140			
bis(2-Ethylhexyl)phthalate	2.74	0.333	mg/kg wet	3.333		82	40-140			
Butylbenzylphthalate	2.96	0.333	mg/kg wet	3.333		89	40-140			
Chrysene	2.69	0.167	mg/kg wet	3.333		81	40-140			
Dibenzo(a,h)Anthracene	2.75	0.167	mg/kg wet	3.333		83	40-140			
Dibenzofuran	2.48	0.333	mg/kg wet	3.333		74	40-140			
Diethylphthalate	2.61	0.333	mg/kg wet	3.333		78	40-140			
Dimethylphthalate	2.61	0.333	mg/kg wet	3.333		78	40-140			
Di-n-butylphthalate	2.50	0.333	mg/kg wet	3.333		75	40-140			
Di-n-octylphthalate	2.57	0.333	mg/kg wet	3.333		77	40-140			
Fluoranthene	2.60	0.333	mg/kg wet	3.333		78	40-140			
Fluorene	2.52	0.333	mg/kg wet	3.333		76	40-140			
Hexachlorobenzene	2.82	0.333	mg/kg wet	3.333		84	40-140			
Hexachlorobutadiene	2.34	0.333	mg/kg wet	3.333		70	40-140			
Hexachloroethane	2.32	0.333	mg/kg wet	3.333		70	40-140			
Indeno(1,2,3-cd)Pyrene	2.80	0.333	mg/kg wet	3.333		84	40-140			
Isophorone	2.28	0.333	mg/kg wet	3.333		68	40-140			
Naphthalene	2.30	0.333	mg/kg wet	3.333		69	40-140			
Nitrobenzene	2.43	0.333	mg/kg wet	3.333		73	40-140			
N-Nitrosodimethylamine	2.18	0.333	mg/kg wet	3.333		66	40-140			
Pentachlorophenol	2.91	1.67	mg/kg wet	3.333		87	30-130			
Phenanthrene	2.59	0.333	mg/kg wet	3.333		78	40-140			
Phenol	2.64	0.333	mg/kg wet	3.333		79	30-130			
Pyrene	2.96	0.333	mg/kg wet	3.333		89	40-140			
Pyridine	1.95	1.67	mg/kg wet	3.333		58	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	*2.48*		mg/kg wet	*3.333*		*74*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.68*		mg/kg wet	*5.000*		*94*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*4.20*		mg/kg wet	*5.000*		*84*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.69*		mg/kg wet	*3.333*		*81*	*30-130*			
Surrogate: 2-Fluorophenol	*4.20*		mg/kg wet	*5.000*		*84*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.66*		mg/kg wet	*3.333*		*80*	*30-130*			
Surrogate: Phenol-d6	*4.43*		mg/kg wet	*5.000*		*89*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.19*		mg/kg wet	*3.333*		*96*	*30-130*			
LCS Dup										
1,2,4-Trichlorobenzene	2.27	0.333	mg/kg wet	3.333		68	40-140	0.5	30	
1,2-Dichlorobenzene	2.31	0.333	mg/kg wet	3.333		69	40-140	1	30	
1,3-Dichlorobenzene	2.22	0.333	mg/kg wet	3.333		67	40-140	2	30	
1,4-Dichlorobenzene	2.20	0.333	mg/kg wet	3.333		66	40-140	3	30	
2,4,5-Trichlorophenol	2.56	0.333	mg/kg wet	3.333		77	30-130	0.9	30	
2,4,6-Trichlorophenol	2.51	0.333	mg/kg wet	3.333		75	30-130	2	30	
2,4-Dichlorophenol	2.52	0.333	mg/kg wet	3.333		75	30-130	1	30	
2,4-Dimethylphenol	2.52	0.333	mg/kg wet	3.333		75	30-130	2	30	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
2,4-Dinitrophenol	2.61	1.67	mg/kg wet	3.333		78	30-130	4	30	
2,4-Dinitrotoluene	2.45	0.333	mg/kg wet	3.333		73	40-140	1	30	
2,6-Dinitrotoluene	2.44	0.333	mg/kg wet	3.333		73	40-140	1	30	
2-Chloronaphthalene	2.40	0.333	mg/kg wet	3.333		72	40-140	4	30	
2-Chlorophenol	2.41	0.333	mg/kg wet	3.333		72	30-130	3	30	
2-Methylnaphthalene	2.34	0.333	mg/kg wet	3.333		70	40-140	0.4	30	
2-Methylphenol	2.40	0.333	mg/kg wet	3.333		72	30-130	0.7	30	
2-Nitrophenol	2.28	0.333	mg/kg wet	3.333		68	30-130	1	30	
3,3´-Dichlorobenzidine	1.61	0.667	mg/kg wet	3.333		48	40-140	5	30	
3+4-Methylphenol	5.44	0.667	mg/kg wet	6.667		82	30-130	1	30	
4-Bromophenyl-phenylether	2.87	0.333	mg/kg wet	3.333		86	40-140	1	30	
4-Chloroaniline	1.25	0.667	mg/kg wet	3.333		38	40-140	2	30	B-
4-Nitrophenol	2.43	1.67	mg/kg wet	3.333		73	30-130	0.9	30	
Acenaphthene	2.36	0.333	mg/kg wet	3.333		71	40-140	2	30	
Acenaphthylene	2.12	0.333	mg/kg wet	3.333		64	40-140	3	30	
Acetophenone	2.77	0.667	mg/kg wet	3.333		83	40-140	2	30	
Aniline	1.42	1.67	mg/kg wet	3.333		43	40-140	5	30	
Anthracene	2.65	0.333	mg/kg wet	3.333		79	40-140	0.01	30	
Azobenzene	2.98	0.333	mg/kg wet	3.333		89	40-140	0.5	30	
Benzo(a)anthracene	2.64	0.333	mg/kg wet	3.333		79	40-140	1	30	
Benzo(a)pyrene	2.65	0.167	mg/kg wet	3.333		79	40-140	2	30	
Benzo(b)fluoranthene	2.68	0.333	mg/kg wet	3.333		80	40-140	4	30	
Benzo(g,h,i)perylene	2.94	0.333	mg/kg wet	3.333		88	40-140	4	30	
Benzo(k)fluoranthene	2.90	0.333	mg/kg wet	3.333		87	40-140	1	30	
bis(2-Chloroethoxy)methane	2.46	0.333	mg/kg wet	3.333		74	40-140	3	30	
bis(2-Chloroethyl)ether	2.38	0.333	mg/kg wet	3.333		71	40-140	3	30	
bis(2-chloroisopropyl)Ether	2.27	0.333	mg/kg wet	3.333		68	40-140	1	30	
bis(2-Ethylhexyl)phthalate	2.87	0.333	mg/kg wet	3.333		86	40-140	5	30	
Butylbenzylphthalate	3.11	0.333	mg/kg wet	3.333		93	40-140	5	30	
Chrysene	2.65	0.167	mg/kg wet	3.333		80	40-140	1	30	
Dibenzo(a,h)Anthracene	2.81	0.167	mg/kg wet	3.333		84	40-140	2	30	
Dibenzofuran	2.47	0.333	mg/kg wet	3.333		74	40-140	0.5	30	
Diethylphthalate	2.64	0.333	mg/kg wet	3.333		79	40-140	1	30	
Dimethylphthalate	2.62	0.333	mg/kg wet	3.333		79	40-140	0.5	30	
Di-n-butylphthalate	2.54	0.333	mg/kg wet	3.333		76	40-140	1	30	
Di-n-octylphthalate	2.76	0.333	mg/kg wet	3.333		83	40-140	7	30	
Fluoranthene	2.54	0.333	mg/kg wet	3.333		76	40-140	2	30	
Fluorene	2.54	0.333	mg/kg wet	3.333		76	40-140	1	30	
Hexachlorobenzene	2.85	0.333	mg/kg wet	3.333		85	40-140	1	30	
Hexachlorobutadiene	2.30	0.333	mg/kg wet	3.333		69	40-140	2	30	
Hexachloroethane	2.28	0.333	mg/kg wet	3.333		68	40-140	2	30	
Indeno(1,2,3-cd)Pyrene	2.89	0.333	mg/kg wet	3.333		87	40-140	3	30	
Isophorone	2.22	0.333	mg/kg wet	3.333		67	40-140	2	30	
Naphthalene	2.27	0.333	mg/kg wet	3.333		68	40-140	1	30	
Nitrobenzene	2.35	0.333	mg/kg wet	3.333		71	40-140	3	30	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CA90716 - 3546										
N-Nitrosodimethylamine	2.12	0.333	mg/kg wet	3.333		63	40-140	3	30	
Pentachlorophenol	2.96	1.67	mg/kg wet	3.333		89	30-130	2	30	
Phenanthrene	2.61	0.333	mg/kg wet	3.333		78	40-140	0.8	30	
Phenol	2.58	0.333	mg/kg wet	3.333		77	30-130	3	30	
Pyrene	3.11	0.333	mg/kg wet	3.333		93	40-140	5	30	
Pyridine	1.83	1.67	mg/kg wet	3.333		55	40-140	6	30	
Surrogate: 1,2-Dichlorobenzene-d4	*2.34*		mg/kg wet	*3.333*		*70*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.53*		mg/kg wet	*5.000*		*91*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*4.00*		mg/kg wet	*5.000*		*80*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.50*		mg/kg wet	*3.333*		*75*	*30-130*			
Surrogate: 2-Fluorophenol	*3.95*		mg/kg wet	*5.000*		*79*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.47*		mg/kg wet	*3.333*		*74*	*30-130*			
Surrogate: Phenol-d6	*4.15*		mg/kg wet	*5.000*		*83*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.30*		mg/kg wet	*3.333*		*99*	*30-130*			
Classical Chemistry										
Batch CA90430 - General Preparation										
Blank										
Conductivity	ND	5	umhos/cm							
LCS										
Conductivity	1400		umhos/cm	1411		99	90-110			
Batch CA90722 - General Preparation										
Reference										
Flashpoint	81		°F	81.00		100	97.9-102.1			
Batch CA90745 - General Preparation										
Blank										
Reactive Cyanide	ND	2.0	mg/kg							
Reactive Sulfide	ND	2.0	mg/kg							
LCS										
Reactive Cyanide	3.8	2.0	mg/kg	100.3		4	0.68-5.41			
Reactive Sulfide	ND	2.0	mg/kg	10.00		0	0-44			
Batch CA90827 - General Preparation										
Blank										
Total Organic Carbon (1)	ND	100	mg/kg							
Total Organic Carbon (2)	ND	100	mg/kg							
Total Organic Carbon (Average)	ND	100	mg/kg dry wt							
LCS										
Total Organic Carbon (1)	9210	100	mg/kg	10000		92	80-120			
Total Organic Carbon (2)	9300	100	mg/kg	10000		93	80-120			
Total Organic Carbon (Average)	9260	100	mg/kg dry wt							
LCS Dup										
Total Organic Carbon (1)	9190	100	mg/kg	10000		92	80-120	0.2	20	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CA90827 - General Preparation										
Total Organic Carbon (2)	9370	100	mg/kg	10000		94	80-120	0.7	20	
Total Organic Carbon (Average)	9280	100	mg/kg dry wt							
Reference										
Total Organic Carbon (Average)	1.60		mg/kg dry wt							
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA90804 - 3546										
Blank										
C19-C36 Aliphatics1	ND	15.0	mg/kg wet							
C9-C18 Aliphatics1	ND	15.0	mg/kg wet							
Decane (C10)	ND	0.5	mg/kg wet							
Docosane (C22)	ND	0.5	mg/kg wet							
Dodecane (C12)	ND	0.5	mg/kg wet							
Eicosane (C20)	ND	0.5	mg/kg wet							
Hexacosane (C26)	ND	0.5	mg/kg wet							
Hexadecane (C16)	ND	0.5	mg/kg wet							
Hexatriacontane (C36)	ND	0.5	mg/kg wet							
Nonadecane (C19)	ND	0.5	mg/kg wet							
Nonane (C9)	ND	0.5	mg/kg wet							
Octacosane (C28)	ND	0.5	mg/kg wet							
Octadecane (C18)	ND	0.5	mg/kg wet							
Tetracosane (C24)	ND	0.5	mg/kg wet							
Tetradecane (C14)	ND	0.5	mg/kg wet							
Triacontane (C30)	ND	0.5	mg/kg wet							
Surrogate: 1-Chlorooctadecane	*1.45*		mg/kg wet	*2.000*		*72*	*40-140*			
Blank										
2-Methylnaphthalene	ND	0.20	mg/kg wet							
Acenaphthene	ND	0.40	mg/kg wet							
Acenaphthylene	ND	0.20	mg/kg wet							
Anthracene	ND	0.40	mg/kg wet							
Benzo(a)anthracene	ND	0.40	mg/kg wet							
Benzo(a)pyrene	ND	0.40	mg/kg wet							
Benzo(b)fluoranthene	ND	0.40	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.40	mg/kg wet							
Benzo(k)fluoranthene	ND	0.40	mg/kg wet							
C11-C22 Aromatics1,2	ND	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	ND	15.0	mg/kg wet							
Chrysene	ND	0.40	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.20	mg/kg wet							
Fluoranthene	ND	0.40	mg/kg wet							
Fluorene	ND	0.40	mg/kg wet							
Indeno(1,2,3-cd)Pyrene	ND	0.40	mg/kg wet							
Naphthalene	ND	0.40	mg/kg wet							
Phenanthrene	ND	0.40	mg/kg wet							

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA90804 - 3546										
Pyrene	ND	0.40	mg/kg wet							
Surrogate: 2-Bromonaphthalene	*32.5*		mg/L	*50.00*		*65*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*43.8*		mg/L	*50.00*		*88*	*40-140*			
Surrogate: O-Terphenyl	*1.45*		mg/kg wet	*2.000*		*72*	*40-140*			
LCS										
C19-C36 Aliphatics1	16.5	15.0	mg/kg wet	16.00		103	40-140			
C9-C18 Aliphatics1	10.8	15.0	mg/kg wet	12.00		90	40-140			
Decane (C10)	1.2	0.5	mg/kg wet	2.000		58	40-140			
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Dodecane (C12)	1.3	0.5	mg/kg wet	2.000		67	40-140			
Eicosane (C20)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Hexacosane (C26)	1.6	0.5	mg/kg wet	2.000		78	40-140			
Hexadecane (C16)	1.6	0.5	mg/kg wet	2.000		81	40-140			
Hexatriacontane (C36)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Nonadecane (C19)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Nonane (C9)	0.9	0.5	mg/kg wet	2.000		45	30-140			
Octacosane (C28)	1.5	0.5	mg/kg wet	2.000		76	40-140			
Octadecane (C18)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Tetradecane (C14)	1.5	0.5	mg/kg wet	2.000		75	40-140			
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		75	40-140			
Surrogate: 1-Chlorooctadecane	*1.60*		mg/kg wet	*2.000*		*80*	*40-140*			
LCS										
2-Methylnaphthalene	1.68	0.20	mg/kg wet	2.000		84	40-140			
Acenaphthene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Acenaphthylene	1.67	0.20	mg/kg wet	2.000		83	40-140			
Anthracene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Benzo(a)anthracene	1.64	0.40	mg/kg wet	2.000		82	40-140			
Benzo(a)pyrene	1.61	0.40	mg/kg wet	2.000		80	40-140			
Benzo(b)fluoranthene	1.63	0.40	mg/kg wet	2.000		81	40-140			
Benzo(g,h,i)perylene	1.58	0.40	mg/kg wet	2.000		79	40-140			
Benzo(k)fluoranthene	1.72	0.40	mg/kg wet	2.000		86	40-140			
C11-C22 Aromatics1,2	7.67	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	35.4	15.0	mg/kg wet	34.00		104	40-140			
Chrysene	1.68	0.40	mg/kg wet	2.000		84	40-140			
Dibenzo(a,h)Anthracene	1.70	0.20	mg/kg wet	2.000		85	40-140			
Fluoranthene	1.55	0.40	mg/kg wet	2.000		77	40-140			
Fluorene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Indeno(1,2,3-cd)Pyrene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Naphthalene	1.61	0.40	mg/kg wet	2.000		80	40-140			
Phenanthrene	1.58	0.40	mg/kg wet	2.000		79	40-140			
Pyrene	1.60	0.40	mg/kg wet	2.000		80	40-140			
Surrogate: 2-Bromonaphthalene	*31.6*		mg/L	*50.00*		*63*	*40-140*			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA90804 - 3546										
Surrogate: 2-Fluorobiphenyl	*43.1*		mg/L	*50.00*		*86*	*40-140*			
Surrogate: O-Terphenyl	*1.60*		mg/kg wet	*2.000*		*80*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	16.1	15.0	mg/kg wet	16.00		101	40-140	2	25	
C9-C18 Aliphatics1	9.9	15.0	mg/kg wet	12.00		82	40-140	9	25	
Decane (C10)	1.0	0.5	mg/kg wet	2.000		49	40-140	17	25	
Docosane (C22)	1.5	0.5	mg/kg wet	2.000		76	40-140	5	25	
Dodecane (C12)	1.1	0.5	mg/kg wet	2.000		57	40-140	16	25	
Eicosane (C20)	1.5	0.5	mg/kg wet	2.000		75	40-140	6	25	
Hexacosane (C26)	1.5	0.5	mg/kg wet	2.000		73	40-140	7	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		73	40-140	11	25	
Hexatriacontane (C36)	1.5	0.5	mg/kg wet	2.000		75	40-140	6	25	
Nonadecane (C19)	1.5	0.5	mg/kg wet	2.000		75	40-140	6	25	
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		37	30-140	20	25	
Octacosane (C28)	1.4	0.5	mg/kg wet	2.000		72	40-140	6	25	
Octadecane (C18)	1.5	0.5	mg/kg wet	2.000		74	40-140	7	25	
Tetracosane (C24)	1.5	0.5	mg/kg wet	2.000		74	40-140	8	25	
Tetradecane (C14)	1.3	0.5	mg/kg wet	2.000		65	40-140	14	25	
Triacontane (C30)	1.4	0.5	mg/kg wet	2.000		72	40-140	5	25	
Surrogate: 1-Chlorooctadecane	*1.48*		mg/kg wet	*2.000*		*74*	*40-140*			
LCS Dup										
2-Methylnaphthalene	1.43	0.20	mg/kg wet	2.000		72	40-140	16	30	
Acenaphthene	1.46	0.40	mg/kg wet	2.000		73	40-140	11	30	
Acenaphthylene	1.47	0.20	mg/kg wet	2.000		74	40-140	13	30	
Anthracene	1.50	0.40	mg/kg wet	2.000		75	40-140	9	30	
Benzo(a)anthracene	1.51	0.40	mg/kg wet	2.000		75	40-140	8	30	
Benzo(a)pyrene	1.50	0.40	mg/kg wet	2.000		75	40-140	7	30	
Benzo(b)fluoranthene	1.50	0.40	mg/kg wet	2.000		75	40-140	8	30	
Benzo(g,h,i)perylene	1.50	0.40	mg/kg wet	2.000		75	40-140	5	30	
Benzo(k)fluoranthene	1.58	0.40	mg/kg wet	2.000		79	40-140	8	30	
C11-C22 Aromatics1,2	9.63	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	35.0	15.0	mg/kg wet	34.00		103	40-140	1	25	
Chrysene	1.54	0.40	mg/kg wet	2.000		77	40-140	8	30	
Dibenzo(a,h)Anthracene	1.57	0.20	mg/kg wet	2.000		79	40-140	8	30	
Fluoranthene	1.48	0.40	mg/kg wet	2.000		74	40-140	5	30	
Fluorene	1.46	0.40	mg/kg wet	2.000		73	40-140	11	30	
Indeno(1,2,3-cd)Pyrene	1.52	0.40	mg/kg wet	2.000		76	40-140	7	30	
Naphthalene	1.43	0.40	mg/kg wet	2.000		71	40-140	12	30	
Phenanthrene	1.45	0.40	mg/kg wet	2.000		73	40-140	8	30	
Pyrene	1.50	0.40	mg/kg wet	2.000		75	40-140	7	30	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA90804 - 3546										
Surrogate: 2-Bromonaphthalene	*36.0*		mg/L	*50.00*		*72*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*43.8*		mg/L	*50.00*		*88*	*40-140*			
Surrogate: O-Terphenyl	*1.49*		mg/kg wet	*2.000*		*74*	*40-140*			
LCS Dup										
2-Methylnaphthalene Breakthrough	0.0		%				0-5		200	
Naphthalene Breakthrough	0.0		%				0-5		200	

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway ESS Laboratory Work Order: 1901077

Notes and Definitions

SM	Surrogate recovery(ies) outside of criteria due to matrix (UCM/coelution/matrix is present) (SM).
>	Greater than.
B-	Blank Spike recovery is below lower control limit (B-).
CD-	Continuing Calibration %Diff/Drift is below control limit (CD-).
CD+	Continuing Calibration %Diff/Drift is above control limit (CD+).
D	Diluted.
D+	Relative percent difference for duplicate is outside of criteria (D+).
I	Internal Standard(s) outside of criteria (I).
LC	Lower value is used due to matrix interferences (LC).
P	Percent difference between primary and confirmation results exceeds 40% (P).
#	Modified result
S+	Surrogate recovery(ies) above upper control limit (S+).
Z18	Temperature is not within 23 +/-2 ºC.
U	Analyte included in the analysis, but not detected
WL	Results obtained from a deionized water leach of the sample.
XH	Peaks found in the retention time window for MCPP did not confirm by GC/MS.
Z-08	See Attached
Z-09	ND
Z-10	Soil pH measured in water at 19 ºC.
Z-10a	Soil pH measured in water at 19.2 ºC.
Z-10b	Soil pH measured in water at 19.5 ºC.
Z-10c	Soil pH measured in water at 19.6 ºC.
Q	Calibration required quadratic regression (Q).
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Peabody Bikeway

ESS Laboratory Work Order: 1901077

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

to CTS

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 901077

Turn Time: ✓ Standard Rush ____ Approved By: ____

Reporting Limits -

State where samples were collected: (MA) RI CT NH NJ NY ME Other ____

Is this project for any of the following: (please circle)
MA-MCP CT-RCP NJ-DKQP RGP DOD Other ____

Electonic Deliverable: Yes ✓ No ____
Format: Excel ✓ Access ____ PDF ____ Other ____

GZA Project Manager: MICHAEL SMITH
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062
(781) 278-3700
PRESUMPTIVE CERTAINTY REQUIRED

Project No.: 174019.00
Project Name: PEABODY BIKEWAY
Contract Pricing ____
Special Pricing WO#: ____

ESS Lab Sample ID	Date	Collection Time	Grab-G Composite-C	Matrix	Sample Identification	# of Containers	Analysis: SVOC (Include Library Search)	TPH, RCRA-8 Metals, Hg, PCB, PAH, EPH	Pesticides (Include Toxaphene)	Herb., Corrosivity, pH, Flashpoint	Reactivity (CN, SO3)	VOC High (8260)	VOC Low (8260)	% Solids, Waste	TCLP + 20x rule if triggered	Comment #
1	1/4/19	0800hr	C	S	BRIDGE-LEFTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	2
2	1/4/19	0845hr	C	S	BRIDGE-RIGHTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	
3	1/4/19	0930hr	C	S	BORING BS-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	
4	1/4/19	1000hr	C	S	BORING B6-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-____
Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA
Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____ No
Seals Intact ____ Yes ____ No NA: ✓
Cooler Temperature: 1.1 ICE RC

Sampled by: GLENN LAROSE, ZACH MORRIS
Comments: 1) EMAIL RESULTS TO Michael.Smith@GZA.COM; ~~Zach.Morris@GZA.com~~ Zachary.Morris@GZA.com
2) CONTACT PM PRIOR TO RUNNING TCLP IF TRIGGERED

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	1/4/19 1200	1/4/19 1315	1/4/19 1615		1.7.19
	1/4/19 1200	1/4/19 1600			

Please E-mail all changes to Chain of Custody in writing.

Page 1 of 1

Proposal No. 609211-132091
A00829 - 220

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1901077
Date Received: 1/4/2019
Project Due Date: 1/11/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** (Yes) / No / NA
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? (Yes) / No
    ESS Sample IDs: **1--4**
    Analysis: **Grain size**
    TAT: **5 day**
12. Were VOAs received? (Yes) / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? (Yes) / No / NA
13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: 1/4/19 Time: 1730 By: [signature]
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608.3 Pesticides)
01	307769	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
01	307770	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
01	307774	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	307782	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
01	307789	Yes	NA	Yes	VOA Vial - Other	Other	
01	307790	Yes	NA	Yes	VOA Vial - Other	Other	
01	307898	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
02	307767	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
02	307768	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
02	307773	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	307781	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
02	307787	Yes	NA	Yes	VOA Vial - Other	Other	
02	307788	Yes	NA	Yes	VOA Vial - Other	Other	
02	307897	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	307765	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	307766	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	307772	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	307780	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
03	307785	Yes	NA	Yes	VOA Vial - Other	Other	
03	307786	Yes	NA	Yes	VOA Vial - Other	Other	
03	307896	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
04	307763	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
04	307764	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
04	307771	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/MM

ESS Project ID: 1901077
Date Received: 1/4/2019

04	307779	Yes	NA	Yes	VOA Vial - Methanol	MeOH
04	307783	Yes	NA	Yes	VOA Vial - Other	Other
04	307784	Yes	NA	Yes	VOA Vial - Other	Other
04	307895	Yes	NA	Yes	8 oz. Jar - Unpres	NP

2nd Review

All containers scanned into storage/lab Initials: IN

Are barcode labels on correct containers? (Yes) No

Are all necessary stickers attached? (Yes) No

Completed By: _____ Date & Time: 1/4/19 1652

Reviewed By: _____ Date & Time: 1/4/19 1730

Delivered By: _____ 1/4/19 1730

Changes made per client 1/7/19 - PRB

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 901077

Turn Time ✓ Standard Rush_____ Approved By: _____

Reporting Limits -

State where samples were collected: (MA) RI CT NH NJ NY ME Other_____

Is this project for any of the following: (please circle)
MA-MCP CT-RCP NJ-DKQP RGP DOD Other___

Electonic Deliverable Yes ✓ No___
Format: Excel ✓ Access___ PDF___ Other___

GZA Project Manager: MICHAEL SMITH
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062
(781) 278-3700
PRESUMPTIVE CERTAINTY REQUIRED

Project No.: 174019.00
Project Name: PEABODY BIKEWAY
Contract Pricing ____
Special Pricing WO#: _____

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	Analysis: SVOC (Include PYRADINE)	TPH, RCRA-8 METALS Hg, PCB, PAH, EPH	PESTICIDES (Include TOXAPHENE)	HERB, CORROSIVITY PH, FLASHPOINT	REACTIVITY (CN, SO3)	VOC HIGH (8260)	VOC LOW (8260)	% SOLIDS % WAS	TCLP IF >20X MCL IF TRIGGERED	SIEVE ANALYSIS (GRAIN SIZE, TOPSOIL)	Comment #
1	1/4/19	0800hr	C	S	BRIDGE-LEFTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	2
2	1/4/19	0845hr	C	S	BRIDGE-RIGHTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	
3	1/4/19	0930hr	C	S	BORING B5-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	
4	1/4/19	1000hr	C	S	BORING B6-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____No
Seals Intact ____ Yes ____No NA: ✓
Cooler Temperature: 1.1 ICE RC

Sampled by: GLENN LAROSE, ZACH MORRIS
Comments: 1) EMAIL RESULTS TO Michael.Smith@GZA.com; ~~Zach.Morris~~ Zachary.Morris@GZA.com
2) CONTACT PM PRIOR TO RUNNING TCLP IF TRIGGERED

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	1/4/19 1200	1/4/19 1315		1/4/19 1615	
	1/4/19 1200	1/4/19 1607			

Please E-mail all changes to Chain of Custody in writing.

Proposal No. 609211-132091

A00829 - 223

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 901077

Turn Time ✓ Standard Rush_____ Approved By: _____

Reporting Limits -

State where samples were collected: (MA) RI CT NH NJ NY ME Other_____

Is this project for any of the following: (please circle)
MA-MCP CT-RCP NJ-DKQP RGP DOD Other___

Electonic Deliverable Yes ✓ No___
Format: Excel ✓ Access___ PDF___ Other___

GZA Project Manager: MICHAEL SMITH
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062
(781) 278-3700
PRESUMPTIVE CERTAINTY REQUIRED

Project No.: 174019.00
Project Name: PEABODY BIKEWAY
Contract Pricing ____
Special Pricing WO#: _____

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	Analysis: SVOC (Include PYRADINE)	TPH, RCRA-8 METALS Hg, PCB, PAH, EPH	PESTICIDES (Include TOXAPHENE)	HERB, CORROSIVITY PH, FLASHPOINT	REACTIVITY (CN, SO3)	VOC HIGH (8260)	VOC LOW (8260)	% SOLIDS % WAS	TCLP IF >20X PAL IF TRIGGERED	SIEVE AND SHRINK GRAIN SIZE, TOTAL ORGANIC CARBON	Comment #
1	1/4/19	0800hr	C	S	BRIDGE-LEFTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	2
2	1/4/19	0845hr	C	S	BRIDGE-RIGHTBANK 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	
3	1/4/19	0930hr	C	S	BORING B5-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	
4	1/4/19	1000hr	C	S	BORING B6-CULVERT 0-2'	4-AG 3-VOA	X	X	X	X	X	X	X	X	X	X	

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____No
Seals Intact ____ Yes ____No NA: ✓
Cooler Temperature: 1.1 ICE RC

Sampled by: GLENN LAROSE, ZACH MORRIS

Comments: 1) EMAIL RESULTS TO Michael.Smith@GZA.com; ~~Zach.Morris~~ Zachary.Morris@GZA.com
2) CONTACT PM PRIOR TO RUNNING TCLP IF TRIGGERED

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	1/4/19 1200	1/4/19 1315		1/4/19 1615	
	1/4/19 1200	1/4/19 1617			

Please E-mail all changes to Chain of Custody in writing.

Proposal No. 609211-132091

A00829 - 224

APPENDIX G – STORMWATER MANAGEMENT REPORT (BOUND SEPARATELY)

Stormwater Management Report

Independence Greenway Extension

Peabody, MA

Prepared for

10 Park Plaza
Boston, MA 02116

Prepared by Green International Affiliates, Inc.
Water Resources/Permitting Group
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876
(978) 923-0400

Date: March 12, 2024

Table of Contents

Introduction 1
Project Summary 2
Project Description 2
Existing Conditions 7
Proposed Conditions 15
Impaired Waters and TMDLs 21
Stormwater Management Standards 22
Standard 1: No New Untreated Discharges 22
Standard 2: Peak Rate/Flood Control 23
Standard 3: Recharge 25
Standard 4: Water Quality Treatment 27
Standard 5: Land Uses with Higher Potential Pollutant Loads 30
Standard 6: Critical Areas 31
Standard 7: Redevelopment 32
Standard 8: Erosion and Sediment Control 33
Stabilization Activities 34
Standard 9: O&M Plan 35
Standard 10: Illicit Discharges 36

List of Tables

Table 1: Existing Drainage Areas 9
Table 2: Existing SCMs 9
Table 3: Wetland Resource Areas 9
Table 4: Proposed Drainage Areas 18
Table 5: Proposed SCMs 18
Table 6: Impaired Waters and TMDL Information 21
Table 8: Peak Discharge Rates (cfs) 24
Table 9: Required Recharge Volume for Project 26
Table 10: Provided Recharge Volumes by Design Point 26
Table 11: Water Quality Treatment Required and Provided by Design Point 28

List of Figures

Figure 1: USGS Locus Figure 3
Figure 2: Aerial Figure 5
Figure 3: Protected Resource Area Map (Not Included in Stormwater Report)
Figure 4: FEMA Map (Not Included in Stormwater Report)
Figure 5: Soils Figure 11
Figure 6: Existsing Watershed Plans 13
Figure 7: Proposed Watershed Plans 21

List of Appendices

Appendix A: MassDEP Checklist for Stormwater Report
- Massachusetts Stormwater Report Checklist
- Redevelopment Checklist

Appendix B: Soils and FEMA Information
- NRCS Soil Survey Information
- On-Site Subsurface Investigations by GZA
- FEMA Flood Insurance Rate Map (FIRM)
- Flood Insurance Study (FIS)

Appendix C: Supporting Calculations
- Recharge Volume Calculations
- Water Quality Calculations
- TSS Removal Calculations
- Pretreatment Calculations
- HydroCAD Storage Table

Appendix D: Hydraulic and Hydrologic Data
- Existing Conditions HydroCAD Calculations
- Proposed Conditions HydroCAD Calculations
- Proctor Brook StreamStats
- Proctor Brook Culvert Hydraulic and Scour Analysis Summary Report

Appendix E: O&M Plan, LTPPP, and IDCS

Introduction

This Stormwater Management Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00). Appendix A includes a completed Massachusetts Department of Environmental Protection (MassDEP) Checklist for Stormwater Report, stamped by a professional engineer.

The project follows the guidance presented in the MassDOT Stormwater Handbook (the Handbook), and stormwater management systems are designed in accordance with MassDEP Standards.

Project Summary

Project Description

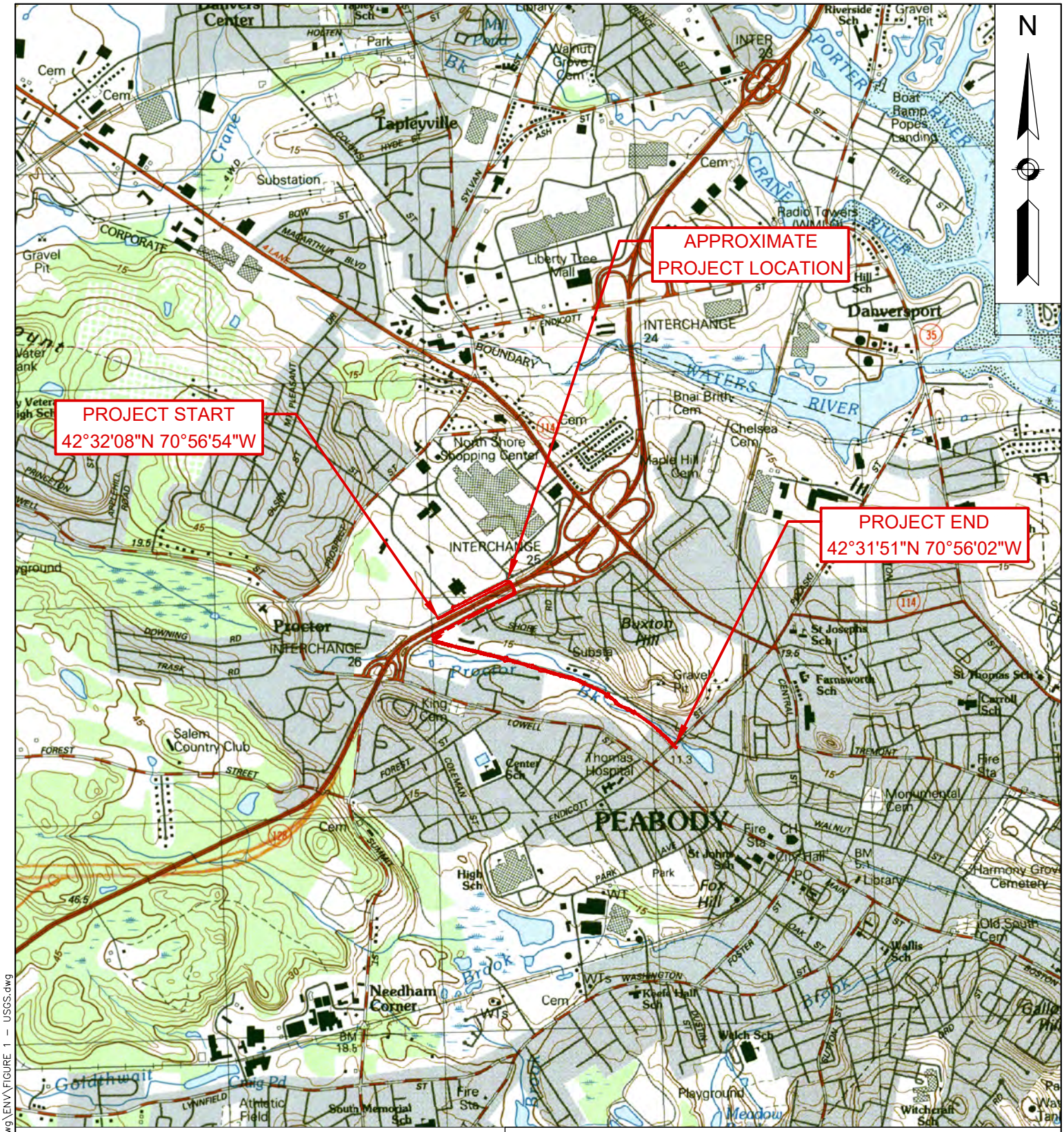
The Applicant, MassDOT, is proposing Project 609211 to construct the Independence Greenway extension in Peabody, MA. The project consists of an approximately 1.3-mile extension of the Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street. The Independence Greenway currently consists of two discontinuous segments separated by Interstate 95 and Route 1. The west section of the existing Independence Greenway runs 2.9 miles between Russell Street near the Ipswich River and Lt. Ross Park. It opened in 2008. The east section is 1.7 miles long and runs from Peabody Road at Proctor Brook and ends at the Northshore Mall near Lahey Medical Center. The trail was built on the route of the former Boston and Maine (B&M) Railroad right-of-way (ROW) north of Lowell Street. The existing Greenway is owned and maintained by the City of Peabody.

This project transforms the former railroad bed into a shared use pedestrian pathway. As the proposed project is a pathway for pedestrian and/or nonmotorized vehicle access, it is therefore categorized as a “Redevelopment Project” under the Massachusetts Stormwater Management Standards. The project is required to meet only Standards 2 & 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 & 6 to the maximum extent practicable.

This project provides an opportunity to improve the existing drainage system and improve the quality of stormwater runoff discharged to adjacent wetlands. This project will incorporate the installation of practical Stormwater Control Measures (SCMs). The goal of the proposed stormwater improvements is to improve the quality of discharged stormwater to the maximum extent that it is practical.

The following report was created in accordance with the “Massachusetts Stormwater Handbook” last revised in January 2008. The report is organized into sections that correspond to the categories listed in the “Massachusetts Stormwater Report Checklist”. The checklist is included in Appendix A of this report along with a “Redevelopment Checklist”. The following is a more detailed description of the existing and proposed drainage areas and the design methodology for this project.

See Figure 1 for the Project Locus Map and Figure 2 for the Aerial Map.



LEGEND:

APPROXIMATE LIMIT OF WORK

SCALE IN FEET

1000 0 1000 2000

ELEVATIONS IN METERS

NOTE: DATA TAKEN FROM MASSGIS

USGS LOCUS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

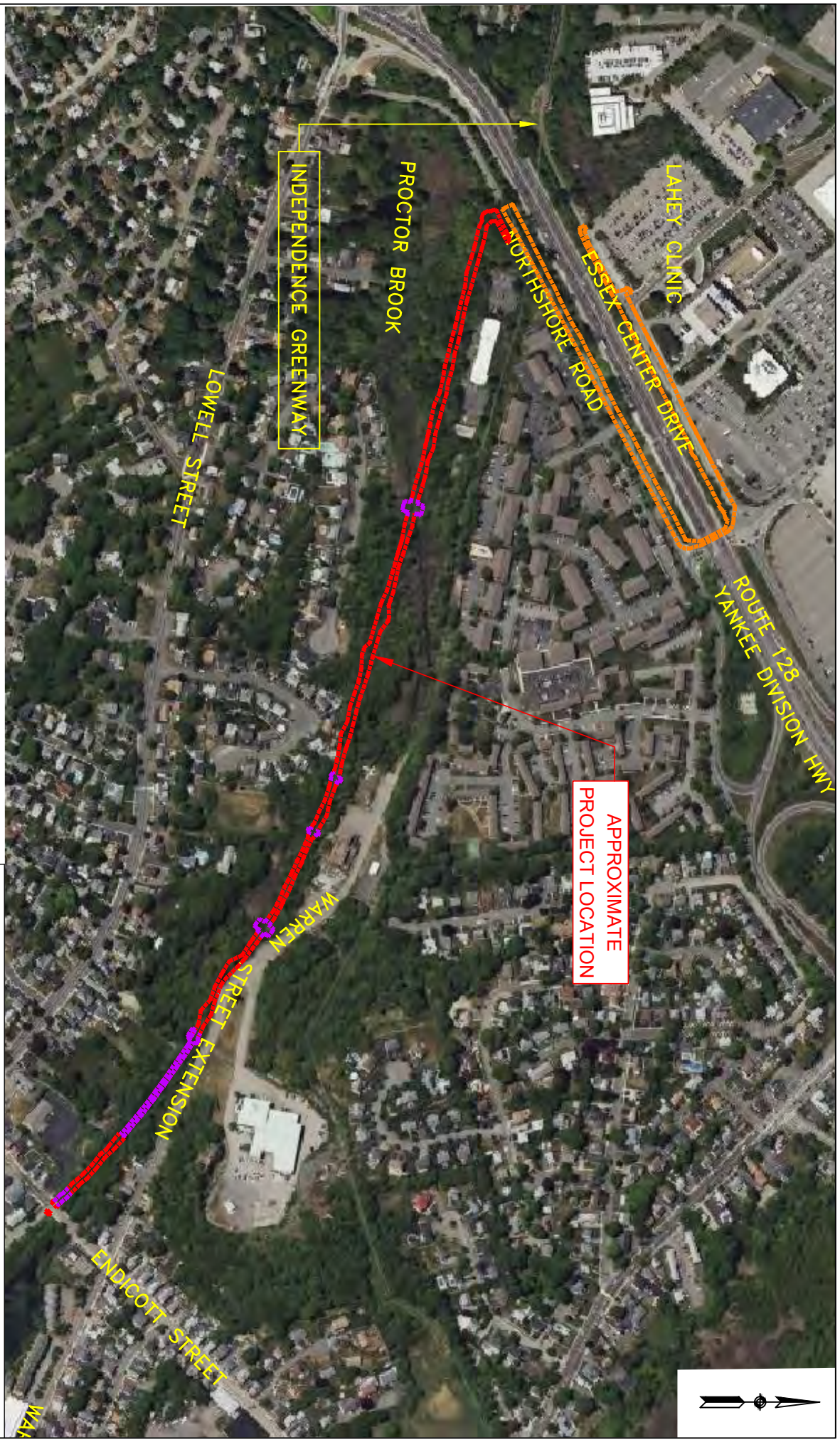
SCALE: AS NOTED	PROJECT NO. 17118
DATE: 1/31/2023	DRAWN BY: JK
REVISED:	CHECKED BY: OF

FIGURE 1

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 1 – USGS.dwg

This Page is left Blank for Double Sided Printing

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 2 – AERIAL.dwg



LEGEND:

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

AERIAL MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION

PEABODY, MA

MASSDOT PROJECT #609211

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:

CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED

DATE: 12/13/2023

REVISED:

PROJECT NO. 17118

DRAWN BY: JK/VR

CHECKED BY: OF

FIGURE 2

This Page is left Blank for Double Sided Printing

Existing Conditions

The existing site can be analyzed as ten (10) watershed areas that contribute runoff to ten (10) discharge points. The existing drainage areas are delineated in Figure 6 - Existing Watershed Plan. For the purpose of this hydrologic analysis, the following assumptions were made:
When the watershed boundary fell outside of the limit of work an arbitrary line was delineated as the watershed boundary.

The total watershed area for the existing conditions is used as the comparison base for the watershed area in the proposed conditions.

There are protected wetland resource areas that exist surrounding Proctor Brook which runs adjacent to North Shore Road. The Riverfront Area associated with Proctor Brook, Buffer Zones, as well as 100-year floodplain extend into the project limits along the Independence Greenway Extension. The upstream and downstream side of Proctor brook are hydraulically connected by existing culverts which cross North Shore Road and Endicott Street. Wetland “A” is also in close proximity to the project limits north of Essex Center Drive.

Some areas of the existing drainage system on the roadways within the project limits and the entirety of the Independence Greenway Extension includes “country drainage” (i.e. no curb), where the runoff sheet flows into the pervious shoulder, roadside ditches, wetlands, or private front yards. These watershed areas include EDA-1, -3, and -6 through -10.

There are separate closed drainage systems spread throughout the project, servicing existing watershed areas via catch basin curb inlets and at low points. Where stormwater does not sheet flow off the roadway via country drainage, it travels via curb along the roadway into these closed drainage systems.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. These locations were analyzed as Discharge Points during the hydrologic analysis, as indicated on the attached Existing Watershed Plan. Brief descriptions of each contributing area are below.

DRAINAGE AREA EDA-1
This area consists mostly of a pervious median adjacent to Essex Center Drive and the start of the Independence Greenway. This area also includes approximately 400’ of the impervious path. Stormwater runoff travels via overland flow into a ditch on the south side of Essex Center Drive and discharges to the north through a culvert beyond the project limits to Wetland “A” at DP-1.

DRAINAGE AREA EDA-2
This area consists mostly of impervious roadway and sidewalk along Essex Center Drive, as well as portions of several parking lots and driveways abutting the roadway to the north. This area also includes one half of the bridge that connects Essex Center Drive with North Shore Road at the eastern project limit. Portions of grass medians and a gravel shoulder are also included in this area. Stormwater runoff travels via gutter flow along the curb into a closed drainage system. The closed drainage system discharges beyond the project limits to the north through a culvert to Wetland “A” at DP-2.

DRAINAGE AREA EDA-3
This area consists of the impervious westbound lane of North Shore Road, as well as one half of the bridge that connects North Shore Road with Essex Center Drive (STA. 303+20 to 306+57). This area also includes pervious grass area within the median on the bridge and the area between North Shore Road and Route 128 to the north. Stormwater runoff from the roadway travels via country drainage and discharges into a ditch on the south side of the roadway at DP-3. Stormwater runoff from the grass area adjacent to the roadway travels via overland flow into a culvert, which discharges to the ditch at DP-3.

DRAINAGE AREA EDA-4
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 306+57 to 314+97). Stormwater runoff from the road travels via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-4.

DRAINAGE AREA EDA-5
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 314+97 to the project limit approximately 500 feet west). Stormwater runoff from the road travels via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-5.

DRAINAGE AREA EDA-6
This area consists entirely of woods starting perpendicular to the eastbound lane of North Shore Road that extends southwest (STA. 318+45 to 329+88). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north through a culvert at DP-6.

DRAINAGE AREA EDA-7
This area consists entirely of woods that extends southwest (STA. 329+88 to 340+31). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-7.

DRAINAGE AREA EDA-8
This area consists entirely of woods that extends southwest (STA. 340+31 to 346+35). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-8.

DRAINAGE AREA EDA-9
This area consists mostly of woods and a portion of Proctor Brook that extends southwest (STA. 346+35 to 351+77). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs

parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north at DP-9.

DRAINAGE AREA EDA-10
This area consists of woods and a portion of Proctor Brook that extends southwest (STA. 351+77 to 359+02). This section of woods is approximately 15 to 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges southwest through a culvert that crosses under Endicott Street at DP-10.

Table 1 presents the existing drainage areas and their characteristics. Figure shows existing drainage patterns and delineations by design point.

Table 1: Existing Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
EDA-1	*DP-1*	*2.14*	*50*
EDA-2	*DP-2*	*2.60*	*84*
EDA-3	*DP-3*	*0.54*	*70*
EDA-4	*DP-4*	*1.46*	*55*
EDA-5	*DP-5*	*0.76*	*54*
EDA-6	*DP-6*	*0.88*	*49*
EDA-7	*DP-7*	*0.78*	*47*
EDA-8	*DP-8*	*0.30*	*37*
EDA-9	*DP-9*	*0.34*	*70*
EDA-10	*DP-10*	*0.29*	*88*

Table 2 lists the existing Stormwater Control Measures (SCMs) and provides a description of each.

Table 2: Existing SCMs

SCM	*Description*
N/A	*N/A*

Proctor Brook and its adjacent Bordering Vegetated Wetland is located within the Project area and listed in Table 3.

Table 3: Wetland Resource Areas

Wetland Resource Area	*Wetland Type*	*Description*
Proctor Brook	*Brook*	*Headwaters, outlet small pond in wetland north of Downing Road, Peabody to Grove/Goodhue Street bridge, Salem (formerly part of MA93-06) (interrupted urban).*
Wetland "A"	*Wetland*	*North of Essex Center Drive.*

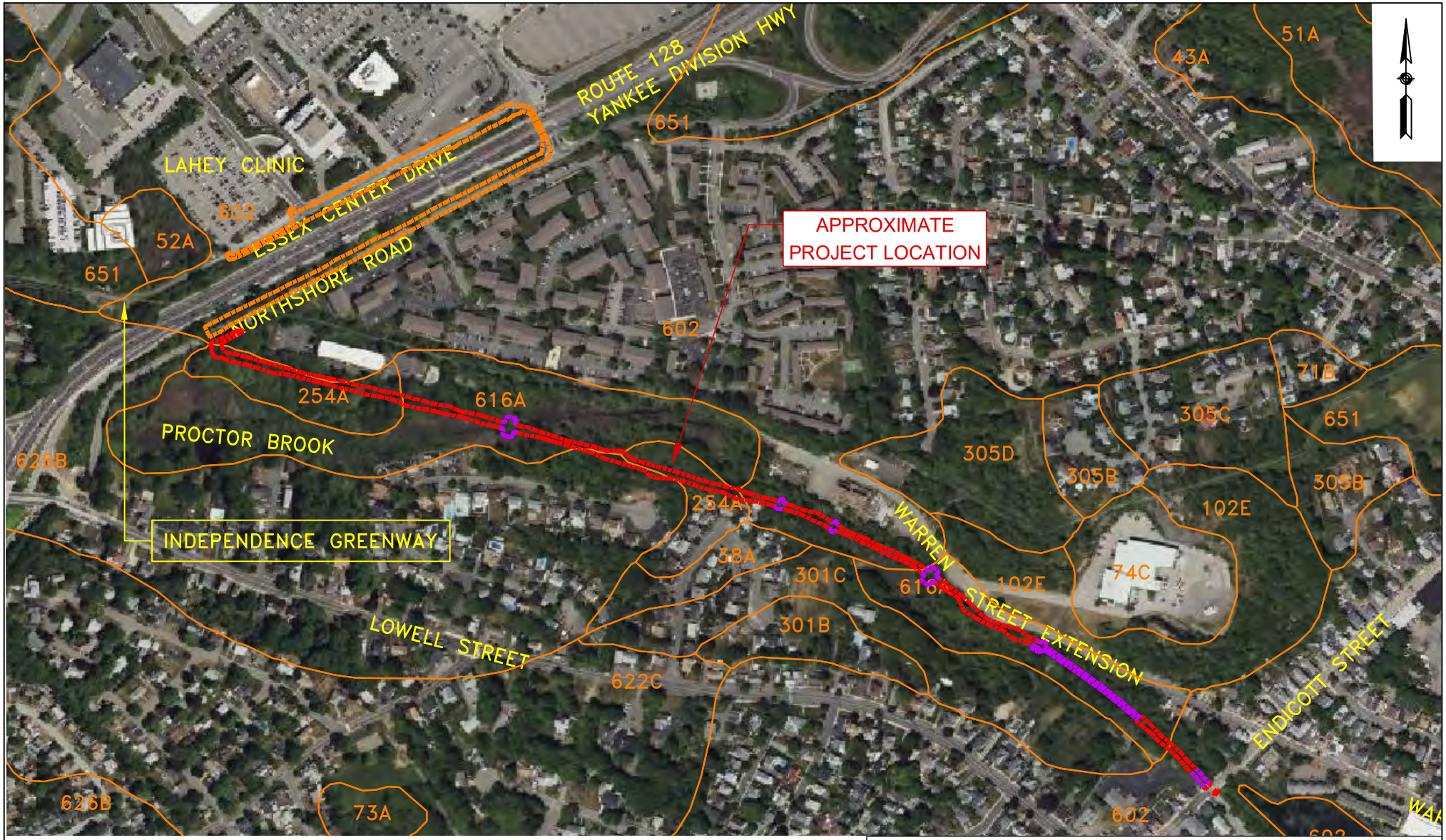
The Project is located within the 100-year floodplain as shown on the FIRM community panel 25009C0412F, dated 07/03/2012 included in Appendix B.

Review of the NRCS Soil Survey map of the Project area identified the following soils within the project limits:

- 38A - “Pipestone loamy fine sand, 0 to 3 percent slopes” (HSG A/D)
- 43A - “Scarboro mucky fine sandy loam, 0 to 3” (HSG A/D)
- 51A - “Swansea muck, 0 to 1 percent slopes” (HSG B/D)
- 52A - “Freetown muck, 0 to 1 percent slopes” (HSG B/D)
- 71B - “Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony” (HSG D)
- 73A - “Whitman fine sandy loam 0 to 3 percent slopes, extremely stony” (HSG D)
- 102E - “Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes” (HSG D)
- 254A - “Merrimac fine sandy loam, 0 to 3 percent slopes” (HSG A)
- 301B - “Montauk fine sandy loam, 0 to 8 percent slopes, very stony” (HSG C)
- 301C - “Montauk fine sandy loam, 8 to 15 percent slopes, very stony” (HSG C)
- 305B - “Paxton fine sandy loam, 3 to 8 percent slopes” (HSG C)
- 305C - “Paxton fine sandy loam 8 to 15 percent slopes” (HSG C)
- 305D - “Paxton fine sandy loam, 15 to 25 percent slopes” (HSG C)
- 311B - “Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony” (HSG C/D)
- 616A - “Fluvaquents, frequently flooded, 0 to 3 percent slopes” (HSG B/D)
- 622C - “Paxton-Urban land complex, 3 to 15 percent slopes” (HSG C)
- 626B - “Merrimac-Urban land complex, 0 to 8 percent slopes” (HSG A)
- 628C – “Canton-Urban land complex, sloping” (No Designation)
- 651 – “Udorthents, smoothed” (No Designation)
- 724C – “Hollis-Urban land-Rock outcrop complex, sloping” (No Designation)

On-site subsurface investigations were performed within the Project area by GZA in 2019. Appendix B provides detailed soils information, including the NRCS soil survey data for the Project area and results of on-site subsurface investigations.

See Figure 5 for the Soils Figure and Figure 6 for the Existing Watershed Plans.



LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- NRCS SOIL SURVEY BOUNDARY
- 73A NRCS SOIL TYPE

NOTE: DATA TAKEN FROM MASSGIS AND THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE (NRCS).

SCALE IN FEET

250 0 250 500

1" = 500'

SOILS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 12/13/2023
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 5

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 5 – SOILS MAP.dwg

A00829 - 240

This Page is left Blank for Double Sided Printing

Proposal No. 609211-132091

A00829 - 242

EDA-2
DP-3
EDA-3
EDA-1
DP-2
DP-1
EDA-4
EDA-5
DP-7
DP-8
DP-6
EDA-7
EDA-8
DP-9
DP-10
1R
DP-5
EDA-6
EDA-9
EDA-10

LEGEND

LIMIT OF WORK

WETLANDS

NRCS SOIL SURVEY BOUNDARY

EXISTING WATERSHED BOUNDARY

EXISTING WATERSHED NUMBER EDA-X

DESIGN POINT DP-X

0' 150' 300' 600'

1" = 300 FEET

DATE	REVISIONS

PEABODY, MASSACHUSETTS

INDEPENDENCE GREENWAY EXTENSION
EXISTING WATERSHED PLAN

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 I F: (978) 399-0033 I WWW.GREENINTL.COM

SCALE 1" = 300'	DATE:	PROJECT NO. 17118
APPROVED:	DESIGNED BY: BV DRAWN BY: BV CHECKED BY: DS	FIGURE NO. 6

This Page is left Blank for Double Sided Printing

Proposed Conditions

The proposed stormwater management analysis can be summarized as ten (10) watershed areas that contribute runoff to ten (10) discharge points. The overall watershed area and discharge points of analysis are the same in the proposed condition as in the existing condition. The proposed drainage areas are delineated in Figure 7 - Proposed Watershed Plan.

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.3 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 56-span light duty timber boardwalk structure will be approximately 437’- 9” long with an out-to-out width of 13’-0” and will provide a clear width of 12’- 1” to accommodate two 5’- 0” wide travel lanes, one in each direction, and two 1’-0” shoulders on each side.

The proposed bituminous shared-use trail pavement will match the dimensions of the existing discontinued railroad structure. This will include 10’-0” wide hot mix asphalt pavement carrying two 5’-0” wide travel lanes, one in each direction, and two 2’-0” wide crushed stone shoulders on both sides. Bike traffic on the existing Independence Greenway has not been formally quantified, but users report that the facility is heavily utilized by bicyclists and pedestrians.

The proposed shared-use trail will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (Fourth Edition, 2012) and the MassDOT Separated Bike Lane Planning & Design Guide 2015. The proposed bridge will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges and the most recent supplemental Specifications, Standard Nomenclature and Engineering Directives.

New catch basins have been proposed to replace existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. A stormwater SCM (infiltration trench) will be installed to help with peak rate attenuation at PDA-4. This project also includes the replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed. All proposed

drainage systems will maintain the historic drainage patterns, distributing runoff to the existing discharge points.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. These locations are the same in both Existing & Proposed Conditions and were analyzed as Discharge Points during the hydrologic analysis, as indicated on the attached Proposed Watershed Plan. Brief descriptions of each contributing area are below.

DRAINAGE AREA PDA-1
This area consists mostly of a pervious median adjacent to Essex Center Drive and the start of the Independence Greenway. This area also includes approximately 400' of the impervious path. Stormwater runoff travels the same as existing conditions via overland flow into a ditch on the south side of Essex Center Drive and discharges to the north through a culvert beyond the project limits to Wetland "A" at DP-1.

DRAINAGE AREA PDA-2
This area consists mostly of impervious roadway and sidewalk along Essex Center Drive, as well as portions of several parking lots and driveways abutting the roadway to the north. This area also includes one half of the bridge that connects Essex Center Drive with North Shore Road at the eastern project limit. Portions of grass medians and a gravel shoulder are also included in this area. Stormwater runoff travels the same as existing conditions via gutter flow along the curb into a closed drainage system. The closed drainage system discharges beyond the project limits to the north through a culvert to Wetland "A" at DP-2.

DRAINAGE AREA PDA-3
This area consists of the impervious westbound lane of North Shore Road, as well one half of the bridge that connects North Shore Road with Essex Center Drive (STA. 303+20 to 306+57). This area also includes pervious grass area within the median on the bridge and the area between North Shore Road and Route 128 to the north. The Independence Greenway extension is also proposed through this PDA. Stormwater runoff from the roadway travels the same as existing conditions via country drainage and discharges into a ditch on the south side of the roadway at DP-3. Stormwater runoff from the grass area adjacent to the roadway travels via overland flow into a proposed catch basin, which discharges to the ditch at DP-3.

DRAINAGE AREA PDA-4
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 306+57 to 314+97). The Independence Greenway extension is also proposed through this PDA. Stormwater runoff from the road travels the same as existing conditions via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a proposed infiltration trench SCM that discharges to a catch basin connected to the existing culvert at DP-4.

DRAINAGE AREA PDA-5
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 314+97 to the project limit approximately 500 feet west). The Independence Greenway extension is also proposed through

this PDA. Stormwater runoff from the road travels the same as existing conditions via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-5.

DRAINAGE AREA PDA-6
This area consists of the Independence Greenway extension starting perpendicular to the eastbound lane of North Shore Road that extends southwest (STA. 318+45 to 329+88). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north through a culvert at DP-6.

DRAINAGE AREA PDA-7
This area consists of the Independence Greenway extension that extends southwest (STA. 329+88 to 340+31). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. This area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-7.

DRAINAGE AREA PDA-8
This area consists of the Independence Greenway extension that extends southwest (STA. 340+31 to 346+35). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-8.

DRAINAGE AREA PDA-9
This area consists of the Independence Greenway extension that extends southwest (STA. 346+35 to 351+77). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north at DP-9.

DRAINAGE AREA PDA-10
This area consists of the Independence Greenway extension that extends southwest (STA. 351+77 to 359+02). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, loam & seed grass area, and a boardwalk over Proctor Brook that is approximately 440 feet in length. The area is approximately 15 to 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges southwest through a culvert that crosses under Endicott Street at DP-10.

Table 4 presents the proposed drainage areas and their characteristics under proposed conditions. Figure 7 shows proposed drainage patterns and drainage area delineations by design point.

Table 4: Proposed Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
PDA-1	*DP-1*	*1.92*	*50*
PDA-2	*DP-2*	*2.81*	*83*
PDA-3	*DP-3*	*0.55*	*68*
PDA-4	*DP-4*	*1.46*	*51*
PDA-5	*DP-5*	*0.76*	*49*
PDA-6	*DP-6*	*0.88*	*74*
PDA-7	*DP-7*	*0.78*	*74*
PDA-8	*DP-8*	*0.29*	*78*
PDA-9	*DP-9*	*0.34*	*86*
PDA-10	*DP-10*	*0.29*	*88*

Table 5 lists the proposed SCMs and provides a description of each.

Table 5: Proposed SCMs

SCM	*Description*
Infiltration Trench	*Stormwater runoff from PDA-4 is directed to this infiltration trench, which discharges to the south into depressed farmland area at DP-4.*

See Figure 7 for the Proposed Watershed Plans.

Proposal No. 609211-132091

A00829 - 248

PDA-1
PDA-2
PDA-3
PDA-4
PDA-5
PDA-6
PDA-7
PDA-8
PDA-9
PDA-10
DP-1
DP-2
DP-3
DP-4
DP-5
DP-6
DP-7
DP-8
DP-9
DP-10
1R
INTERCHA
25
15
Buxton
Hill
Gravel
Pit
SHORE
RD
Substa
Bk
LOWELL
ST
thomas

LEGEND

LIMIT OF WORK

WETLANDS

NRCS SOIL SURVEY BOUNDARY

PROPOSED WATERSHED BOUNDARY

PROPOSED WATERSHED NUMBER — PDA-X

DESIGN POINT — DP-X

0' 150' 300' 600'

1" = 300 FEET

DATE	REVISIONS

PEABODY, MASSACHUSETTS

INDEPENDENCE GREENWAY EXTENSION
PROPOSED WATERSHED PLAN

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 I F: (978) 399-0033 I WWW.GREENINTL.COM

SCALE 1" = 300'	DATE:	PROJECT NO. 17118
APPROVED: _____	DESIGNED BY: BV DRAWN BY: BV CHECKED BY: DS	FIGURE NO. 7

This Page is left Blank for Double Sided Printing

Impaired Waters and TMDLs

As described under the Proposed Conditions section, the Project will discharge to Proctor Brook (Segment ID MA93-39). Proctor Brook is impaired based on the MassDEP Year 2016 Integrated List of Waters, also known as the 303(d) list. The WQDF assists in the identification of impaired waters and TMDL requirements and quantifies the pollutant reduction provided by the Project's SCMs.

Table 6 lists the receiving water bodies that are impaired, if the water body is covered by a TMDL, and the TMDL's Waste Load Allocation (WLA) for MassDOT property.

Table 6: Impaired Waters and TMDL Information

Water Body	*MassDEP Category*	*303(d) list Impairments*	*TMDL*	*TMDL Pollutant*	*TMDL Name*	*Waste Load Allocation for MassDOT (lbs/yr)*
Proctor Brook	*5*	*E.coli, Fecal Coliform*	*Yes*	*227*	*E. Coli and Trash/Debris*	*N/A*

The proposed infiltration trench has been designed to meet the required water quality volume and TSS removal rates; however, it does not discharge to Proctor Brook. E. Coli is not a stormwater caused pollutant; therefore, TMDL removal calculations were not performed. See Standard 4 for more detailed water quality calculations and discussions.

Stormwater Management Standards

As demonstrated below, the proposed Project complies with the MassDEP Stormwater Management Standards (the Standards). The Project is considered a redevelopment project and only meets standards 2, 3, and 4 to the maximum extent practicable.

Standard 1: No New Untreated Discharges

No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The Massachusetts Stormwater Handbook, Standard 1, requires that the project demonstrates that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands.

Existing runoff discharges to adjacent wetlands and properties via overland flow or by an existing outfall that can be approximated as ten (10) discharge points, as shown on Figure 6 - Existing Watershed Plan. The runoff is conveyed by a combination of overland flow (country drainage), piped networks to outfalls, and culverts that cross the roadway and track bed. The proposed design adds catch basins in some areas to collect runoff, designed based on MassDOT standards, to increase drainage efficiency. Under proposed conditions, runoff will be conveyed through a combination of overland flow, a closed drainage system, and one infiltration trench.

To improve upon existing conditions, stormwater runoff contributing to one of the existing discharge points (DP-4) will have a portion of the catchment area routed to a treatment SCM prior to discharge. The SCM that discharges to DP-4 is an infiltration trench. The proposed catch basins will have deep sumps and hoods to provide additional treatment. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge.

All new culverts are designed with rip rap protection to prevent erosion to Proctor Brook. Appendix C provides supporting calculations for the outlet protection design.

Stormwater runoff will be treated by deep sump catch basins with hoods at DP-2, -3, and -4, as well as an infiltration trench at DP-4 before discharging. See Standard 4 for the water quality treatment provided by the Project.

There are no new untreated point source discharges created as a result of this project. This standard is fully met.

Standard 2: Peak Rate/Flood Control

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Standard 2 requires that the rates of flow be attenuated for the proposed development condition. This project is a redevelopment project and is required to meet Standard 2 to the maximum extent practicable. The Independence Greenway Extension will result in a net increase in impervious area.

The peak flow rates were calculated for the 2-, 10-, 25- and 100-year storm events under proposed conditions and compared to the existing peak flow rates. The proposed Independence Greenway Extension and minor geometry improvements result in an overall increase of 44,910 square feet in impervious area within the project limits. The increase in impervious area correlates to a minor overall increase in peak flow rates for the 2-, 10-, 25-, and 100-year storms.

There is an increase in peak flow rates for DP-2, DP-6, DP-7, DP-8, and DP-9 for all storm events due to the proposed increase in impervious area. The increase in peak rates for DP-2, which is the start of the Independence Greenway extension, ranges from 0.17 to 1.38 cfs (cubic feet per second), is minor and considered negligible. The other increases (DP-6,-7,-8, and -9) all occur due to the replacement of track bed with a paved shared use path. The increase of peak rates for DP-6 ranges from 0.96 to 3.21 cfs. The increase of peak rates for DP-7 ranges from 0.84 to 3.07 cfs. The increase of peak rates for DP-8 ranges from 0.41 to 1.77 cfs. The increase of peak rates for DP-9 ranges from 0.42 to 0.63 cfs. These four discharge points correspond to the four cross culverts under the track bed. DP-6 is where two twin 42” culverts that are obstructed are located. DP-7 is where the existing 6.4’ x 4’ box culvert has been washed away. Both areas have resulted in degraded track bed and overtopping of Proctor Brook. The proposed improvements will not only restore what was previously installed but also will enlarge the culverts to allow additional flow through the culverts rather than over the shared use pathway. DP-8 and DP-9 represent existing failed smaller culverts that will be replaced in kind that convey intermittent streams.

When the drainage areas (DP-6, -7, -8, and -9) that discharge to Proctor Brook are combined and compared to the overall peak rates of the Proctor Brook watershed, the increases are negligible. The project drainage area that directly discharges to Proctor Brook is 1.08 acres, with a net increase discharge rate of 8.71 cfs for the 100-year storm event under proposed conditions. Because the project site is located on the lower end of the watershed, the stormwater runoff from the path will reach its peak, prior to Proctor Brook (the combination of DP-6, 7, 8, 9, and 10) reaching its peak at DP-10, resulting in no increase in flood elevations for any storm event. This is demonstrated by adding the net increase in peak rates for the 100-year storm event from the HydroCAD model for DP-6,-7,-8,-9, and -10 (8.71 cfs), to the effective FEMA FIS 100-year peak discharge of 420 cfs for Proctor Brook for a total of 428.71 cfs. The hydraulic model resulted in no increase to the base flood elevation; thereby, demonstrating that the minor increase in peak rates from the project will not result in downstream flooding. A copy of the hydraulic study is included in Appendix D.

Therefore, no adverse impacts are anticipated by the increase in peak rates as a result of the project. The results of this analysis are presented in Appendix D of this report.

Per MassDOT Requirements, a proposed stormwater SCM must hold peak volumes up to the 10-year storm event. The proposed infiltration trench stormwater SCM fully meets this requirement.

Table 7 provides a summary of peak rates for each design point under existing and proposed conditions. Appendix D provides computations and supporting information regarding the hydraulic and hydrologic modeling.

Table 7: Peak Discharge Rates (cfs)

	Existing				*Proposed*			
Design Point	*2-year*	*10-year*	*25-year*	*100-year*	*2-year*	*10-year*	*25-year*	*100-year*
DP-1	*0.04*	*0.88*	*2.44*	*6.63*	*0.04*	*0.79*	*2.19*	*5.96*
DP-2	*4.90*	*9.24*	*12.74*	*20.06*	*5.07*	*9.72*	*13.51*	*21.44*
DP-3	*0.44*	*1.15*	*1.80*	*3.25*	*0.38*	*1.07*	*1.71*	*3.16*
DP-4	*0.14*	*1.18*	*2.43*	*5.64*	*0.00*	*0.00*	*1.13*	*4.62*
DP-5	*0.06*	*0.55*	*1.18*	*2.81*	*0.01*	*0.26*	*0.78*	*2.22*
DP-6	*0.01*	*0.31*	*0.92*	*2.60*	*0.97*	*2.25*	*3.37*	*5.81*
DP-7	*0.01*	*0.18*	*0.65*	*2.04*	*0.85*	*1.98*	*2.96*	*5.11*
DP-8	*0.00*	*0.00*	*0.04*	*0.32*	*0.41*	*0.87*	*1.26*	*2.09*
DP-9	*0.28*	*0.73*	*1.15*	*2.07*	*0.70*	*1.28*	*1.74*	*2.70*
DP-10	*0.64*	*1.13*	*1.51*	*2.31*	*0.64*	*1.13*	*1.51*	*2.31*
Proctor Brook (DP-6 through DP-10)	*0.92*	*2.28*	*4.20*	*9.32*	*3.57*	*7.51*	*10.85*	*18.03*

Standard 3: Recharge

Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the MassDEP Massachusetts Stormwater Handbook.

Standard 3 requires that three computations or demonstrations be fulfilled in order to satisfy the stormwater recharge requirements. They are as follows:

- Impervious Area
- Required Recharge Volume
- Bottom Area Sizing for Subsurface Infiltration Systems and Porous Pavement

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. This project has 119,834 square feet of total existing impervious area within the limit of work and results in an increase in impervious area by approximately 46,907 square feet due to the Independence Greenway extension and minor roadway geometry improvements. The required recharge volume for the total impervious area within the limit of work is 8,000 CF. The required recharge volume for the net increase in impervious area within the limit of work is 2,348 CF. The required recharge volume for the proposed SCM is 926 CF.

The project considered implementation of SCM's that would provide recharge throughout the project limits; however, there was only one feasible location within the project, which is close to DP-4. Given the limited space within the ROW, existing utilities, the crisscrossing of Proctor Brook under the track bed, close proximity to waterbodies and high groundwater throughout the majority of the project, it was not feasible to propose additional SCMs in all the drainage areas in the project.

The Soil Survey Analysis is included in Section 1.1 of this report, Figure 3 Soils Map, and Appendix B Soil Information. The infiltration trench is located near borings B-3 and B-4 taken by GZA. Boring B-3 did not encounter groundwater and boring B-4 encountered groundwater at 9.5' below the existing surface. The bottom of the proposed infiltration trench will have more than 2-feet of separation to ledge and/or seasonal high groundwater. The NRCS soil report for this area demonstrates that the soil type is 602, Urban Land, within the infiltration trench, which does not have a hydrologic soil group associated with it. The closest NRCS identified soil group to this area is 626, Merrimac urban land with HSG A. In addition, the Geotechnical Report developed by GZA in Appendix B describes the soils closest to the infiltration trench (borings B-3 and B-4) as fine to coarse sand, some silt, trace gravel, and trace ash, which is consistent with HSG A. Therefore, the SCM is determined to be comprised of HSG A soils and the required recharge calculations were made using HSG A soils. See Appendix C of this report for required recharge calculations.

For the infiltration trench SCM, the contributing impervious areas and its underlying Hydrologic Soil Group were used to estimate the recharge volume lost by the addition of impervious area, which was used as its required recharge volume. The combined storage provided by the proposed

infiltration trench is 1,415 CF. While the infiltration trench does not provide storage for the total proposed impervious area within the project limits, the storage volume meets the required volume determined by the impervious area that is routed to the SCM. Therefore, Standard 3 is met to the maximum extent practicable.

The SCM was designed using the static method, so that the storage available below the first overflow is equivalent or larger than the required recharge volume. Drawdown calculations were performed to show that the infiltration trench will drain within 72 hours. For this calculation, the RAWLs infiltration rates were used to estimate the recharge potential of each of the SCMs.

Table 8 provides the required recharge volume for the project, and Table 9 provides the provided recharge volumes for each design point.

Table 8: Required Recharge Volume for Project

	HSG A	*HSG B*	*HSG C*	*HSG D*	*Total*
Existing Impervious (sq. ft.)	119,834	-	-	-	119,834
Proposed Impervious (sq. ft.)	150,450	16,291	-	-	164,744
Net Impervious Area (sq. ft.)	30,616	16,291	-	-	46,907
Target depth, F (in)*	0.6	0.35	0.25	0.1	-
Total Required Recharge Volume, Rv (cf)	8,000				
Net Increase Required Recharge Volume, Rv (cf)	2,348				
Receiving Area Required Recharge Volume, Rv (cf)	926				

*Provided by the MassDEP Massachusetts Stormwater Handbook

Table 9: Provided Recharge Volumes by Design Point

	HSG A	*HSB B*	*HSG C*	*HSG D*	*Total*
DP-4 (Drainage Area PDA-4)					
Provided Recharge Volume (cf)	1,415	-	-	-	1,415

Appendix B provides soil evaluation information (including the geotechnical report), and Appendix C provides computations, drawdown calculations, and supporting information regarding recharge.

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2’ separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points.

Standard 4: Water Quality Treatment

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

- *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the MassDEP Massachusetts Stormwater Handbook; and*
- *Pretreatment is provided in accordance with the MassDEP Massachusetts Stormwater Handbook.*

Standard 4 requires that all stormwater management systems be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The Massachusetts Stormwater Handbook states that this standard is met when:

- Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. As mentioned in Section 5, there is an increase in impervious area and one (1) SCM is proposed as part of this project. It has been designed to provide water quality treatment for the area of impervious surface that it captures. The treatment practice is:

- (1) Infiltration Trench

The combination of an infiltration trench and deep sump catch basins with hoods provides 85% TSS removal for DP-4 only. This standard is met to the maximum extent practicable.

The project is not located within a stormwater critical area; therefore, Massachusetts Stormwater Regulations require a “Water Quality Depth” of half (1/2) inch. This project is considered a redevelopment project; one of the objectives of the proposed stormwater improvements is to improve upon the quality of discharged stormwater.

The proposed design aims to improve the water quality by installing a new infiltration SCM and catch basins with deep sumps and hoods where feasible. The required water quality volume for the total impervious area within the limit of work is 6,864 CF. The required water quality volume for the net increase in impervious area within the limit of work is 1,954 CF. The required water quality volume for the impervious area that the SCM receives is 772 CF. Though the proposed infiltration trench does not provide enough volume for the total or net increase of impervious area, it exceeds the water quality volume requirement for the area it was designed to hold, by providing 1,415 CF of storage. As a result, this standard will be met to the maximum extent practicable. See Appendix C for required water quality volume calculations.

The Project has been designed to comply with Standard 4. Stormwater control measures have been sized to treat the required water quality volume and remove required pollutant load to the maximum extent practicable.

The Project used the SCM WQ Curves, as provided by the WQDF, to determine the treatment depth based on the required TSS and/or TP removal percentage for each SCM. Table 10 shows the SCMs organized by design point with each SCM's corresponding treatment depth and TSS and/or TP treatment removal.

Table 10: Water Quality Treatment Required and Provided by Design Point

Design Point	*Pretreatment*	*Contributing Impervious Area (sf)*	*Treatment Depth (in)*	*% TSS Removal*
DP-1 (PDA-1)				
Untreated	*Untreated*	*3,997*	*-*	*-*
DP-1 Total				*-*
DP-2 (PDA-2)				
Catch Basin	*Deep Sump Catch Basin with Hood*	*86,729*	*0.5*	*25%*
DP-2 Total				*25%*
DP-3 (PDA-3)				
Catch Basin	*Deep Sump Catch Basin with Hood*	*11,089*	*0.5*	*25%*
DP-3 Total				*25%*
DP-4 (PDA-4)				
Infiltration Trench & Catch Basin	*Trench Storage & Deep Sump Catch Basin with Hood*	*18,524*	*0.5*	*85%*
DP-4 Total				*85%*
DP-5 (PDA-5A)				
Untreated	*Untreated*	*9,011*	*-*	*-*
DP-5 Total				*-*
DP-6 (PDA-6)				
Untreated	*Untreated*	*12,281*	*-*	*-*
DP-6 Total				*-*
DP-7 (PDA-7)				
Untreated	*Untreated*	*10,438*	*-*	*-*
DP-7 Total				*-*
DP-8 (PDA-8)				
Untreated	*Untreated*	*6,047*	*-*	*-*
DP-8 Total				*-*
DP-9 (PDA-9)				
Untreated	*Untreated*	*4,765*	*-*	*-*
DP-9 Total				*-*
DP-10 (PDA-10)				
Untreated	*Untreated*	*3,890*	*-*	*-*
DP-10 Total				*-*
Project Total				*24.4%*

Appendix C provides the MassDEP TSS Removal Calculation Worksheets.
The City of Peabody has an active MS4 permit which includes long term operation and maintenance. The project will be maintained by the City's current O&M plan. Appendix E includes the LTPPP for this project.

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2' separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another option was to use proprietary devices at each discharge point for stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

The project's water quality treatment provides a minimum of 25% removal where closed drainage only was provided, and up to 85% of removal where the infiltration trench is proposed. The shared-use pathway that will replace the former railroad bed will sheet flow runoff to vegetated/wooded areas. Standard 4 is met to the maximum extent practicable.

Standard 5: Land Uses with Higher Potential Pollutant Loads

For Land Uses with Higher Potential Pollutant Loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the MassDEP Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all LHPPLs cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the MassDEP Massachusetts Stormwater Handbook. Stormwater discharges from LUHPPLs shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Standard 5 does not apply to the Project. There are no land uses with higher potential pollutant loads within the Project area.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the MassDEP Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Standard 6 does not apply to this Project. There are no critical areas within the Project limits.

Standard 7: Redevelopment

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The Independence Greenway extension is considered Redevelopment; therefore, Standard 7 is applicable to this project. Standard 7 requires a redevelopment project to meet Standards 2, 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 and 6 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project provides an opportunity to improve the quality of stormwater runoff discharged to adjacent wetlands. The proposed stormwater enhancements are summarized below:

There is one SCM proposed as part of this project. A portion of the proposed drainage system has been designed to convey runoff to this SCM for water quality treatment, and attenuation prior to discharge to the surrounding environment. The proposed SCM is an infiltration trench.

Cath basins with sumps and hoods are also installed within the project where feasible, which provide additional treatment.

The reconstructed drainage system will utilize existing outfall locations and invert elevations where feasible.

A Redevelopment Stormwater Checklist is provided in Appendix A of this report which illustrates which standards have been met to the maximum extent practicable. The standards are listed below:

Standard 1: Fully Met

Standard 2: Maximum Extent Practicable

Standard 3: Maximum Extent Practicable

Standard 4: Maximum Extent Practicable

Standard 5: Fully Met

Standard 6: Not Applicable

Standard 7: Fully Met

Standard 8: Fully Met

Standard 9: Fully Met

Standard 10: Fully Met

Standard 8: Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The implementation of erosion and sediment controls (ESC) during construction is considered a standard practice for all MassDOT projects. ESC will be installed before any land disturbance begins for the Project and will remain in place for the duration of the project. Construction period pollution prevention and erosion and sedimentation control measures will be implemented at the project site to control construction related impacts during construction and land disturbance activities. The General Contractor for the project will be responsible for implementation of the construction period controls.

The project will disturb more than one acre of land during the construction process and will require a NPDES Construction General Permit issued by the Environmental Protection Agency. As a result, the General Contractor will be required to prepare a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP document will satisfy the requirements of the Construction General Permit and the construction period erosion, sedimentation and pollution prevention plan requirements outlined in Standard 8 of the Massachusetts Stormwater Handbook. A SWPPP has not been prepared for inclusion with this stormwater report; however, one will be prepared prior to any construction activities at the site by the General Contractor.

Without proper erosion and sediment control measures, grading, filling and installing new structures may cause erosion and sedimentation, resulting in temporarily increased turbidity and suspended solid loads. Runoff from construction sites may also transport sediment to downstream watercourses, where sediment deposition and accumulation will occur as flow velocities decrease.

Erosion and sedimentation controls will be employed to prevent the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

Below is a description of some of the erosion and sediment control measures that will be employed at the project and that will be included in the SWPPP.

Minimize Disturbed Area and Protect Natural Features and Soil

The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance and limiting the size and length of the tributary drainage areas to the worksite and drainage structures. These fundamental principles will be the key factors in the Contractor's control of erosion on the project site. If appropriate, the Contractor will construct temporary diversion swales and settling basins or use a settling tank. If additional drainage or erosion control measures are needed, they will be located up-gradient from the compost filter tubes and sedimentation fences when possible.

The Contractor is responsible for the maintenance and repair of all on-site erosion control devices. All erosion control devices will be regularly inspected. At no time will silt-laden water be allowed to enter sensitive areas (wetlands, streams, and drainage systems). Any runoff from disturbed surfaces

will be directed through a sedimentation process prior to being discharged to the existing on-site drainage system.

The contractor will establish a staging area(s) on areas to be disturbed for the overnight storage of equipment and stockpiling of materials.

In the staging area, the Contractor will have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials will include, but are not limited to, compost filter tubes, sedimentation fence, erosion control matting and crushed stone. As mentioned previously, erosion and sedimentation controls will be employed to minimize the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

The Contractor is responsible for erosion control on the site and will utilize erosion control measures where needed, regardless of whether the measures are specified on the construction plans or in supplemental plans prepared for the Stormwater Pollution Prevention Plan (SWPPP).

Primary erosion control techniques proposed include compost filter tubes, sedimentation fence barriers, and a stabilized construction entrance. A detailed description of each technique is discussed below.

Best Management Practices (BMPs)

COMPOST FILTER TUBES AND SEDIMENTATION FENCE

Erosion control barriers such as compost filter tubes and/or sedimentation fence or similar will be installed where required prior to the start of construction. These barriers will remain in place until all tributary surfaces have been fully stabilized.

DRAINAGE SYSTEM PROTECTION

Sediment filters (silt sacks) will be installed at all existing and proposed drainage structures and maintained and cleaned as required to maintain their effectiveness. Catch basins, drainage manholes and storm drain pipes will be cleaned of sediment and debris after the completion of construction. Sediment collected in structures will be disposed of properly and covered, if stored on-site. The following construction measures will be implemented to prevent the transport of sediment through the drainage system.

The Project disturbs one or more acres of land; therefore, the project contractor will request coverage under the NPDES Construction General Permit (CGP) and develop a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP follows the requirements of this standard and will be in compliance with the latest NPDES CGP.

Standard 9: O&M Plan

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The City of Peabody is responsible for implementing the O&M Plan within their jurisdiction. Appendix E includes the O&M Plan for this project.

Standard 10: Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. As stated in the handbook, "The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater."

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system.

Standard 10 also states that "The Illicit Discharge Compliance Statement must be accompanied by a site map that is drawn to scale and that identifies the location of any systems for conveying stormwater on the site and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. The site map shall identify the location of any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater management system." Included with the Notice of Intent Submission are construction plans that displays the location of all of the stormwater management components as well as other utilities (existing and proposed) on the project site and conforms to requirements of a "site map" to accompany the Illicit Discharge Compliance Statement.

An Illicit Discharge Compliance Statement is included in Appendix E – Illicit Discharge Compliance Statement of this Report.

Where a new, closed drainage system will be constructed, there will be no connections to sanitary sewer. In other areas, stormwater runoff discharges via overland flow.

The design plans submitted with this report have been designed in full compliance with Standard 10. The project area does not have any known illicit connections.

Appendix A: MassDEP Checklist for Stormwater Report

- Massachusetts Stormwater Report Checklist
- Redevelopment Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

2/2/2023
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☐ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☒ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Infiltration Trench

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☒ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Checklist for Redevelopment Projects

Redevelopment Location:
The entire work within the limit of disturbance is considered redevelopment.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. Standards that are fully met are checked and do not require additional explanation.

☒ Standard 1: (Untreated discharges)
No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

☐ Standard 2: (Peak rate control and flood prevention)
Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

The peak flow rates were calculated for the 2-, 10-, 25- and 100-year storm events under proposed conditions and compared to the existing peak flow rates. The proposed Independence Greenway extension and minor geometry improvements result in an overall increase in square feet of impervious area within the project limits.

Though there is an increase in peak flow rates for DP -2, -6, -7, -8, and -9 for all storm events, additional studies were done to demonstrate there will be no adverse impacts. See page 16 in the Stormwater Report for additional information.

Implementations of Stormwater Control Measures (SCMs) for peak rate attenuation were used for one discharge point, but are not feasible for all discharge points due to the limited space within the existing Right-Of-Way (ROW), high groundwater, close proximity to resource areas and existing utilities.

☐ Standard 3: (Recharge to Ground water)
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The project considered implementation of SCM's that would provide recharge throughout the project limits; however, there was only one feasible location in the project close to DP-4. Given the limited space within the ROW, existing utilities, the crisscrossing of Proctor Brook under the track

bed, close proximity to waterbodies and high groundwater throughout the majority of the project, it was not feasible to propose SCMs in all the drainage areas in the project.

For the SCM, the contributing impervious areas and their underlying Hydrologic Soil Groups were used to estimate the recharge volume lost by the paved shared use path, which was used as the required recharge volume for the given SCM. The recharge volume provided by the SCM is 1,415 CF. While the infiltration trench does not provide storage for the total proposed impervious area within the project limits, the storage volume meets the required volume determined by the impervious area that is routed to the SCM. Therefore, Standard 3 is met to the maximum extent practicable.

☐ Standard 4: (80% TSS Removal)

Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;*
b. *Stormwater BMPs are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2' separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another option was to use proprietary devices at each discharge point for stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

The infiltration trench at DP-4 will be able to achieve 85% TSS removal with the crushed stone shoulder forebay and the catch basins with deep sump and hood providing pretreatment.

The project's water quality treatment provides a minimum of 25% removal where closed drainage only was provided, and up to 85% of removal where the infiltration trench is proposed. The shared-use pathway that will replace the former railroad bed will sheet flow runoff to vegetated/wooded areas. Standard 4 is met to the maximum extent practicable.

☒ Standard 5 (Higher Potential Pollutant Loads (HPPL)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific stormwater BMPs determined by the Department to be suitable for such use as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Not Applicable.

☒ Standard 6 (Critical Areas)

Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of the public water supply.

Not Applicable.

☒ Standard 8: (Erosion, Sediment Control)

A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented.

☒ Standard 9: (Operation and Maintenance)

A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.

☒ Standard 10 (Illicit Discharges)

All illicit discharges to the stormwater management system are prohibited.

Appendix B: Soils and FEMA Information

- NRCS Soil Survey Information
- On-Site Subsurface Investigations by GZA
- FEMA Flood Insurance Rate Map (FIRM)
- Flood Insurance Study (FIS)

Proposal No. 609211-132091

A00829 - 282

Hydrologic Soil Group—Essex County, Massachusetts, Southern Part

Proposal No. 609211-132091

A00829 - 283

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 19, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		2.7	0.5%
38A	Pipestone loamy fine sand, 0 to 3 percent slopes	A/D	2.4	0.4%
43A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	7.0	1.3%
51A	Swansea muck, 0 to 1 percent slopes	B/D	3.9	0.7%
52A	Freetown muck, 0 to 1 percent slopes	B/D	1.8	0.3%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	3.5	0.6%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	2.4	0.4%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	D	10.4	1.9%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	5.3	1.0%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	C	3.1	0.6%
301C	Montauk fine sandy loam, 8 to 15 percent slopes, very stony	C	9.1	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	5.3	1.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	6.0	1.1%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	6.8	1.2%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	3.7	0.7%
602	Urban land		277.1	50.4%
616A	Fluvaquents, frequently flooded, 0 to 3 percent slopes	B/D	19.8	3.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
622C	Paxton-Urban land complex, 3 to 15 percent slopes	C	61.9	11.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	63.0	11.5%
628C	Canton-Urban land complex, sloping		0.4	0.1%
651	Udorthents, smoothed		47.9	8.7%
724C	Hollis-Urban land-Rock outcrop complex, sloping		6.0	1.1%
Totals for Area of Interest			**549.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

GEOTECHNICAL ENGINEERING REPORT

for

Proposed Peabody Bikeway – Phase II
Peabody, MA

April 19, 2021
File No. 01.0174019.00

PREPARED FOR:
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue | Norwood, MA 02062

31 Offices Nationwide
www.gza.com

Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781.278.3700
F: 781.278.5701
F: 781.278.5702
www.gza.com

April 19, 2021
File No. 01.0174019.00

Mr. Adel Shahin, P.E.
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

Re: Geotechnical Engineering Report
Proposed Peabody Bikeway – Phase II
Peabody, Massachusetts

Dear Adel:

In accordance with our Agreement dated December 20, 2018, GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this geotechnical engineering report for the proposed Peabody Bikeway project located in Peabody, Massachusetts. The objectives of our services were to evaluate subsurface conditions and develop geotechnical design and construction recommendations to support the 25% design of proposed structural features of the project.

The proposed Peabody Bikeway Phase II project is part of the overall 5.3-mile Independence Greenway that extends from the Ipswich River Trailhead in Middleton, MA to the North Shore Mall Trailhead in Peabody, MA. The Peabody Bikeway Phase II Segment is an approximately 1.3-mile-long segment of trail that extends from the North Shore Mall Trailhead (STA 290+00) to Endicott Street in Peabody (STA 359+43).

This report supersedes our Preliminary Geotechnical Engineering Report dated April 22, 2019. The report was updated to reflect changes to the structural design and structural elements to the project. Specifically, the two retaining walls previously proposed between the Route 128 northbound highway embankment and the existing sidewalk of North Shore Road have been eliminated from the project. In addition, we understand that the proposed stream crossing structure located off Warren Street extension crossing Proctor Brook will consist of an approximately 438-foot-long elevated boardwalk rather than an 80-foot-long prefabricated steel truss bridge.

Elevations herein are in feet and referenced to the National American Vertical Datum of 1988 (NAVD 88). This report is subject to the Limitations set forth in **Appendix A** and the Terms and Conditions of our Agreement.

BACKGROUND

Our understanding of the project is based on:

- Discussions and email correspondence with Green International Affiliates Inc. (Green);
- Aerial photograph with proposed boring locations selected by Green at each structural feature;

- Construction Plans and Profiles along the Bikeway, Sheets 32 through 39, prepared by Green dated "fiscal year 2005";
- Site visits and observations of subsurface explorations at the site;
- CAD file of project base map provided by Green on January 15, 2019;
- MassDOT 25% Submittal Plan and Profile of Independence Greenway Extension, provided by Green on January 23, 2019;
- In-progress Sketch Plans entitled "Proposed Bridge Peabody Independence Greenway Extension over Proctor Brook", prepared by Green, with print date April 9, 2021.
- In-progress Construction Plans and Profiles, with print date April 5, 2021 and Bikeway Cross Sections, with print date April 7, 2021, prepared by Green.
- Readily available on-line surficial geology information, as well as on-line aerial photographs and topographic maps.

Existing Conditions

The Peabody Bikeway Phase II site starts from a previously completed portion of the Independence Greenway located near the southbound Route128 roadway and the North Shore Shopping Mall in Peabody, MA (Begin Bikeway STA 289+66). The bikeway extends east about 1,200 feet roughly parallel to the Route 128 roadway, then crosses under the southbound and northbound Route 128 roadways (at the existing Route 128 bridge over the entrance to the shopping mall), extends west about 1,400 feet along North Shore Road, crosses North Shore Road, and then follows an existing abandoned railroad right-of-way in an easterly direction roughly following Proctor Brook and terminating at about Endicott Street (End Bikeway STA 369+30) for about 4,100 feet. A site Locus is presented as **Figure 1**.

<u>Route 128 Southbound Roadway Embankment Segment</u>

The segment of the bikeway along the southbound Route 128 roadway (shopping mall side of the bikeway) will consist of an approximately 4-foot-wide trail. There are no structural features required to support the bikeway along this portion of the alignment.

<u>North Shore Road Segment</u>

The North Shore Road segment of the bikeway alignment is the existing highway embankment along the northbound side of Route 128. The embankment is grass covered with vegetation, overgrown bushes and small-diameter trees. There are several drainage basins and culverts within the embankment.

Photograph A: Embankment Slope looking Southwest at Route 128 Northbound Roadway adjacent to North Shore Road.

The embankment slope is approximately 1.5 horizontal to 1 vertical (1.5H:1V) at the northern end underpass and becomes flatter towards the west (**Photograph A**). The existing grade ranges from approximately elevation (El.) 53 to El. 68 feet along North Shore Road to about El. 52 to El. 75 at Route 128 - Northbound. The segment of the bikeway along the North Shore Road will consist of an approximately 10-foot-wide trail. There are no structural features required to support the bikeway along this portion of the alignment. However, earthwork with cuts up to about 5 feet at a maximum 2H:1V side slope and fills up to about 5 feet at a maximum 4H:1V side slope will be required to construct the bikeway along the existing embankment.

Existing Abandoned Railroad Right-of-Way Segment

The proposed bikeway alignment extends east from North Shore Road along an existing railroad right-of-way through a wooded area located between and roughly parallel to Lowell Street to the south and Warren Street Extension to the north. The railroad alignment approximately follows Proctor Brook. This portion of the site is heavily wooded with wetland vegetation. Existing site grades range from approximately El. 50 to El. 38.

There are four existing culvert crossings along the existing rail bed:

- a 36-inch and a 42-inch-diameter culvert at about STA 329+85
- a 30-inch-diameter culvert at about STA 340+10
- a 24-inch-diameter culvert at about STA 342+25
- a stone culvert of unknown size at about STA. 346+20.

There is also a former stream crossing over Proctor Brook at about STA. 351+60 (**Photograph B**).

Photograph B: Former Stream Crossing at Proctor Brook. Also, location of proposed pedestrian boardwalk.

An existing 42-inch-diameter sewer main also crosses through the right-of-way between Warren Street Extension and Endicott Street. The sewer main is reported to be about 12 feet below grade.

Proposed Construction

Proposed structural features for the bikeway include two box culverts and a stream crossing structure consisting of an elevated boardwalk.

Culverts

Two precast concrete, single-cell box culverts will be constructed to replace two of the existing culverts along Proctor Brook. One culvert is located at about STA 329+85 and is proposed to be 2.5-feet high by 6-feet wide by 24-feet long and the other culvert is located at about STA. 346+20 and is proposed to be 3-feet high by 7-feet wide and 18-feet long. Each culvert will include precast wing walls set at 45 degrees at both ends of the box culvert.

Stream Crossing Structure

The proposed stream crossing structure will consist of an elevated boardwalk located off the west end of Warren Street Extension that crosses over Proctor Brook and extends through wetland areas adjacent to the brook between approximately STA. 351+09 and STA. 355+47, terminating about 300 feet west of Endicott Street. The boardwalk will consist of composite wood decking with a clear width of 12 feet and piers (bents) generally spaced at 8-feet on-center. Helical piles are proposed for support of the boardwalk. The Sketch Plans show a timber wingwall at the abutments at the west and east ends of the boardwalk. The height of the boardwalk is generally within about 3 feet above existing

grade and extends locally up to about 3.75 feet above existing grade. The stream crossing structure will be designed to accommodate light-duty H-5 truck loading conditions.

SUBSURFACE EXPLORATIONS

Subsurface explorations included geotechnical test borings at each of the proposed structural features along the proposed bikeway alignment and sediment sampling for laboratory testing to provide data for scour analyses and completion of a 401 Water Quality Certification by others for the stream crossing structure.

Geotechnical Test Borings

GZA engaged New England Boring Contractors, Inc. (NEBC) of Derry, New Hampshire to perform eight test borings, including four borings (B-1 through B-4) along the highway embankment adjacent to North Shore Road for the previously proposed retaining walls (which are now planned to be a cut/fill slopes); two borings (B-5 and B-6) at the proposed culvert replacement locations, and two borings (B-7 and B-8) at the proposed pedestrian crossing as planned in 2018. It is noted that test boring B-5 was not performed due to accessibility issues but may be drilled at a later date as a confirmation boring during construction. The locations of several of the other borings had to be relocated from the originally proposed locations due to lack of access or the presence of overhead electrical wires. Approximate locations of the completed borings are shown on **Figure 2**. The original proposed boring locations were located in the field with a Trimble GPS unit and relocated borings using tape measurements from existing topographic features. Exploration locations should be considered accurate to the degree implied by the method used.

The test borings were performed between January 2 and 15, 2019 with an ATV-mounted drill rig using either 2-¾-inch inner diameter (I.D.) hollow stem augers or drive-and-wash drilling techniques to depths ranging from about 10 to 36 feet below ground surface (bgs). Split-spoon samples were collected and Standard Penetration Tests (SPTs) were generally taken continuously through the fill, and then at approximate 5-foot intervals thereafter. The samples were obtained in general accordance with ASTM D1586. The SPT method consists of driving a 1-⅜ I.D. split-spoon sampler 24 inches with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler from 6 to 18 inches is the SPT blow count (N-value), which is a commonly used indicator of soil density and consistency. An NX-sized, 10-foot-long rock core was obtained at borings B-7 and B-8 to confirm the type and quality of bedrock. Water levels were recorded at the completion of drilling, however, may not represent stabilized groundwater levels due to the introduction of drilling fluids. Upon completion of drilling, all borings were backfilled with drill cuttings and surficial soils.

A GZA representative was present during drilling to observe the borings and visually classify the soil samples using the Modified Burmister Soil Classification System and rock cores using the International Society of Rock Mechanics (ISRM) System. Boring logs prepared by GZA are attached in **Appendix B**. Photographs of the rock cores obtained from the borings are presented in **Appendix C**.

Sediment Sampling

GZA collected ten (10) shallow soil samples to a depth of up to 2 feet below the bottom of the brook for laboratory gradation testing for use in scour analysis by others and the 401 Water Quality Certification.

Six shallow soil/sediment samples were collected at the pedestrian bridge (as previously proposed in 2018) at locations specified by Green including, three samples approximately 72 feet upstream of the bridge (distance from the bridge equal to the length of the bridge crossing over the brook): one sample from the left bank on land, one sample from the right bank

on land, and one in the channel; and three samples at the bridge: one sample at the left abutment on land in front of the abutment, one sample at the right abutment on land in front of the abutment, and one in the channel.

Two (2) shallow sediment samples were also collected at each of the two proposed box culverts (total of 4 samples). The samples were obtained at the upstream opening of the existing culvert and at a distance upstream from the culvert equal to the length of the box culvert spanning over the brook; in this case one culvert is 24 feet wide and the other 18 feet wide.

The samples were collected using a hand shovel and a hand auger. The sediment material submitted for laboratory testing was a composite of material collected over the depth of sampling. Locations of the samples were made using tape measurements to existing topographical features.

LABORATORY TESTING

Geotechnical Laboratory Testing

Four soil samples from the geotechnical borings were submitted to Thielsch Laboratories in Cranston, Rhode Island for sieve analyses (ASTM D 422) to confirm field classifications, evaluate soil properties across the site, and evaluate the potential for soil re-use. Geotechnical laboratory test results are attached as **Appendix D**.

The ten (10) sediment samples obtained from the pedestrian bridge and replacement culvert locations were submitted to Thielsch Laboratories for sieve analyses for use in scour analyses by others and for 401 Water Quality Certification. Geotechnical laboratory test results of the sediment are attached as **Appendix D**.

Environmental 401 Water Quality Certification Testing

Four sediment samples were submitted to ESS Laboratory in Cranston, Rhode Island for environmental laboratory testing to evaluate parameters specified in the MassDEP BRP WW 08 Dredging Application and in accordance with MassDEP Policy No. Comm 97-001 Reuse and Disposal of Contaminated Soil at Massachusetts Landfills. Soil that is generated during the removal of sediment form the bottom of the brook and during excavation for the bridge abutments which is considered to be excess to the project must be managed in accordance with the MassDEP Massachusetts Contingency Plan (MCP) regulations and to evaluate whether the excavated material can meet the criteria for disposal at a Massachusetts landfill, if required. The testing also included analytes to satisfy criteria listed in 314 CMR 9.07 Criteria for Evaluation of Applications for Dredging and Dredged Materials Management. Analyses included:

<u>BRP WW 08 (assuming minor dredging):</u>

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)
- EPA Method 8100 Polycyclic Aromatic Hydrocarbons (PAHs)
- EPA Method 8080 Polychlorinated Biphenyls (PCBs)
- MassDEP Extractable Petroleum Hydrocarbons (EPH) ranges
- Total Petroleum Hydrocarbons (TPH)
- Volatile Solids (percent)
- Water (percent)
- Grain Size (performed as part of geotechnical laboratory testing above)

Additional testing performed not covered by BRP WW 08, but needed for MassDEP and Massachusetts dredging, included:

MassDEP Policy No. Comm 97-001:

- EPA Method 8270 Semi-Volatile Organic Compounds (SVOCs)
- EPA Method 8260 Conductivity

314 CMR 9.07(2):

- EPA Method 8240 Volatile Organic Compound (VOCs)
- Total Organic Carbon

In addition, testing was performed for pesticides and herbicides, reactive sulfide and cyanide, pH, and flashpoint, since these tests are often required for certain disposal facilities.

Results of the environmental laboratory testing are summarized on **Table 1** and contained in **Appendix E**. As indicated on **Table 1**, the laboratory test results indicate levels for chromium in two samples (one at the bridge from boring B-7 and one at a culvert from boring B-6 exceeds the MassDEP MCP CMR 40.1600 Reportable Concentration (RC) S-1 standards. Reporting Category RC S-1 means "the category of criteria listed in CMR 40.1600 applicable to soil samples obtained at or within 500 feet of a residential dwelling, a residentially-zoned property, school, playground, recreational area or park; or within the geographic boundaries of a groundwater resource area categorized as RC GW-1". Excess soils generated during construction may be disposed at a Massachusetts landfill, but additional sampling and testing may be required by the disposal facility at the time of construction.

SUBSURFACE CONDITIONS

Subsurface conditions encountered in the borings generally consisted of fill underlain by natural granular soil deposits and bedrock. The strata encountered in the borings are described below in order of increasing depth and are summarized on **Table 2**. The depths, thicknesses, and elevations referenced herein should be considered approximate. Refer to the borings logs for more detailed subsurface conditions at specific exploration locations. A general description of the subsurface conditions encountered in the borings from the ground surface down follows:

North Shore Road Embankment Segment (B-1 through B-4)

This section provides a general description of the primary stratigraphic units encountered in the borings along the North Shore Road embankment segment.

Fill – Underlying approximately 6 to 12 inches of topsoil, granular fill was encountered to depths ranging from about 3 to 8 feet bgs. The fill generally consisted of dark brown to brown, fine to coarse sand with up to 30 percent silt and up to 15 percent gravel, root fibers, and ash particles. SPT N-values within the fill varied between 4 and greater than 100 blows per foot (bpf). The higher SPT N-values are likely due to the presence of gravel.

Natural Granular Soil Deposits – Natural granular soil/glacial deposits were encountered below the fill in borings B-1 through B-4 and ranged from about 6.5 to 13.5 feet in thickness before the split-spoon sampling was terminated on refusal within this deposit. The glacial deposits generally consisted of medium dense to very dense, brown to gray, fine to coarse sand with up to 50 percent gravel and up to 30 percent silt. The SPT N-values within the glacial deposits layer ranged from 15 to greater than 100 bpf. The higher SPT N-values are likely due to the presence of gravel or possibly, refusal on the top of bedrock.

Bedrock – Borings B-1 through B-4 were terminated upon reaching refusal to either or both advancement of the split-spoon and/or auger on possible top of bedrock at depths ranging from about 10.5 to 17 feet bgs. The refusal on bedrock was not confirmed by coring.

Existing Abandoned Railroad Right-of-Way Segment (B-6 through B-8)

This section provides a general description of the primary stratigraphic units encountered in the borings along the existing abandoned railroad right-of-way and elevated boardwalk segment. A generalized subsurface profile along the alignment of the proposed is presented on **Figure 3**. It should be noted that the borings along the Proctor Brook stream crossing were located based on the previous 80-foot-long prefabricated steel truss bridge crossing rather than the 438-foot-long elevated boardwalk, which is why there were no borings taken at the east end of the boardwalk.

Fill – Underlying topsoil, fill was encountered to depths ranging from about 2 to 4 feet bgs. The fill generally consisted of dark brown to brown, fine to medium sand with up to 35 percent silt and up to 20 percent gravel, root fibers, and wood fragments. The fill in boring B-8 was predominantly dark brown, organic Clay & Silt with up to 35 percent sand and up to 20 percent gravel. SPT N-values within the fill varied between 5 and 32 bpf.

Natural Granular Soil Deposits – The natural granular soil deposit in boring B-6 was predominantly fine to coarse sand with SPT N-values ranging from 11 to 36 bpf. The natural granular soil deposit in boring B-6 was encountered at a depth of about 2 feet bgs and extended to a depth of about 26 feet where the split-spoon sampling was terminated on possible bedrock. "Blow-in" was observed while drilling boring B-6 at around 10 to 12 feet bgs.

The natural granular soil deposits in borings B-7 and B-8 performed for the proposed pedestrian crossing differed from the other borings drilled for the bikeway. The natural granular soil deposits were further classified into sand and gravel, silt & clay, and a glacial deposit, each layer generally described as follows:

Sand and Gravel: encountered underlying the fill at approximately 4 feet bgs. The Sand and Gravel layer ranged from about 13.5 feet thick (B-7) to 15 feet thick (B-8) and generally consisted of medium dense to dense, brown to light brown fine to medium sand with up to 35 percent gravel and up to 15 percent silt. The SPT N-values within the Sand and Gravel layer ranged from 6 to 33 bpf. The SPT N-values in boring B-7 appeared to generally be lower than in boring B-8.

Silt & Clay – A relatively thin (approximately 2 to 3 feet thick) layer of Silt & Clay was observed in borings B-7 and B-8 at depths ranging from 17 to 22 feet bgs and generally consisted of brown to gray, Silt & Clay with up to 10 percent sand and gravel. One SPT N-value obtained in this layer indicated 12 bpf indicating stiff consistency.

Glacial Deposits – Glacial deposits were encountered underlying the Silt & Clay in borings B-7 and B-8 ranging from about 19 to 22 feet bgs. The glacial deposits generally consisted of dense to very dense, brown to gray, fine to coarse sand with up to 30 percent silt and up to 30 percent gravel. The SPT N-values based on two samples obtained from this layer were 40 bpf (B-8) and 44 bpf B-7).

Bedrock – It appears that the top of bedrock may include a relatively thin layer of weathered bedrock overlying more competent rock. In each boring, a layer of gravel and refusal to the split-spoon was encountered. The weathered rock appears to range from about 6 to 12 inches thick. Bedrock was not confirmed by coring in boring B-6, however, bedrock was confirmed with rock coring in borings B-7 and B-8 starting at 26 feet and 31 feet bgs, respectively. These depths correspond to approximately El. 13 and El. 8, respectively. Less than 100 feet north of Proctor Brook on the opposite side of Warren Street Extension bedrock outcrops are present.

The bedrock, based on the cores obtained from borings B-7 and B-8, generally consists of gray, hard, slightly weathered, medium to coarse grained GRANITE. **Table A** summarizes the rock recovery percentages and the Rock Quality Designation (RQD) values (the sum of the lengths of NX-sized core pieces that are greater than 4 inches in length divided by the length of the core run) for each core run. As noted in the table, the RQD values in boring B-8 were very poor. The rock core barrel jammed during coring the rock in boring B-8.

Table A: Summary of Rock Core Data

Boring Number	Core Run	Core Depth Below Ground Surface (ft)	Approximate Elevation (ft)	Recovery (%)	RQD (%)
B-7	C-1	26 – 31	13.5 – 8.5	93	20
	C-2	31 – 36	8.5 – 2.5	100	35
B-8	C-1	31 – 36	7.8 – 2.8	70	0
	C-2	36 – 41	2.8 – -3.2	100	0

GROUNDWATER

Groundwater levels were measured in the borings after completion of drilling, prior to backfilling and therefore, are not considered to be representative of stabilized groundwater levels. Measured levels are indicated on **Table 2** and summarized below:

- The groundwater levels along the Northshore Road segment ranged from approximately 6 to 10 feet bgs, corresponding to elevations ranging from 42 to 62.
- The groundwater level at the culvert at STA 346+20 (boring B-6) was encountered at about 3.5 feet bgs, corresponding to about El. 37.
- The groundwater levels at the elevated boardwalk ranged from 3 to 6 feet bgs, corresponding to about El. 32 to El. 36.

Note that fluctuations in groundwater levels are expected to occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements.

The bikeway is located within the 100-year flood zone based on FEMA FIRM 25009C0412F dated July 3, 2012. The 100-year base flood ranges from about El. 47 at North Shore Road to El. 39.5 feet at Endicott Street. We understand that the stream level within Proctor Brook is relatively shallow and runs west to east. A summary of stream levels based on the hydraulic study performed by others for the project site is provided in **Table B**.

Table B: Summary of Stream Levels at the Proctor Brook Stream Crossing Structure

Return Period	Elevation (ft)
Ordinary High Water	37.88
10-year Design Flood	39.33
25-year Scour Design Flood	39.53
50-year Scour Check Flood	39.82
100-year Base Flood	40.19

KEY GEOTECHNICAL ISSUES

The primary geotechnical issues associated with the design and construction of the proposed culverts and elevated boardwalk include:

- Relatively Shallow Groundwater Within the Existing Abandoned Railroad Segment. Being that the Proctor Brook is a wetland area, groundwater is shallow, and significant portions of the proposed bikeway are prone to flooding. Construction dewatering and possibly temporary cofferdams will likely be required during excavations for the culvert and approach embankments for the elevated boardwalk.

- Working within the Wetland to Construct the Culverts and Stream Crossing Structure. Limiting disturbance to the wetland areas surrounding the rail alignment associated with excavation in the wetlands needs to be considered when selecting foundation types to limit excavation quantities and access for construction equipment. In addition, construction equipment will only be able to access the bikeway from limited locations. Therefore, tracked and/or small- to medium-sized construction equipment would allow for installation of foundations that limit disturbance. Also, contractors will need to be aware of restrictions from the Conservation Commission with regard to removal of brush.

- Existing Granular Soils at the Elevated Boardwalk. The soils at the elevated boardwalk structure are relatively "clean" and are susceptible to scour during the design scour flood event and the check scour flood event due to water velocity. Based on hydraulic analyses by others, the scour depth at the abutments is 1.95 feet and at the piers is 1.17 feet during the Design Scour (25-year flood) event and scour depth at the abutments is 2.28 feet and at the piers is 1.22 feet during the Check Scour (50-year flood) event.

- Existing Cobbles/Boulders at Ground Surface. Clearing of the existing surficial cobbles/boulders will be required prior to installation of foundations for the elevated boardwalk structure.

- Existing Sewer Line. The existing sewer line extends between Warren Street Extension and Endicott Street and is close to the elevated boardwalk. The closest point occurs at the west side of the boardwalk, where the sewer line is located within less than 5 feet laterally of the proposed foundations. In order to avoid imposing load on the existing sewer, foundations for the stream crossing will need to extend into the natural soils below the bottom elevation of the sewer. Construction methods used to install foundations for the stream crossing will need to consider and mitigate potential construction impacts (i.e., ground movement and vibrations) to the existing sewer line.

GEOTECHNICAL RECOMMENDATIONS

This section presents the geotechnical recommendations for the proposed culverts and elevated boardwalk structure. These recommendations are subject to the limitations contained in **Appendix A**. Recommendations for the culverts and wing walls for the elevated boardwalk are based on foundation design provisions of the AASHTO LRFD Bridge Design Specifications, 8th Edition (2017 AASHTO LRFD), 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, with 2015 Interim Revisions (2015 AASHTO LRFD Seismic), and the MassDOT LRFD Bridge Manual, 2020. Recommendations for the foundations for the elevated boardwalk are based on helical piles and allowable stress design and the International Code Council Evaluation Services (ICC-ES) Acceptance Criteria AC358 for Helical Systems and Devices.

1. CULVERTS AND CULVERT WING WALLS

Type of Culvert

The proposed box culverts specified by Green for this project are single-cell, precast box sections and the wing walls at the ends of the culverts will also be precast sections. Criteria for loads and live load distributions should be in accordance with Section 3.3.4.4 of the MassDOT LRFD Bridge Manual. As specified in that section of the Manual, earth pressure should be based on a minimum and maximum equivalent fluid pressure of 30 pcf and 60 pcf, respectively. Lateral earth pressure from weight of earth above and adjacent to a box section should be taken as 0.5 times the vertical pressure. Load factors on the lateral earth pressures should follow the recommendations in Section 3.3.4.4.

We anticipate that the box culverts and wing walls can be installed by cut and cover methods in excavated trenches. The length of the trenches may need to be limited to help control in-flow of groundwater but will need to be long enough to accommodate the lengths of the precast box sections.

Based on the subsurface conditions indicated in boring B-6 (boring B-5 is pending), the box culvert will bear on relatively clean granular soil consisting of medium dense to dense fine to medium or fine to coarse sand with up to 10 percent silt and up to 10 percent gravel. These natural granular soil deposits are considered suitable for support of the box culverts provided the subgrade can be adequately dewatered to allow the subgrade to be recompacted and remain firm and stable when proof compacted.

If organic soils, loose or otherwise unstable or disturbed soils are encountered at subgrade level, those soils should be excavated and replaced with Gravel Borrow or ¾" crushed stone wrapped in non-woven filter fabric to the top of the naturally deposited inorganic soils below, or to a maximum depth of 3 ft below the bottom of culvert. Where compacted Gravel Borrow or ¾" crushed stone is placed for support of the box culvert, the lateral limits of the fill should be defined as a line extending horizontally outward and downward at a 1H:1V slope from the bottom of the culvert. Controlled density fill may be used in lieu of Gravel Borrow or crushed stone.

Culvert Bedding

The box culvert sections should be placed on a bedding of at least 12 inches of Gravel Borrow or ¾" crushed stone wrapped in Mirafi 180N, or equivalent, non-woven filter fabric.

Trench Backfill

Material placed against the culverts should consist of Gravel Borrow, Type C. Sidesway of the structure may be ignored in the design of the culverts provided that the fill placed around the structure is placed on both sides to approximately the same elevations at the same time.

2. ELEVATED BOARDWALK STRUCTURE

Boardwalk – Helical Pile Foundations

We recommend the boardwalk be supported on helical piles deriving their support in the natural granular soil deposits below the existing fill. Helical piles are a steel foundation system consisting of a central shaft with one or more helix-shaped bearing plates, welded to a lead section. Extension shafts are used to extend the pile into competent load-bearing soils. Helical piles will derive their support primarily in bearing of the helices within the

natural granular soil deposits. Helical piles are advanced by rotating the pile into the ground with the application of torque.

Helical piles are available as both round and square shafts with a range of shaft diameters and helix configurations (number of helices, helix diameters and helix spacing), depending on the design loads and installation considerations and vary by the manufacturer

Due to special requirements for installation of helical piles and the requirements for proper performance of the structural system, helical piles, including bracket assemblies should be designed and installed by a specialized helical pile Contractor. In addition, each Contractor typically works with a specific manufacturer and engineer. Thus, the size of the helical pile shaft, the number and diameter of the helices, and the overall design will vary depending on the manufacturer selected by the Contractor. Therefore, performance design criteria need to be specified on the Contract Bid Drawings and Specifications in sufficient detail to enable a Contractor to design and install piles for support of the proposed boardwalk.

To evaluate the feasibility of using helical piles to support the elevated boardwalk, a preliminary helical pile design was performed using geometry and the design loads provided by Green on April 6, 2021, which are summarized in **Table C**. Based on our evaluation, Chance™ RS2875.276 helical piles with a 10-, 12-, and 14-inch diameter helix lead section is considered a feasible helical pile option. The estimated pile embedment of the top helix is 11 feet below existing ground surface, or about 9 feet below the scoured ground surface. The preliminary helical pile calculations are provided in **Appendix F**.

Table C: Helical Pile Loads for Proposed Elevated Boardwalk

Load Type	Design Load (kips)
Vertical – Compression	25.0
Vertical – Tension	10.0
Lateral – Transverse (every bent)	7.5
Lateral – Longitudinal (every third bent)	5.0 (each way)

Note: The design compression, tension and lateral design loads are the ultimate load divided by a factor or safety of 2.0.

The following design criteria are presented for the helical pile foundation system:

- The structural design of the decking is based on 8-foot bent (longitudinal) spacing.
- Two vertical helical piles and one inclined (battered) pile are specified at each bent to resist axial compression/tension and horizontal (transverse direction) loads in compression/tension. The inclined helical anchor at each bent should alternate lateral directions from bent to bent.
- Two inclined piles are specified at every third bent of the boardwalk to resist longitudinal loading.
- The Contractor should determine the required angle of inclination for inclined piles so that the angle is no greater than 45 degrees and no less than 25 degrees from vertical.
- Design of the helical piles should be based on Allowable Stress Design (ASD) and should use a factor of safety of 2.0.

- Helical piles should be designed to provide allowable geotechnical capacity greater than the design loads presented in **Table C**.
- Static load testing should be performed in accordance with ASTM D1143 for compression and ASTM D3689 for tension.
- Helical piles should be designed so that the helices derive support entirely in the natural sand and gravel deposits underlying the existing fill stratum.
- The helical piles should be designed for tension during the design scour (25-year) flood. The maximum scour occurs at the abutments, therefore the piles should be designed for 1.95 feet of scour.
- The top helix should extend at least 11 feet below ground surface to provide sufficient overburden weight for the tension load (note that this will also provide more than the 4 feet of embedment required for frost protection).
- Helical piles in close proximity to the existing sewer line will need to be installed such that the top helix is located below the zone of influence on the pipe. The zone influence for the purpose of loading is defined as a 1H:1V plane from the springline of the pipe. The utility plans should be reviewed to confirm the sewer location and minimum depth to the top helix during final design.
- Design and installation of helical piles should conform to the manufacturer's recommendations.

These design criteria, as well as further specifics for design and installation of the helical piles should be provided in the Helical Pile performance specification. Further requirements regarding connection details will be presented on the structural drawings to be prepared by Green. Also, refer to the Construction Recommendations presented herein for additional requirements.

Abutments and Wingwalls

The Sketch Plans show timber abutments and wingwalls. In order to protect the existing sewer line, we have assumed the abutment and wingwalls will consist of crib walls constructed using pressured treated timber. Additional types of retaining walls should be considered for design and construction of the abutment and wing walls including mechanically stabilized earth, cast-in-place concrete, precast concrete, and other proprietary walls types such as Redi-Rock or similar. Selection of the final wall type should consider type of equipment that can readily access the wall locations and using construction methods that result in the least amount of disturbance to the wetland.

Bearing Resistance & Settlement

The factored geotechnical bearing resistance for the new abutment and wingwalls were evaluated using the following parameters and assumptions based on the methodology of 2017 AASHTO LRFD Section 10.6.3.1.2a:

- Effective footing widths (B') ranging from 2 to 6 feet
- Eccentricity (e) is less than or equal to 1/3 of the footing width
- Estimated footing lengths (L) of 10, 15, and 20 feet

- Minimum footing embedment depth (Df) of 4 feet below check scoured ground surface which will provide a minimum of 4 feet of embedment for frost protection even after the scour check event.
- Design groundwater elevation at proposed scoured streambed
- Footings are assumed to bear in the existing fill or natural granular soils. The presence of the Crushed Stone stabilization layer is neglected.
- Estimated friction angle (ϕ) of the footing bearing soils of 32 degrees
- Unit weight of the bearing soils of 120 pounds per cubic foot (pcf)
- Resistance factor for bearing resistance (ϕb) of 0.45 in accordance with 2017 AASHTO LRFD Table 10.5.5.2.2-1.

As required by MassDOT LRFD Section 3.2.10, the stability and bearing resistance of the footings under scour conditions is required to be considered.

Bearing resistance design charts to facilitate the selection of a footing size for the abutment and wingwalls based on factored bearing pressures (strength limit state) and tolerable settlement (service limit state) are provided in **Appendix F**. The charts are based on the effective footing width, B', where B'=B-2e (B is the footing width and e is the eccentricity of the loading on the footing). The factored bearing pressures shown in the charts in **Appendix F** are based on a resistance factor of 0.45, which is conservative for the wingwalls. The net bearing pressure for service limit state should be used to estimate footing settlement on the chart. Settlement is anticipated to be elastic and the majority of settlement will occur during construction (i.e., from the bridge dead loads).

Sliding and Overturning

The abutments and wingwalls need to be designed for sliding and overturning. The overturning analyses should be based on limiting the eccentricity to no more than one-third the footing dimension, B/3 (2017 AASHTO LRFD Section 10.6.3.3). Sliding analyses should be performed in accordance with Section 10.6.3.4 of 2017 AASHTO LRFD utilizing a resistance factor of 0.9 (Table 10.5.5.2.2-1) and a friction factor (tan δ) of 0.625 for soil-to-soil contact assuming the crib walls are filled with granular material.

We recommend that the passive soil resistance on the front side of the wingwalls and abutments be ignored when evaluating sliding.

Lateral Earth Pressure

The following backfill parameters/assumptions are recommended for the design of the abutment and wingwalls backfilled using compacted Gravel Borrow:

- Estimated soil friction angle (ϕ) of 34 degrees.
- A moist soil unit weight of 125 pounds per cubic foot (pcf) above the groundwater level and a saturated unit weight of 130 pcf below the groundwater level.
- Horizontal backfill slope behind the wall (walkway grade).
- Design groundwater at the top of the abutment assuming the area is prone to flooding.

- Based on Section 3.1.6 of the 2013 MassDOT LRFD Bridge Manual, for walls greater than 5 feet, the lateral earth pressure should be based on active earth pressure (K_a) conditions. Walls should be designed an active earth pressure coefficient of 0.26 for Gravel Borrow.

Additional lateral pressures due to traffic surcharge loads should be applied as required by 2017 AASHTO LRFD. However, based on Section 3.3.1.3 of the 2013 MassDOT LRFD Bridge Manual, if approach slabs are used, the AASHTO live load surcharge load on the abutment can be ignored.

The ends of the elevated boardwalk will be relatively hard points in comparison to the adjacent at-grade trail. We recommend an approach slab similar to that used for a bridge abutment or a cantilever end segment of boardwalk be used. The approach slab or cantilever segment should be structurally tied to the abutment or last pier and be free to rotate. The intent is to avoid any abrupt differential settlement between the boardwalk and approach embankment, which could cause a tripping hazard.

When considering fill in front of the wall, passive resistance should be neglected in determining wall stability in accordance with the 2013 MassDOT LRFD Bridge Manual.

3. ELEVATED BOARDWALK APPROACH EMBANKMENTS

Approach embankments up to about 5 feet above the current grade will be required at the ends of the elevated boardwalk. The approach embankments will be graded to a 3.1% slope or less. The approach embankments will be 14-feet wide with 2H:1V side slopes down to existing grade. The approach embankment fill should consist of Gravel Borrow (M.1.03.0, Type B) compacted to 95% of the maximum dry density. If project hydraulic studies indicate that erosion of the side slopes of the approach embankment is a concern, protection of the slope surface by armoring with stones (such as a modified rock fill underlain by non-woven filter fabric), a permanent turf reinforcement mat (TRM), or other material acceptable to the conservation agency will need to be constructed.

The approach embankment, including base course should be constructed as soon as practical and at least 2 months prior to binder course construction. Placement of the final wearing course of pavement should be held off to the degree practical to allow for any settlement of the new embankment to occur during construction.

Prior to placement of embankment fill, the subgrade embankment areas should be prepared and proof-compacted as recommended herein.

4. GEOTECHNICAL SEISMIC DESIGN PARAMETERS

Seismic Site Class

A Seismic Site Class analysis was performed using SPT N-values from the borings in accordance with Section 3.10.3.1 of 2017 AASHTO. Based on the results of our analysis we recommend Site Class D be used for design.

The design response spectrum parameters are based on the 1,000-year return period, corresponding to a non-critical, non-essential structure. In accordance with 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, with 2015 Interim Revisions (AASHTO 2015 Seismic), for Site Class D, we recommend the following design response spectra parameters:

A_s = 0.133g S_{DS} = 0.263g S_{D1} = 0.096g

where:

A_s is the short period acceleration based on Site Class D
S_{DS} is the design spectral acceleration coefficient at 0.2-second period
S_{D1} is the design spectral acceleration coefficient at 1.0-second period

Seismic Design Category

Based on the 1-second period design spectral acceleration for this site and in accordance with Table 3.5-1 of AASHTO Guide Specifications for LRFD Seismic Bridge Design, the elevated boardwalk structure may be assigned to Seismic Design Category (SDC) A.

Liquefaction

In accordance with Section 3.5 of the 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, no liquefaction evaluation is required for bridges assigned to SDC A. Furthermore, based on the SPT N-values obtained from the borings, the soils are judged to be not considered susceptible to liquefaction.

5. ADDITIONAL SUBSURFACE EXPLORATIONS

During design development, the length of the stream crossing structure presented in the Bridge Type Selection Worksheet was increased from about 70 feet to about 438 feet. Thus, we recommend that additional explorations be performed prior to final design for the elevated boardwalk. Four borings should be performed between boring B-8 and the east abutment/transition ramp. The borings should be advanced to a depth of 25 feet bgs, or refusal, whichever is shallower. Split-spoon samples and SPTs are recommended to be taken continuously from 10 to 20 feet bgs and at standard 5-foot intervals to complete the boring to the specified depth. The borings will provide confirmatory information for the east end of the alignment where there is currently no subsurface information available.

CONSTRUCTION CONSIDERATIONS

1. HELICAL PILES

Contractor Qualifications

A specialty contractor should be engaged by the Contractor to install the helical piles who is capable of demonstrating successful completion of design, installation, and testing of helical piles with similar load capacity and similar subsurface conditions. The design of the helical piles and load tests should be prepared and stamped by a Professional Engineer Registered in the Commonwealth of Massachusetts. In addition to the design calculations, the Contractor's submittal should include a description of the load test set-up, equipment, and procedures.

Helical Pile Load Testing

The helical pile geotechnical capacity should be confirmed with load tests. We recommend performing a compression and tension load test on at least two piles. Load testing should be in accordance with ASTM D1143 for compression testing, and ASTM D3689 for tension testing. Locations of the load test piles should be agreed upon by the Contractor and geotechnical engineer. Tension load testing may be performed on the same pile that compression testing is performed.

QA/QC During Installation of Helical Piles

Observation of helical pile testing and production helical pile installation should be made by experienced geotechnical personnel. The depth, final installation torque, advancement rate, number and diameter of helices, diameter of extension shafts, and alignment should be verified and documented for each helical pile.

Obstructions

Removal of surficial cobble/boulders along the will be required prior to helical pile installation. Pre-drilling may be required to penetrate the cobbles and boulders. If, after pre-drilling, foundations are not able to be installed at anticipated locations, the structural engineer should be prepared to relocate and/or add additional helical piles to provide the required geotechnical resistance to support the proposed structures.

2. SUBGRADE PREPARATION FOR EMBANKMENTS

Remove all existing topsoil/subsoil within proposed fill areas to construct embankments (e.g., along North Shore Road and for the approaches to the elevated boardwalk). Perform final excavation using a smooth-edged bucket to limit disturbance to the exposed final subgrade. Proof-roll final subgrade areas prior to placement fill with at least ten (10) passes of a large vibratory plate compactor or walk-behind vibratory drum roller. If work is performed during periods of wet weather and groundwater is near the subgrade proof-rolling should be performed at the discretion of the Geotechnical Engineer and should be performed using static (non-vibratory) equipment. Weak, unstable or saturated areas that are observed during proof-rolling should be overexcavated and replaced with compacted Gravel Borrow (or crushed stone wrapped in non-woven geotextile fabric if greater than 4 inches in thickness).

Subgrade preparation for the culverts and culvert wing walls was described in Design Section 2 above.

Fill for embankments, footings for the culvert wingwalls as well as bedding for the culverts and culvert wingwalls should not be placed in water or on frozen ground.

3. GROUNDWATER AND SURFACE WATER CONTROL

Proctor Brook is a wetland and it is prone to flooding. The Contractor should be prepared to divert, manage, and control infiltrating groundwater during excavations for foundations and culverts, as well as control surface water from entering excavations to provide a dry and stable subgrade. The method of diverting water and dewatering excavations will depend on several factors, including localized soil conditions encountered, time of year performed, size of the open excavation and the length of time the excavation is left open. The Contractor should be responsible for selecting diversion, management and dewatering methods based on his proposed methods and equipment used for excavation in order to achieve the desired objectives (that is, maintaining a dry condition at the bottom of the excavation during installation of structures, preparation of stable subgrades, etc.). Temporary portable cofferdams, sandbags, supersacks or berms with bypass culverts or pumps may be required to mitigate surface water inflow. If utilized, local sump pumps should be surrounded by ¾-inch Crushed Stone wrapped in non-woven

filter fabric and well points should utilize properly graded filter material to limit migration of fines. Dewatering discharge must satisfy requirements of local, state and federal environmental and conservation authorities.

4. EXCAVATIONS / PROTECTION OF EXISTING UTILITIES

We anticipate that the excavations can be made using conventional earthmoving equipment. Most excavations are expected to be less than about 5 feet deep and should not require excavation support systems but will likely require dewatering to maintain stable side slopes and bottom subgrade. Where open excavations are constructed, the side slopes should be designed and sloped in accordance with OSHA regulations. Where excavation support is used, the Contractor's engineer should design the excavation support system.

Excavations should not extend into the zone of influence of any utility or structure. The zone of influence is defined as a line extending 2 feet beyond the bottom exterior edge of the foundation or springline of the utility then down and away at a one horizontal to one vertical (1H:1V) slope. Undermining of existing foundations or utilities must not occur.

5. BACKFILL AND COMPACTION

Embankment fill and fill placed behind the abutments should be in accordance with Sections 150 and M of MassDOT Standard Specifications for Highways and Bridges. Reference is also made to **Table F**.

Table F: Backfill Material Specification & Recommended Use

Borrow Material	MassDOT Spec. No.	Use
Ordinary Borrow	M1.01.0	General Fill
Special Borrow	M1.02.0	Drainage, Stabilization Fill
Gravel Borrow	M1.03.0, Type B	Behind abutments and wingwalls and as embankment fill
Crushed Stone	M2.01.4	Drainage

Fill should be placed in loose layers not more than 12 inches thick and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). In confined areas, place only 6-inch layers and compact with manually operated, powered vibratory compactor acceptable to the geotechnical engineer. Crushed Stone should be placed in lifts no greater than 12-inches-thick with each lift compacted to an unyielding surface. Crushed Stone placed in layers greater than 4 inches should be wrapped all-around in non-woven geotextile fabric. Fill should be free of frost and not be placed over frozen soil. Subgrades should be protected against frost during and after construction.

6. REUSE OF EXCAVATED MATERIALS

Based on the soil descriptions on the boring logs, it is not expected that the existing on-site soils will meet the gradation requirements for the borrow materials presented in **Table F**, except ordinary borrow. Excavated soil that cannot be reused on-site or on other portions of the project should be removed from the site in accordance with applicable local, state and federal regulations.

FINAL DESIGN, CONTRACT DOCUMENTS AND CONSTRUCTION MONITORING

GZA will continue to support you with preparation of specifications and review of near final plans for conformance with our geotechnical recommendations. We also recommend that during construction GZA provide review of contractor submittals related to foundations and earthwork, and construction QA/QC observation and testing services during the earthwork and helical pile installation phases of the project. Construction services may include verification of subgrade soils, observation of proof-rolling operations and placement of fill, performance of field density tests, observation of helical pile testing and production installation, and in general, observe compliance with recommendations in this report and the Contract Documents. This construction oversight is considered an important part of obtaining quality site improvements.

CLOSING

We trust the information presented herein is sufficient for your use in preliminary design of the proposed Peabody Bikeway structures. We look forward to working with you as you advance the project through Final Design. Please contact the undersigned with any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Michael P. Smith, P.E.
Senior Project Manager

Andrew R. Blaisdell, P.E.
Consultant/Reviewer

Terese M. Kwiatkowski, P.E.
Principal

Attachments: Tables
Figures
Appendix A – Limitations
Appendix B – GZA Boring Logs
~~Appendix C – Rock Core Photographs~~
Appendix D – Geotechnical Laboratory Test Results
~~Appendix E – Environmental Laboratory Test Results~~
~~Appendix F – Calculations~~

\\gzanor\jobs\170,000-179,999\174019\174019-00.MPS\Report\text & PDF 4-16-2021\0174019 Peabody Bikeway_Geotech Report 4-19-2021.docx

Tables

File No. 01.0174019.00
March 2019

Peabody Bikeway - Phase II
Peabody, Massachusetts

TABLE 1
SUMMARY OF ANALYTICAL TESTING RESULTS

	Left Bank at Bridge 0-2'		Right Bank at Bridge 0-2'		Boring B-5 - Culvert 0-2'		Boring B-6 - Culvert 0-2'		MCP RCS-1	MA Unlined Landfill	MA Lined Landfill	Asphalt Batch Facility	401 WQC Parameters
Volatile Organic Compounds (mg/kg) EPA Method 8260	ND		ND		0.036		0.0933		4	4	10	30 to 1800 (Variable)	0.1
Semi-Volatile Organics (mg/kg) EPA Method 8270													
Phenanthrene	0.647		ND		ND		ND		10				
Anthracene	ND		ND		ND		ND		1000				
Fluoranthene	1.41		ND		ND		1.14		1000				
Pyrene	0.955		ND		ND		1.01		1000				
Benzo [a] Anthracene	0.573		ND		ND		0.459		7				
Chrysene	0.647		ND		ND		0.666		70				
Benzo [b] Fluoranthene	0.577		ND		ND		0.684		7				
Benzo [k] Fluoranthene	ND		ND		ND		ND		70				
Benzo [a] Pyrene	0.518		ND		ND		0.499		2				
Indeno [1,2,3-cd] Pyrene	ND		ND		ND		ND		7				
Benzo [g,h,i] Perylene	ND		ND		ND		0.488		1000				
Total SVOCs	*5.3*		*0.0*		*0.0*		*0.0*			*100*	*100*		
Extractable Petroleum Hydrocarbons (mg/kg) MADEP													
Unadjusted C11-C22 Aromatic	29.6		ND		ND		57.0		1000				25
C9-C18 Aliphatic Fraction	ND		ND		ND		ND		1000				
C19-C36 Aliphatic Fraction	ND		ND		ND		40.5		3000				
C11-C22 Aromatic Fraction	26.7		ND		ND		49.4		1000				
Total Petroleum Hydrocarbons (mg/kg)	41.4		12.9		29.2		43.4		1000	2,500	5,000	5,000 to 60,000 (Variable)	
Organochlorine Peticides (mg/kg) EPA 8081	ND		ND		ND		ND						
Polychlorinated Biphenyls (mg/kg) EPA Method 8082	ND		ND		ND		ND			<2	<2	<2	0.01
Herbicides (mg/kg) EPA 8151	ND		ND		ND		0.126						
Total Metals (mg/kg) EPA 6010C													
Arsenic	5.53		3.05		2.66		4.84		20	40	40	30	0.5
Cadmium	0.73		ND		0.31		0.48		2	30	80	11 to 30 (Var.)	0.1
Chromium	130.0	§	18.5		14.9		96.7	§	30	1,000	1,000	500	1
Copper	NS		NS		NS		NS		1,000				1
Mercury	0.098		0.045		0.011		0.085		20	10	10	3 to 10 (Var.)	0.02
Nickel	NS		NS		NS		NS		20				1
Lead	110		15		17		51		300	1,000	2,000	1,000	1
Zinc	NS		NS		NS		NS		2500				1
Reactivity (mg/kg) EPA 7.3.3, 7.3.4													
Cyanide	ND		ND		ND		ND						
Sulfide	ND		ND		ND		ND						
Conductivity (uS/cm) EPA 9050A	306		170		240		262			4,000	8,000		
Flashpoint (° F) EPA 1010	>200		>200		>200		>200						
Total Organic Carbon (%) EPA 9060	5.42		1.29		5.33		6.01						0.10
Water Content (%) SM 2540 G	48.5		19.6		23.7		94.9						
Total Volatile Solids (%) SM 2540G	NS		NS		NS		NS						
pH (mg/kg) EPA 9045	6.68		6.63		6.38		6.70						
TCLP Lead (mg/l) EPA 1311/6010B	N/A		N/A		N/A		N/A						

Notes:

1. Samples collected on January 4, 2019 by GZA personnel. Analyses performed by ESS Laboratory in Cranston, RI except for Grain Size Analysis which was subcontracted to Thielsch Engineering in Cranston, RI.
2. ND = Not Detected, NS = Not Sampled, NA = Not Applicable.
3. Massachusetts Contingency Plan (MCP) RC S-1 standards as per MCP CMR 40.1600; MA Lined & Unlined Landfill Criteria per Massachusetts State DEP Policy # COMM-97-001; Asphalt Batch Criteria per Massachusetts State DEP Policy # WSC 94-400.
4. Where RCS-1, MA Landfills, and Asphalt Batch Facility columns are blank, no limiting criteria has been established.
5. VOC and SVOC constituents that were not detected were omitted from this table.
6. TPH taken as sum of EPH fractions, in accordance with MassDEP guidance.
7. § = reported concentration exceeds the Massachusetts Contingency Plan (MCP) RC S-1 standards as per MCP CMR 40.1600
8. Bold text indicates that the reported concentration exceeds the disposal criteria for a MA Unlined Landfill.
9. Bold italicized text indicates that the reported concentration exceeds the disposal criteria for a MA Lined Landfill.
10. Asphalt batching facility criteria will vary, especially at out-of-state locations.

Peabody Bikeway - Phase II
Peabody, Massachusetts

TABLE 2
SUMMARY OF SUBSURFACE CONDITIONS

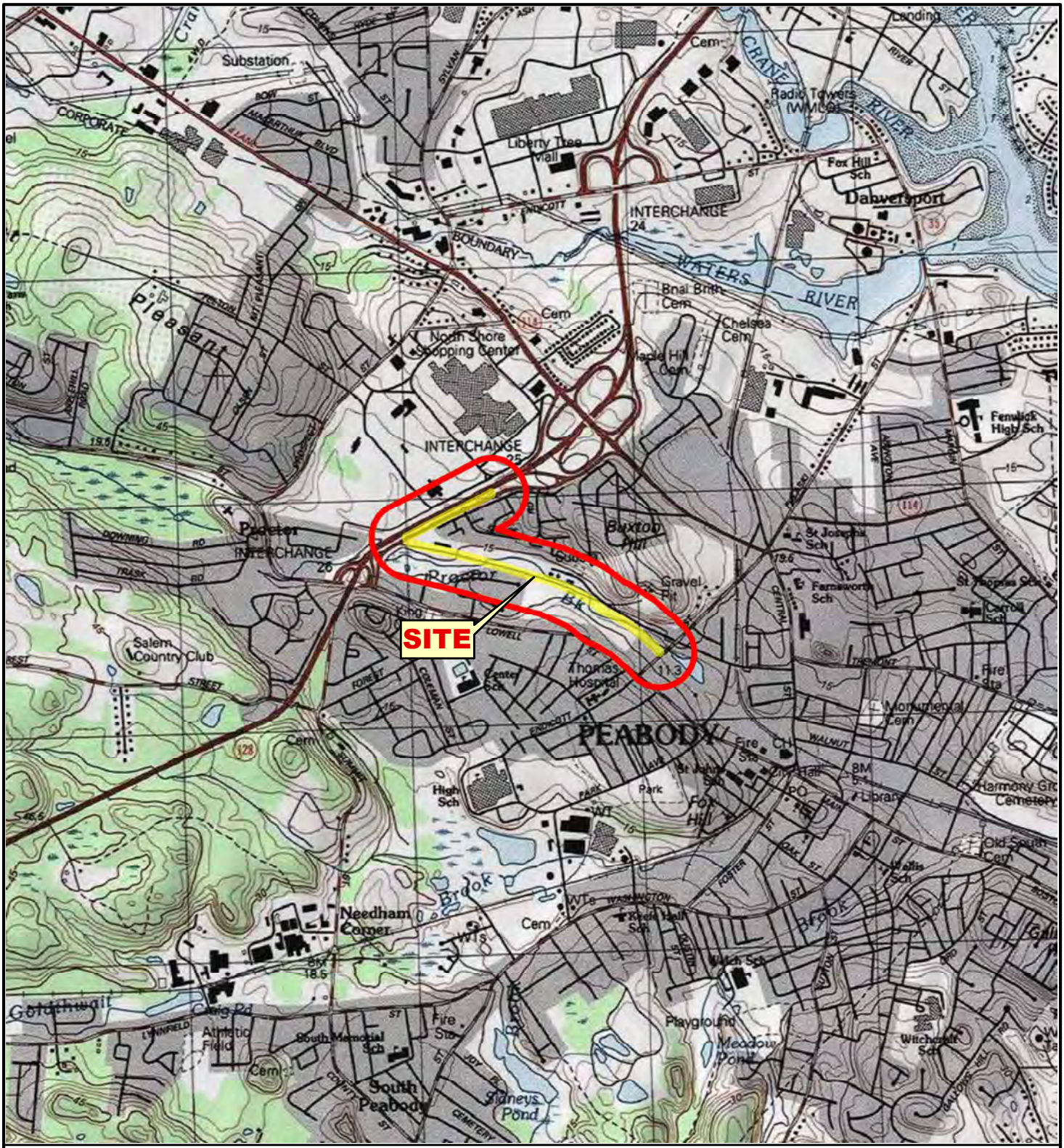
Boring No.	Boring Location[7]	Approximate Ground Surface Elevation[1,2] (ft)	Thickness of Fill/Topsoil (ft)	Depth / El. Top of Naturally Deposited Soil (ft)		Depth / El. Top of Bedrock[3] (ft)		Depth / El. Bottom of Boring (ft)		Depth / El. of Groundwater[4,5] (ft)	
B-1	North Shore Road Segment	68.6	5.3	5.3	63.3	15.3	53.3	15	53	6.5	62.1
B-2		68.4	4.0	4.0	64.4	10.5	57.9	11	58	10.0	58.4
B-3		62.3	8.0	8.0	54.3	14.7	47.6	15	48	NE	NE
B-4		51.8	3.5	3.5	48.3	17.0	34.8	17	35	9.5	42.3
B-5	Box Culverts	Not Yet Drilled									
B-6		40.5	2.0	2.0	38.5	25.9	14.6	26	15	3.5	37.0
B-7	Pedestrian Bridge	38.5	4.0	4.0	34.5	23.8	14.7	36	3	2.8	35.7
B-8		37.8	4.0	4.0	33.8	31.0	6.8	41	-3	5.8	32.0

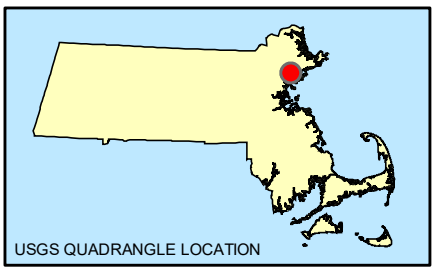
Notes:

1. Ground surface elevation estimated from electronic plan entitled Peabody Bike Path 2018 Merge Basempap-Final.DWG", provided by Green on 1/16/2019.
2. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).
3. Depth to top of bedrock for borings B-1 through B-6 is based on refusal to the split-spoon or auger. Rock coring not performed in these borings. Depth to bedrock for borings B-7 and B-8 was confirmed by rock coring. Top of rock noted in boring B-7 is top of competent rock. An approximate 1.2 feet of weathered rock was encountered prior to the start of rock coring.
4. NE = Not Encountered.
5. Refer to the boring logs for additional notes and stabilization times at the time of the measurement.

Proposal No. 609211-132091
A00829 - 308

Figures





SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED SEPTEMBER 26, 2018 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

PROJ. MGR.: MPS
DESIGNED BY: ZSM
REVIEWED BY: TMK
OPERATOR: EMD

DATE: 01-30-2019

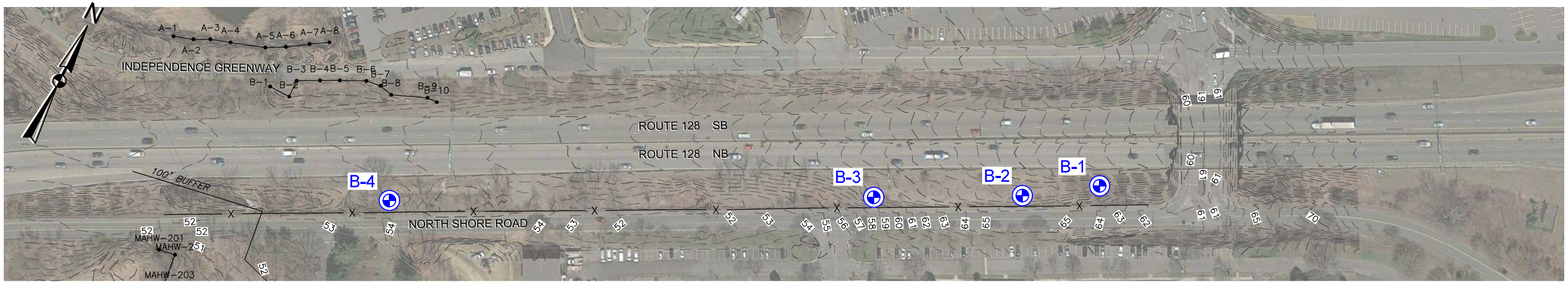
SITE LOCUS PLAN

PEABODY BIKEWAY - PHASE II
PEABODY, MASSACHUSETTS

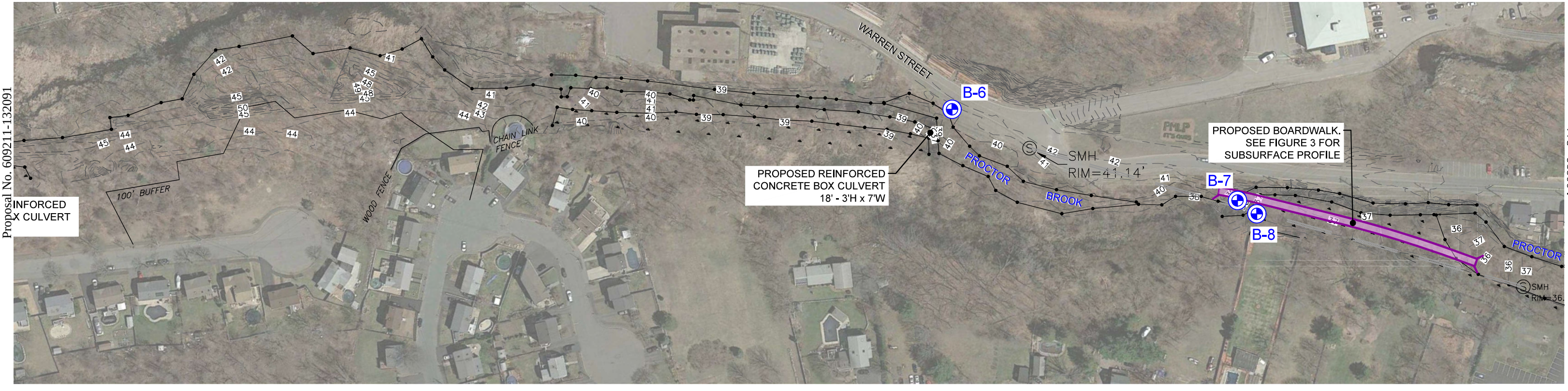
JOB NO.
01.0174019.00

FIGURE NO.
1

© 2019 - GZA GeoEnvironmental, Inc., J:\170,000-179,999\174019\174019-00.MPS\Figures_GIS\174019_SiteLocus_PeabodyBikePath_FIG1.mxd, 1/30/2019, 10:43:13 AM, elaine.donohue



NORTH SHORE ROAD BASE PLAN



LEGEND

SOIL BORING

PROCTOR BROOK BASE PLAN

0 75 150 300

BASEMAP SCALE IN FEET

AN

4000

LE IN FEET

NOTES:

1. THE BASEMAP WAS DEVELOPED FROM ELECTRONIC CAD FILE PLANS "Peabody Bike Path 2018 Merge Basemap-Final.DWG" PROVIDED BY GREEN INTERNATIONAL INC., ON 01/16/2019.
2. BORINGS WERE PERFORMED BY NEW ENGLAND BORING COMPANY OF DERRY, NEW HAMPSHIRE BETWEEN JANUARY 2 AND 15, 2019.
3. LOCATIONS OF BORINGS WERE LOCATED IN THE FIELD USING A TRIMBLE GPS UNIT. SEVERAL BORING LOCATIONS WERE MOVED IN THE FIELD DURING THE DRILLING PROGRAM BASED ON SITE ACCESS. REVISED LOCATIONS WERE BASED ON TAPED MEASUREMENTS FROM MARKED LOCATIONS. EXPLORATION LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.
4. TEST BORING B-5 WAS NOT PERFORMED DUE TO ACCESSIBILITY ISSUES BUT MAY BE DRILLED AT A LATER DATE AS A CONFIRMATION BORING DURING CONSTRUCTION.

NO.	DATE	ISSUE/DESCRIPTION	BY	REV'D	CHK'D
1	4/16/21	REVISE BRIDGE TO BOARDWALK / REMOVE WALLS	MPS	TMK	ARB

UNLESS SPECIFICALLY STATED BY WRITTE
GEOENVIRONMENTAL, INC. (GZA). THE INFO
CLIENT OR THE CLIENT'S DESIGNATED REPRE
THE DRAWING. THE DRAWING SHALL NOT BE
USE AT ANY OTHER LOCATION OR FOR ANY
TRANSFER, REUSE, OR MODIFICATION TO THE
EXPRESS CONSENT OF GZA, WILL BE AT TH

PEABODY
PEABODY

EXPLORATI

PREPARED BY:

GZA GeoEnvironme
Engineers and Scie
www.gza.com

PROJ MGR: MPS	REVIEWED BY
DESIGNED BY: ZSM	DRAWN BY:
DATE: 02-06-2019	PROJECT N 01.0174

Proposal No. 609211-132091

A00829 - 311

NO.	DATE	ISSUE/DESCRIPTION	BY	REV'D	CHK'D
1	4/16/21	REVISE BRIDGE TO BOARDWALK / REMOVE WALLS	MPS	TMK	ARB

PREPARED BY:

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PROJ. MGR: MPS | REVIEWED BY:

DESIGNED BY: ZSM | DRAWN BY:

DATE: 02-06-2019 | PROJECT NO. 01.0174C

PEABODY
PEABODY
ELEVAT
SUBSU

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, GEOENVIRONMENTAL, INC. (GZA), THE INFORMATION ON THIS DRAWING, THE DRAWING SHALL NOT BE USED BY THE CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE, NOR SHALL IT BE TRANSFERRED, REUSED, OR MODIFIED WITHOUT THE EXPRESS CONSENT OF GZA, AND ANY UNAUTHORIZED

HORIZONTAL: 0, 20

VERTICAL: 0, 4

LEGEND

LITHOLOGY

- FILL
- SAND
- SILT
- GLACIAL TILL
- WEATHERED BEDROCK
- BEDROCK

B7

35%
R
11

ELEVATION, FT (NAVD88)

10
0
-10
20
30
40
50

STATION, FT

351+00
352+00
353+00
354+00
355+00
356+00

PROPOSED APPROACH EMBANKMENT FILL (TYP)

PROPOSED GRADE / TOP OF BOARDWALK

EXISTING GRADE

PROPOSED EAST ABUTMENT ~STA 355+48

APPROX LIMITS OF PROPOSED BOARDWALK

100-YR STORM EL. 40.19±

25-YR STORM EL. 39.53±

POSED WEST ABUTMENT ~STA 351+09

B8

0%
0%
R
40
12
19
24
29
33
32
8

B7

35%
20%
R
44
20
11
6
6
5
12

Proposal No. 609211-132091

A00829 - 312

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of Green International Affiliates, Inc. (Green) for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in the Report) at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

COMPLIANCE WITH CODES AND REGULATIONS

9. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

ADDITIONAL SERVICES

10. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – GZA Boring Logs

Modified Burmister Soil Classification

Soil samples are visually classified by the Modified Burmister System using the following format and order:

1. Density or Consistency
2. Color
3. MAJOR SOIL TYPE
4. Minor Components
5. Special Components

Density or Consistency – Density or consistency estimates are based on the measured N-Values obtained from the Standard Penetration Test (SPT). For granular soils (sand, gravel, silt), density is reported. For plastic soils, consistency is reported. Broken gravel, if encountered at the tip of the spoon, is indicated on the log and will affect the measured SPT N-Value.

Table A-1: Density and Consistency of Soils

Granular Soils		Plastic Soils	
SPT N-Value	Relative Density	SPT N-Value	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

Color - The color of the soil matrix is estimated in the field by the engineer or geologist observing the borehole.

Major Soil Type - The soil type is determined by the major component of the soil that comprises 50% or more of the sample by weight. The major component in the description is capitalized (e.g. SAND, GRAVEL, SILT).

Table A-2: Soil Types/Components

Sieve Size	Description	Visual Description
Passing No. 200	SILT	No grains, cannot roll into thread
	Clayey SILT	Can roll into 1/4" thread*
	SILT & CLAY	Can roll into 1/8" thread*
	CLAY & SILT	Can roll into 1/16" thread*
	Silty CLAY	Can roll into 1/32" thread*
	CLAY	Can roll into 1/64" thread*
No. 200 – No. 40	Fine SAND	Finest Visible Particles
No. 40 – No. 10	Medium SAND	1/64 to 1/16"
No. 10 – No. 4	Coarse SAND	1/16 to 1/4"
No. 4 – 3/4 Inch	Fine GRAVEL	1/4 to 3/4"
3/4 Inch – 3 Inch	Coarse GRAVEL	
3 Inch – 6 Inch	Cobbles	
>6 Inch	Boulders	

* May need to moisten sample to determine thread diameter

Table A-3: Expanded Sand/Gravel Soil Descriptions

Granular Description	Proportions of Component
Fine	Less than 10% coarse and medium
Medium	Less than 10% coarse and fine
Fine to Medium	Less than 10% coarse
Medium to Coarse	Less than 10% fine
Fine to Coarse	All greater than 10%

Minor Components – Minor components are described after the major component in order of decreasing percentages. Only the first letter of the minor component is capitalized, except if "and" is used (e.g. trace Silt).

Table A-4: Definition of Proportional Terms

Proportional Term	Percent by Weight of Total Sample
and	35-50
some	20-35
little	10-20
trace	<10

Special Components – anthropogenic materials encountered in the fill such as Glass, Brick fragments, etc. Proportional terms used are occasional (<15% by weight) and frequent (15% or more by weight).

Modified ISRM Rock Classification

Rock cores are visually classified by the Modified ISRM System using the following format and order: Field hardness, weathering, grain size, color, ROCK TYPE, foliation thickness, foliation dip angle, foliation joint/fracture shape and roughness, foliation joint/fracture spacing, dip angle of other joints and fractures, condition of joint surfaces, other features such as minerals.

FIELD HARDNESS:
Very Hard – Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologists pick.
Hard – Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Medium – Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows from the point of a geologist's pick.
Soft – Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft – Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING:
Fresh – Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Slight – Rock generally fresh, joints stained, and discoloration and weathering effects. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate – Significant portions of rock show discoloration and weathering effects. In granitoid rock, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Severe – All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Complete – Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or Stringers.

GRAIN SIZE:
Fine Grained – Barely seen with naked eye.
Coarse Grained: 1/8 in. to 1/4 in.
Amorphous: Too small to be seen with naked eye.
Medium Grained: Barely seen with naked eye to 1/8 in.
Very Coarse Grained: >1/4 in.

DISCONTINUITIES:
Healed Joint – A partial or incomplete fracture.
Joint/Fracture – A simple fracture along which no shear displacement has occurred. May form sets.
Shear – A zone of fractures along which differential movement has taken place parallel to the surface sufficient to produce slickensides, striations, or polishing. May be accompanied by a zone of fractured rock up to a few inches wide.
Fault – A fracture along which there has been displacement and accompanying slickensides, striations, or polishing by gouge and/or severely fractured adjacent zone.
Shear or Fault Zone – A band or zone of parallel, closely spaced shears or faults accompanied by gouge, maylonite, and breccia.

Table A-5: Fractures and Foliation Spacing and Attitude

Fractures	Foliation	Spacing	Attitude	Angle
Very close	Very thin	Less than 2 in.	Horizontal	0° - 5°
Close	Thin	2 in. - 1 ft.	Subhorizontal	5° - 35°
Moderately close	Medium	1 ft. - 3 ft.	Moderately dipping	35° - 55°
Wide	Thick	3 ft. - 10 ft.	Subvertical	55° - 85°
Very Wide	Very thick	More than 10 ft.	Vertical	85° - 90°

Table A-6: Condition of Joint/Fracture Surfaces

Descriptive Term	Conditions
Planar	A flat surface
Curved	A curved surface
Irregular	Multi-curved surface
Slick	A polished and striated surface indicating sliding along a plane; also referred to as slickensided.
Smooth	Few irregularities, but no obvious indication of sliding; adjacent pieces of core can be slid past on another with relative ease.
Rough	Many irregularities; difficult to slide adjacent pieces of core by each other.

GZA reports the total core recovery and rock quality designation for each core run* on the boring logs. The definitions of these terms are as follows:

TOTAL CORE RECOVERY (REC)

$$\textbf{REC (\%)} = \frac{\text{Sum of Recovered Core}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\textbf{RQD (\%)} = \frac{\text{Sum of Lengths of intact Core with Full Diameter in Pieces 4 in. and Longer}}{\text{Length of Core Run}} \times 100$$

The RQD is in general accordance with methodology described by Deere and Deere (1988). In addition, significant vertical to sub-vertical foliation/cross-foliation joints/fractures occur within the rock mass and influence ground behavior. The length of core exhibiting the vertical to sub-vertical joints/fractures has been deducted from the RQD, which is consistent with the "pieces of intact rock core" criteria. The vertical to sub-vertical joints/fractures have been identified on the rock core or the upside divider in the core box with permanent "dots" spaced every 0.1 feet apart. These dots have been counted and entered in the fractures per foot column on the boring log.

* - RQD not reported for severely and/or completely weathered rock or core runs with length of 2.0 feet or less.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 68.6	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 15.3	**V. Datum:** NAVD88
		Date Start - Finish: 1/2/2019 - 1/2/2019	

Auger/Casing Type:	HSA
I.D/O.D.(in):	2.75/5.75
Hammer Weight (lb.):	-
Hammer Fall (in.):	-
Other:	-

Sampler Type:	Split Spoon
I.D./O.D. (in.):	1.375/2
Sampler Hmr Wt (lb):	140
Sampler Hmr Fall (in):	30
Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1030	6.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	1 2 2 3	4	S-1: (Top 7") Dry, dark brown, fine SAND and SILT, trace Roots. (TOPSOIL) (Bottom 7") Dry, brown, fine SAND, some Silt, trace Roots. (SUBSOIL)	1 2			FILL	
5		S-2	5-7	24	13	8 19 86 22	R	S-2: (Top 3") Moist, brown, fine to medium SAND, some Silt. (FILL) (Bottom 10") Moist, brown, fine to coarse SAND, little Silt, trace Gravel. (Piece of gravel stuck in tip of spoon.)			5.3		63.3'
		S-3	7-9	24	10	38 42 45 50	87	S-3: Very dense, wet, brown/gray, GRAVEL, some fine to coarse Sand, trace Silt.	3				
10		S-4	9-11	24	7	25 30 13 36	43	S-4: Dense, wet, brown, fine to medium SAND, some Silt, some Gravel.	4			GLACIAL DEPOSIT	
15		S-5	15-15.1	1	1	100/1"	R	S-5: Very dense, wet, brown/gray, GRAVEL, trace Silt. (Fragment of possible bedrock stuck in tip of spoon.)	5 6		15.3		53.3'
								Bottom of boring at 15.3 feet.					
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Borehole relocated approximately 25 feet from staked location due to access.
3. Driller noted increased drilling resistance at 6.5 feet below ground surface (bgs).
4. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 11 feet bgs.
5. Auger refusal at 15.3 feet bgs on possible bedrock. Borehole terminated.
6. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 68.4	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 10.5	**V. Datum:** NAVD88
		Date Start - Finish: 1/2/2019 - 1/2/2019	

Auger/Casing Type:	HSA
I.D/O.D.(in):	2.75/5.75
Hammer Weight (lb.):	-
Hammer Fall (in.):	-
Other:	-

Sampler Type:	Split Spoon
I.D./O.D. (in.):	1.375/2
Sampler Hmr Wt (lb):	140
Sampler Hmr Fall (in):	30
Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1230	10	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	1 4 27 36	31	S-1: (Top 10") Dry, dark brown, fine SAND, some Silt, trace Roots. (TOPSOIL) (Bottom 8") Dry, dark brown/black, fine to medium SAND, little Silt, trace Gravel.	1				
		S-2	2-4	24	20	30 56 40 36	96	S-2: Very dense, moist, black/gray, fine to coarse SAND, little Silt, trace Gravel.				FILL	
		S-3	4-6	24	9	28 11 19 17	30	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.			4		64.4'
5		S-4	6-8	24	14	70 25 20 20	45	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.	2			GLACIAL DEPOSIT	
10		S-5	10-10.3	3	0	100/3"	R	S-5: No recovery. (Fragments of possible bedrock stuck in tip of spoon.)	3 4		10.5		57.9'
								Bottom of boring at 10.5 feet.					
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 6.5 feet below ground surface (bgs).
3. Auger refusal at 10.5 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 62.3	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 14.7	**V. Datum:** NAVD88
		Date Start - Finish: 1/3/2019 - 1/3/2019	

Auger/Casing Type:	HSA
I.D/O.D.(in):	2.75/5.75
Hammer Weight (lb.):	-
Hammer Fall (in.):	-
Other:	-

Sampler Type:	Split Spoon
I.D./O.D. (in.):	1.375/2
Sampler Hmr Wt (lb):	140
Sampler Hmr Fall (in):	30
Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19		Not encountered		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	2 3 11 14	14	S-1: Medium dense, dry, dark brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots. (TOPSOIL)	1				
		S-2	2-4	24	18	14 35 72 69	R	S-2: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
5		S-3	4-6	24	14	27 11 12 14	23	S-3: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.				FILL	
		S-4	6-8	24	10	12 14 5 3	19	S-4: Very dense, moist, black with brown, GRAVEL and fine to coarse SAND, trace Silt, trace Ash.			8		54.3'
		S-5	8-10	24	9	3 6 9 14	15	S-5: Medium dense, moist, brown, fine to coarse SAND, little Gravel, trace Silt.				GLACIAL DEPOSIT	
10													
15		S-6	14.5-14.7	2	0	100/2"	R	S-6: No recovery.	2 3		14.7		47.6'
								Bottom of boring at 14.7 feet.					
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Auger refusal at 14.5 feet below ground surface (bgs) on possible bedrock. Advanced split spoon. Split spoon refusal at 14.7 feet bgs. Borehole terminated.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 51.8	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 17	**V. Datum:** NAVD88
		Date Start - Finish: 1/3/2019 - 1/3/2019	

Auger/Casing Type:	HSA
I.D/O.D.(in):	2.75/5.75
Hammer Weight (lb.):	-
Hammer Fall (in.):	-
Other:	-

Sampler Type:	Split Spoon
I.D./O.D. (in.):	1.375/2
Sampler Hmr Wt (lb):	140
Sampler Hmr Fall (in):	30
Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1145	9.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	9	3 2 3 2	5	S-1: Loose, dry, dark brown, fine to medium SAND, some Silt, trace Roots.	1			FILL	
		S-2	2-4	24	6	2 3 3 14	6	S-2: Loose, moist, brown, fine to coarse SAND, trace Gravel, trace Silt.			3.5		48.3'
5		S-3	4-6	24	14	12 15 23 17	38	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-4	6-8	24	13	13 20 19 19	39	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	6	15 21 30 21	51	S-5: Very dense, wet, brown, fine to coarse SAND, some Gravel, little Silt.	2			GLACIAL DEPOSIT	
15		S-6	15-16.9	23	12	12 18 69 100/5"	87	S-6: Very dense, wet, brown/gray, fine to coarse SAND, some Gravel, little Silt. (Possible bedrock fragments stuck in tip of spoon.)			17		34.8'
								Bottom of boring at 17 feet.	3 4				
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Driller noted increased drilling effort at 9 feet below ground surface (bgs).
3. Auger refusal at 17 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 40.5	
Logged By: Zachary Morris	**Drilling Method:** HSA/D&W	**Final Boring Depth (ft.):** 25.9	
		Date Start - Finish: 1/3/2019 - 1/3/2019	**V. Datum:** NAVD88

Auger/Casing Type: HSA/HW	**Sampler Type:** Split Spoon		
I.D/O.D.(in): 2.75/5.75 & 4.0/4.5	**I.D./O.D. (in.):** 1.375/2		
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140		
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30		
Other: Safety Hammer	**Other:** Auto Hammer		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1530	3.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	4 4 11 5	15	S-1: Medium dense, dry, dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1			FILL	
		S-2	2-4	24	14	9 6 5 6	11	S-2: Medium dense, wet, brown, fine to medium SAND and SILT, trace Gravel.			2		38.5'
5		S-3	4-6	24	14	4 8 10 14	18	S-3: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt.					
		S-4	6-8	24	19	13 16 17 16	33	S-4: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
10		S-5	10-12	24	16	6 11 19 28	30	S-5: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.	2				
15		S-6	14-16	24	7	4 5 6 6	11	S-6: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.				SAND AND GRAVEL	
20		S-7	19-21	24	8	5 6 5 5	11	S-7: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
25		S-8	24-25.9	22	10	16 14 22 100/2"	36	S-8: Dense, wet, brown/gray, fine to coarse SAND and GRAVEL, trace Silt. (Possible bedrock fragments stuck in tip of spoon.)			25.9		14.6'
								Bottom of boring at 25.9 feet.	3				
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Hole appears to have blown in prior to sampling S-5. Blow counts at S-5 may be inaccurate. Driller removed augers and offset 4 feet southeast of staked location and continued hole with 4-inch casing. Samples S-6 through S-8 obtained using drive and wash drilling methods.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-6

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 1 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 38.5	
Logged By: Doug Maguire	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	
		Date Start - Finish: 1/4/2019 - 1/4/2019	**V. Datum:** NAVD88

Auger/Casing Type: HW	**Sampler Type:** Split Spoon		
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375/2		
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140		
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30		
Other: Safety Hammer	**Other:** Auto Hammer		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/4/19	1300	2.8	24	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	2 5 7 4	12	S-1: Medium dense, dark brown, fine to coarse SAND, little Gravel, little Silt, trace Wood, trace Roots.	1 2				
		S-2	2-4	24	9	2 2 3 1	5	S-2: Loose, gray-brown to dark brown, fine to medium SAND, little Silt, little Gravel, trace Roots.	3			FILL/TOPSOIL	
		S-3	4-6	24	9	3 2 4 4	6	S-3: Loose, gray-brown, fine to medium SAND, little Gravel, little Silt, 3/4" seam of Clayey Silt 4" from bottom.			4		34.5'
5		S-4	6-8	24	12	2 3 3 3	6	S-4: (Top 5") Brown, fine to coarse SAND, some Silt, little Gravel. (Bottom 7") Gray, fine to medium SAND, little Gravel, little Silt.					
		S-5	8-10	24	12	5 5 6 6	11	S-5: Medium dense, brown to gray with orange, fine to medium SAND, some Gravel, little Silt. Silt observed 5-6" from bottom.					
10												SAND AND GRAVEL	
15		S-6	14-16	24	9	6 9 11 11	20	S-6: Medium dense, light brown, fine to medium SAND, some Gravel, little (-) Silt.	4 5				
									6		17.5		21.0'
												SILT & CLAY	
		S-7	19-21	24	14	21 23 21 22	44	S-7: (Top 3") Light brown, SILT & CLAY, trace fine Sand, trace Gravel. (Bottom 11") Light brown, fine to medium SAND, some Gravel, some Silt.			19.3		19.2'
20												GLACIAL DEPOSIT	
		S-8	24-24.2	2	2	100/2"	R	S-8: Very dense, gray, GRAVEL, little fine Sand, little Clayey Silt.	7		23.8		14.7'
25											25	WEATHERED BEDROCK	13.5'
	min/ft	C-1	26-31	60	56			C-1: Hard to medium hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, subhorizontal to subvertical joints/fractures. RQD=20%	8			BEDROCK	
	2:00												
	1:30												
	2:30												
30	2:30												

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 5.5 feet south of staked location due to restricted access and overhead wires.
3. Continuous sampling performed from sampling depths 0 to 10 feet below ground surface (bgs). Driller advanced 4-inch casing down as sampling advanced. The casing was advanced to 14 feet bgs following sampling of S-5.
4. Standard sampling performed from sample depths 14 to 24.2 feet bgs.
5. Driller advanced 4-inch casing from 14 to 24 feet bgs.
6. Clayey Silt observed in drill cuttings from 17.5 to 19 feet bgs.
7. Weathered Bedrock fragments and increased drill effort observed at 23.8 feet bgs.
8. Cored bedrock with a downward pressure of 500 psi at 1,350 rpm in 3rd gear using an NX core barrel.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 2 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
35	2:45 2:30 2:45 3:00 3:00 2:45	C-2	31-36	60	60			C-2: Hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, moderately dipping to subvertical joints/fractures. RQD=35%				BEDROCK	
											36		2.5'
								Bottom of boring at 36 feet.	9				
40													
45													
50													
55													
60													
65													

REMARKS

9. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 1 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Soil Scout	**Ground Surface Elev. (ft.):** 37.8	
Logged By: Doug Maguire	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 41	
		Date Start - Finish: 1/15/2019 - 1/15/2019	**V. Datum:** NAVD88

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375/2	
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30	
Other: Safety Hammer	**Other:** Safety Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/15/19	1520	5.8	29.5	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	11	6 4 4 6	8	S-1: (Top 6") Brown to light brown, fine to medium SAND, some Gravel, trace Silt, trace Roots.	1				
								(Bottom 5") Dark brown, Organic CLAY & SILT, some fine to	2				
		S-2	2-4	24	5	21 18 14 28	32	medium Sand, little Brick, trace Roots, trace Glass.	3			FILL	
								S-2: Hard, dark brown, CLAY & SILT, some fine to medium Sand,			4		33.8'
5		S-3	4-6	24	7	18 15 18 12	33	little Gravel, trace Roots.					
								S-3: Dense, gray-brown, fine to coarse SAND, some Gravel, some Clayey Silt.					
		S-4	6-8	24	15	17 16 13 14	29	S-4: Medium dense, light brown to gray, fine to coarse SAND, some Clayey Silt, some Gravel.					
		S-5	8-10	24	8	16 11 13 13	24	S-5: Dense, light brown, fine to medium SAND, some Gravel, little Silt.					
10												SAND AND GRAVEL	
15		S-6	14-16	24	7	6 10 9 10	19	S-6: Medium dense, light brown, fine to medium SAND, little Silt, trace (+) Gravel.					
											19.2		18.6'
20		S-7	19-21	24	12	6 6 6 7	12	S-7: (Top 2") Light brown, fine to medium SAND, little Silt.					
								(Bottom 10") Brown-gray, SILT & CLAY, trace fine Sand.				SILT & CLAY	
											22.5		15.3'
25		S-8	24-26	24	6	26 22 18 23	40	S-8: Dense, gray-brown, fine to coarse SAND, some Silt, some Gravel.				GLACIAL DEPOSIT	
30		S-9	29-29.4	5	5	100/5"	R	S-9: Very dense, gray, GRAVEL, some fine to coarse Sand, little (-)			30		7.8'

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 3.5 feet south due to restricted access.
3. Advanced boring using 4-inch casing from sample depths 0 to 29 feet below ground surface (bgs).
4. Consistent coarse sand-sized rock fragments observed in drill cuttings from sample depths 30 to 31 feet bgs.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 2 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
	min/ft							Silt.	4				
	3:00	C-1	31-36	60	42			C-1: Hard, slightly to moderately weathered, coarse to medium grained, gray with purple, GRANITE, rough, irregular to planar, very close, subvertical to subhorizontal joints/fractures. RQD=0%	5				
	3:45												
	4:30												
35	5:15												
	4:15								6			BEDROCK	
	4:45	C-2	36-41	60	60			C-2: Hard, slightly weathered, coarse to medium grained, gray with pink and purple, GRANITE, rough, irregular to planar, very close, subhorizontal to subvertical joints/fractures. RQD=0%					
	5:15												
	4:30												
40	4:30												
	3:30										41		-3.2'
								Bottom of boring at 41 feet.	7				
45													
50													
55													
60													
65													

REMARKS

5. Drill rig did not have a downward pressure or RPM gauge. Cored bedrock in 3rd gear using an NX core barrel.
6. Core barrel jammed with no loss of water at sample depths 35.1 and 38.3 feet bgs.
7. Borehole backfilled to approximate ground surface with drill cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

Appendix D – Geotechnical Laboratory Test Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/16/2019

LABORATORY TESTING DATA SHEET

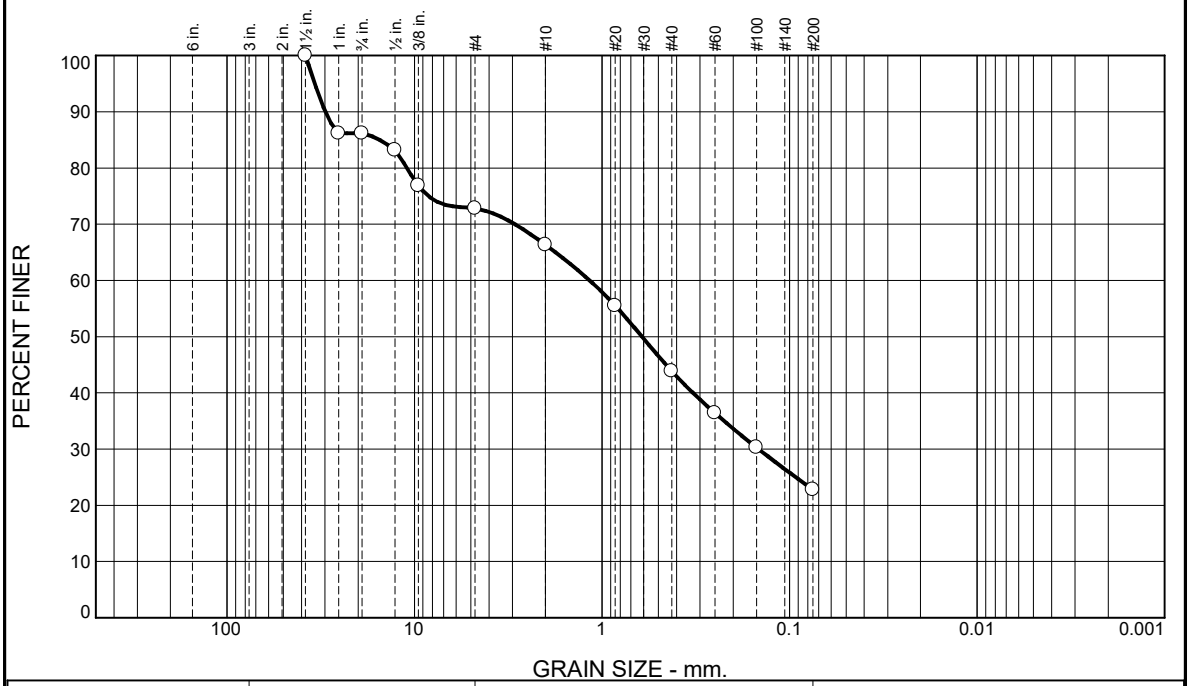
Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
B-2	S-3	4-6	S-9				27.2	50.0	22.8											Brown f-c SAND, some f-c Gravel, some Silt
B-3	S-4	6-8	S-10				53.6	41.3	5.1											Dark Brown f-c GRAVEL and f-c SAND, trace Silt
B-6	S-4	6-8	S-11				6.8	84.5	8.7											Light Brown f-c SAND, trace Silt, trace fine Gravel
B-7	S-5	8-10	S-12				27.9	61.1	11.0											Dark Brown f-m SAND, some fine Gravel, little Silt

Reviewed By Sth Bo

01.16.2019

Proposal No. 609211-132091
A00829 - 329

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.8	13.4	6.5	22.4	21.1	22.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	86.2		
3/4"	86.2		
1/2"	83.2		
3/8"	76.9		
#4	72.8		
#10	66.3		
#20	55.5		
#40	43.9		
#60	36.4		
#100	30.3		
#200	22.8		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, some Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 29.8357 D_{85}= 15.3436 D_{60}= 1.1650
D_{50}= 0.6121 D_{30}= 0.1465 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 4-6' **Date Sampled:**
Sample Number: B-2 / S-3

Thielsch Engineering Inc.

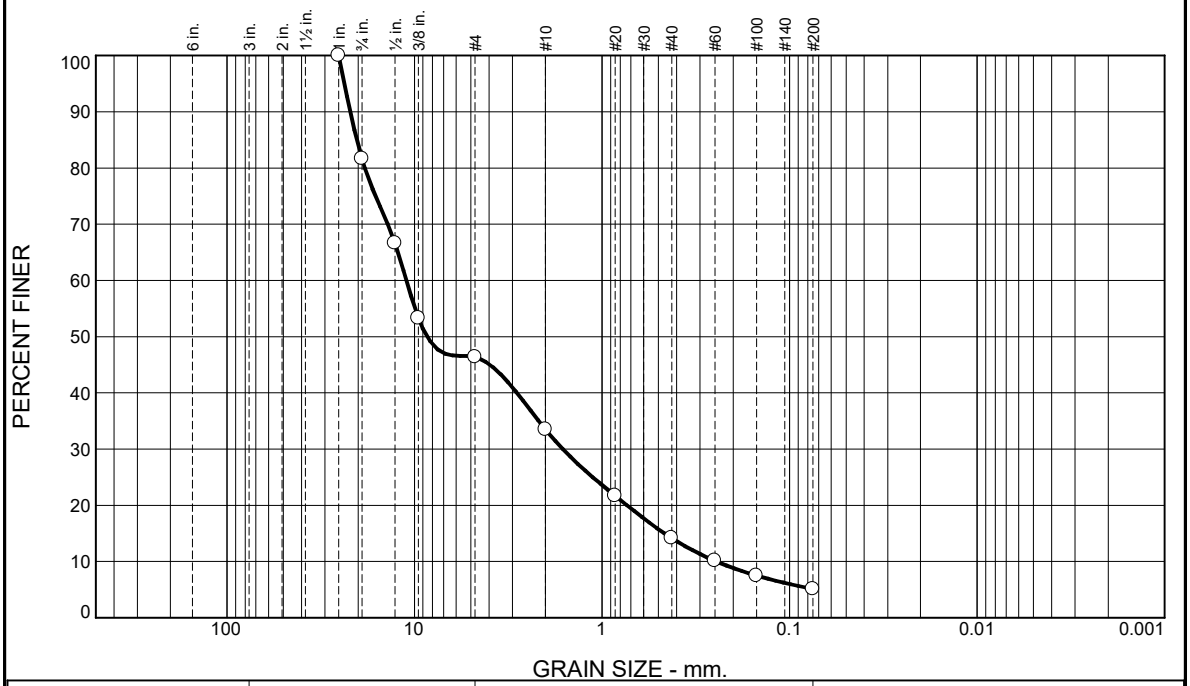
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.3	35.3	12.9	19.3	9.1	5.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	81.7		
0.5"	66.6		
0.375"	53.3		
#4	46.4		
#10	33.5		
#20	21.7		
#40	14.2		
#60	10.1		
#100	7.5		
#200	5.1		

* (no specification provided)

Material Description

Dark Brown f-c GRAVEL and f-c SAND, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GP-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 21.9730 D_{85}= 20.2661 D_{60}= 11.0467
D_{50}= 8.5608 D_{30}= 1.6167 D_{15}= 0.4639
D_{10}= 0.2452 C_u= 45.05 C_c= 0.97

Remarks

Sample contains asphalt and urban debris.

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 6-8' **Date Sampled:**
Sample Number: B-3 / S-4

Thielsch Engineering Inc.

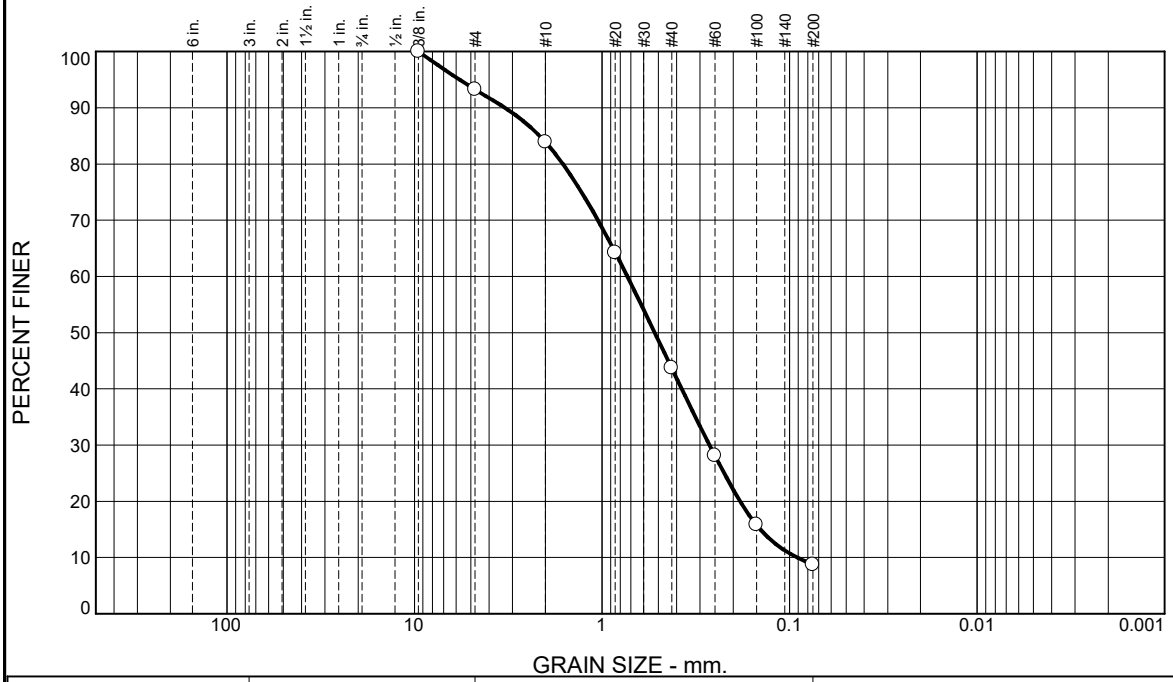
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.8	9.3	40.2	35.0	8.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	93.2		
#10	83.9		
#20	64.2		
#40	43.7		
#60	28.1		
#100	15.8		
#200	8.7		

* (no specification provided)

Material Description

Light Brown f-c SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 3.3007 D_{85}= 2.1523 D_{60}= 0.7332
D_{50}= 0.5236 D_{30}= 0.2672 D_{15}= 0.1431
D_{10}= 0.0909 C_u= 8.07 C_c= 1.07

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 6-8' **Date Sampled:**
Sample Number: B-6 / S-4

Thielsch Engineering Inc.

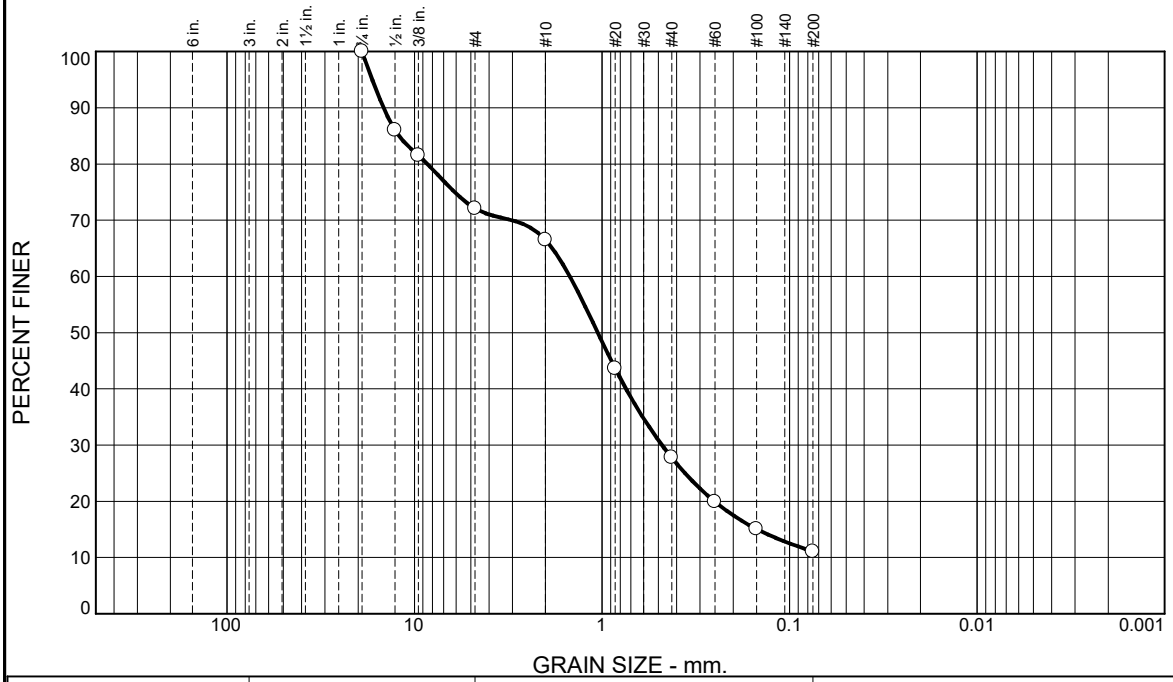
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	27.9	5.6	38.7	16.8	11.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	86.0		
0.375"	81.5		
#4	72.1		
#10	66.5		
#20	43.6		
#40	27.8		
#60	19.9		
#100	15.1		
#200	11.0		

* (no specification provided)

Material Description

Dark Brown f-m SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.6216 D_{85}= 12.1017 D_{60}= 1.4842
D_{50}= 1.0542 D_{30}= 0.4789 D_{15}= 0.1486
D_{10}= C_u= C_c=

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 8-10' **Date Sampled:**
Sample Number: B-7 / S-5

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-12

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

LABORATORY TESTING DATA SHEET

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f-c Gravel, little Silt

Reviewed By SAH

01.14.2019

Proposal No. 609211-132091

A00829 - 334

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Michael Smith
Assigned By: Michael Smith
Collected By: Glenn LaRose, Zach Morris

Project Information:
Peabody Bikeway
Peabody, MA
ESS Project Number: 1901077
Summary Page: 1 of 1
Report Date: 1.10.19

LABORATORY TESTING DATA SHEET

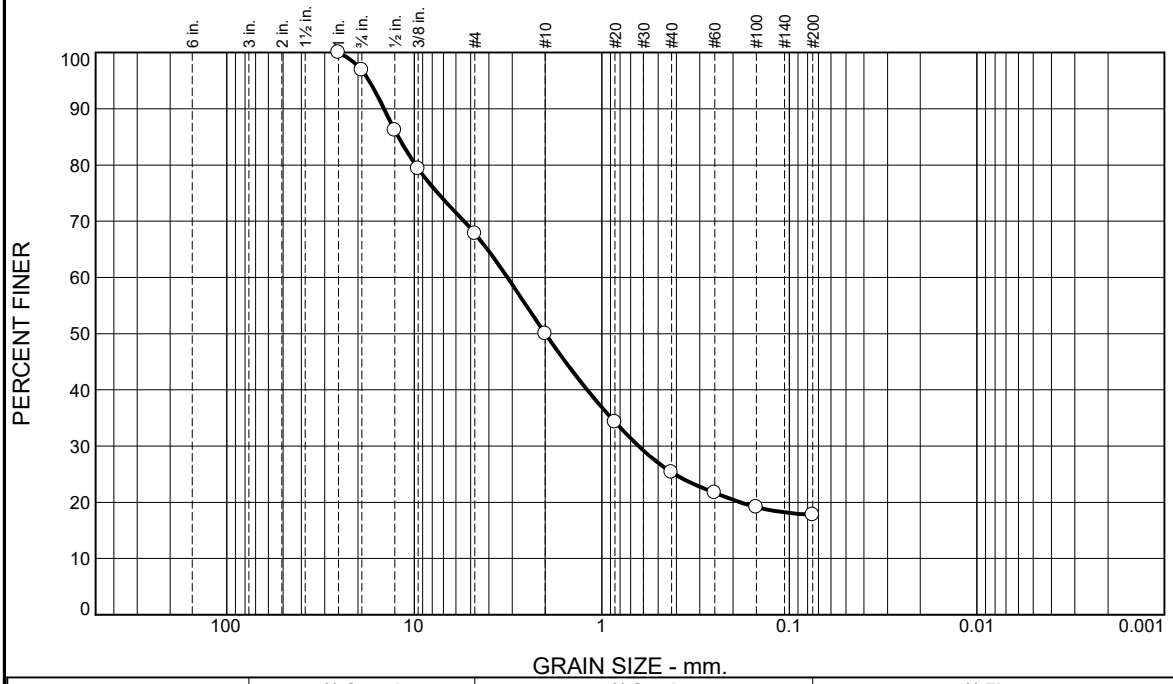
Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge	Left Bank	0-2	19-S-013	48.5						10.7										Organic Only
Bridge	Right Bank	0-2	19-S-014	19.6						1.8										Organic Only
B-5	Culvert	0-2	19-S-015	23.7			32.2	50.1	17.7	1.8										Black Organic f-c SAND, some fine Gravel, little Silt
B-6	Culvert	0-2	19-S-016	94.9			40.9	44.0	15.1	10.2										Black Organic f-c SAND and f-c GRAVEL, little Silt

Reviewed By Sth 60

01.14.2019

Proposal No. 609211-132091
A00829 - 335

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	29.1	17.8	24.6	7.7	17.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.9		
0.5"	86.2		
0.375"	79.3		
#4	67.8		
#10	50.0		
#20	34.3		
#40	25.4		
#60	21.7		
#100	19.1		
#200	17.7		

* (no specification provided)

Material Description

Black Organic f-c SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.5059 D_{85}= 12.1566 D_{60}= 3.1859
D_{50}= 2.0007 D_{30}= 0.6368 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

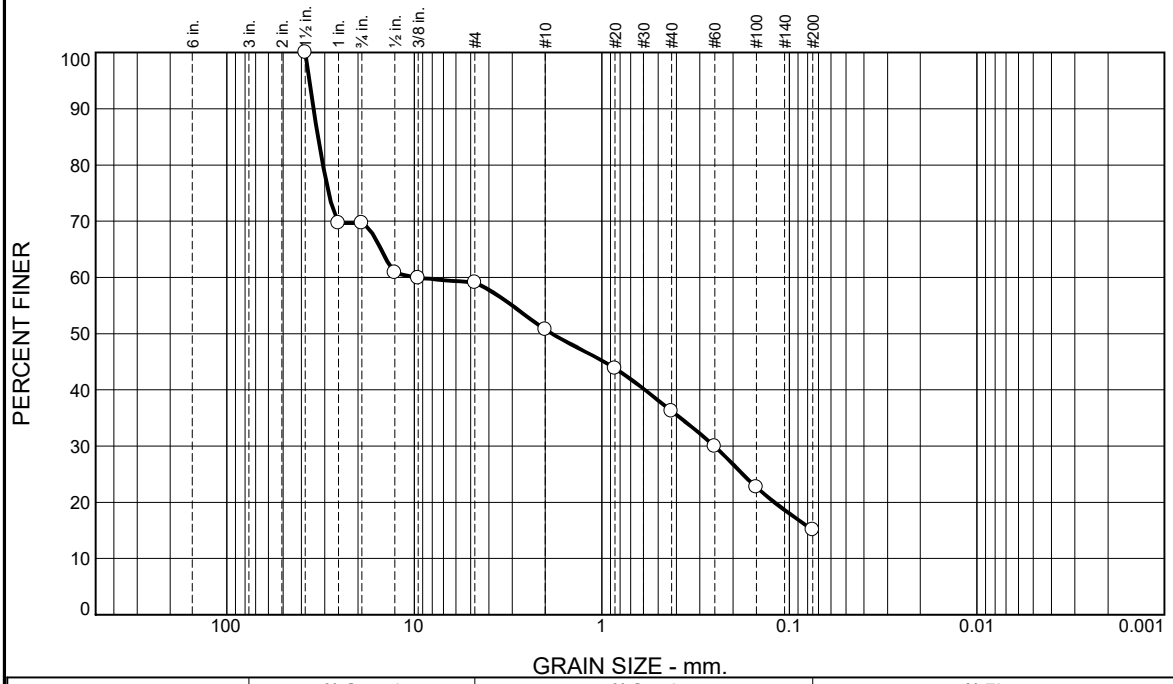
Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B5 / Culvert

Thielsch Engineering Inc.
Cranston, RI

Client: ESS
Project: Peabody Bikeway
Peabody, MA
Project No: 1901077 **Figure** 1901077-03

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.3	10.6	8.4	14.5	21.1	15.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	69.7		
3/4"	69.7		
1/2"	60.8		
3/8"	59.9		
#4	59.1		
#10	50.7		
#20	43.8		
#40	36.2		
#60	29.9		
#100	22.7		
#200	15.1		

* (no specification provided)

Material Description

Black Organic f-c SAND and f-c GRAVEL, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 34.4095 D_{85}= 32.5903 D_{60}= 9.8653
D_{50}= 1.8449 D_{30}= 0.2513 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

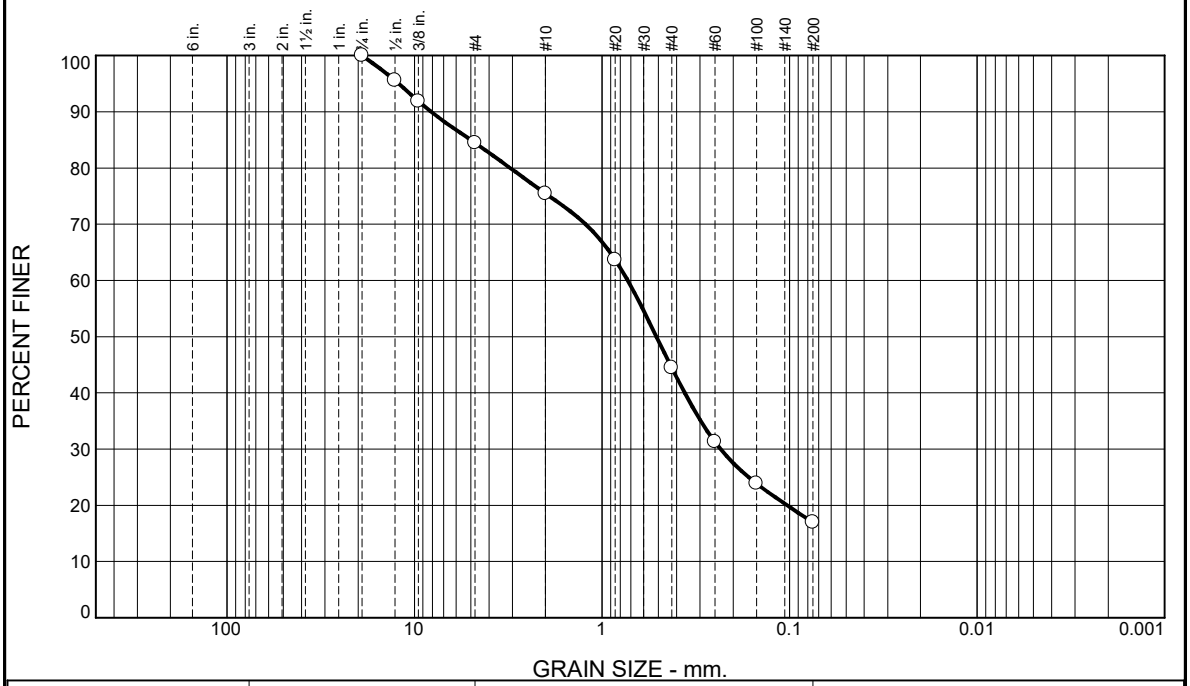
Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B6 / Culvert

Thielsch Engineering Inc.
Cranston, RI

Client: ESS
Project: Peabody Bikeway
Peabody, MA
Project No: 1901077 **Figure** 1901077-04

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.6	8.9	31.0	27.5	17.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	95.6		
0.375"	91.9		
#4	84.4		
#10	75.5		
#20	63.6		
#40	44.5		
#60	31.3		
#100	23.9		
#200	17.0		

* (no specification provided)

Material Description

Brown f-c SAND, little Silt, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 8.1481 D_{85}= 5.0207 D_{60}= 0.7300
D_{50}= 0.5128 D_{30}= 0.2334 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 1

Thielsch Engineering Inc.

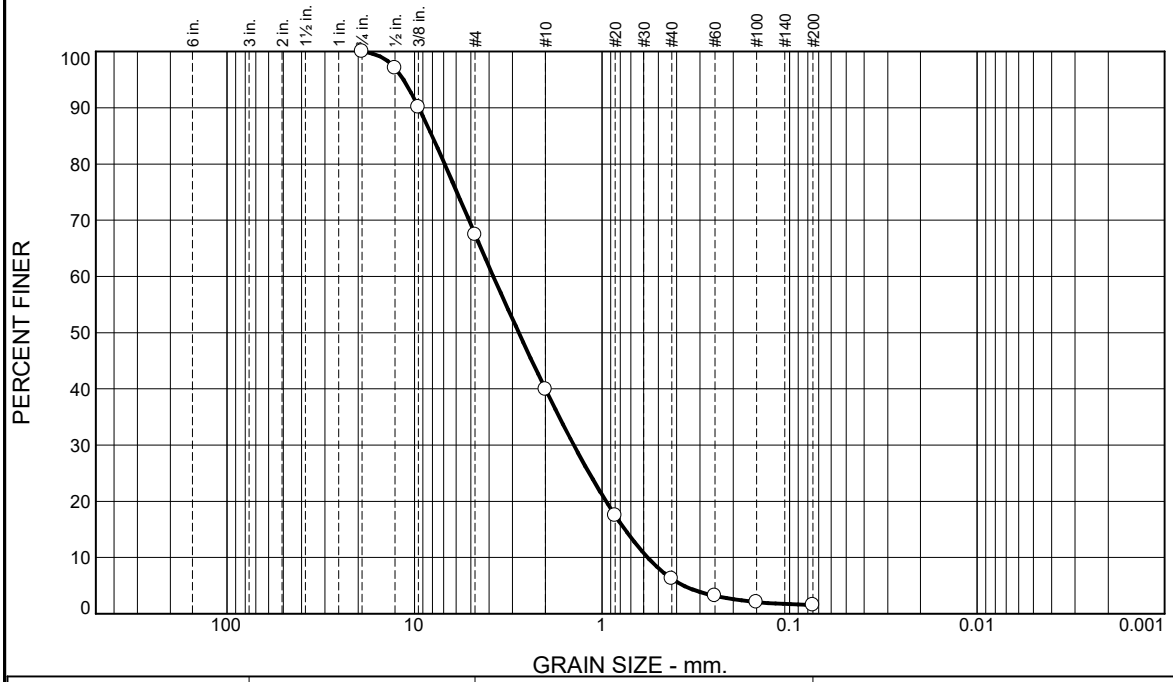
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	32.6	27.5	33.7	4.6	1.6	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.1		
0.375"	90.1		
#4	67.4		
#10	39.9		
#20	17.5		
#40	6.2		
#60	3.2		
#100	2.1		
#200	1.6		

* (no specification provided)

Material Description

Brown m-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 9.4954 D_{85}= 8.0567 D_{60}= 3.7970
D_{50}= 2.7818 D_{30}= 1.4137 D_{15}= 0.7552
D_{10}= 0.5709 C_u= 6.65 C_c= 0.92

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

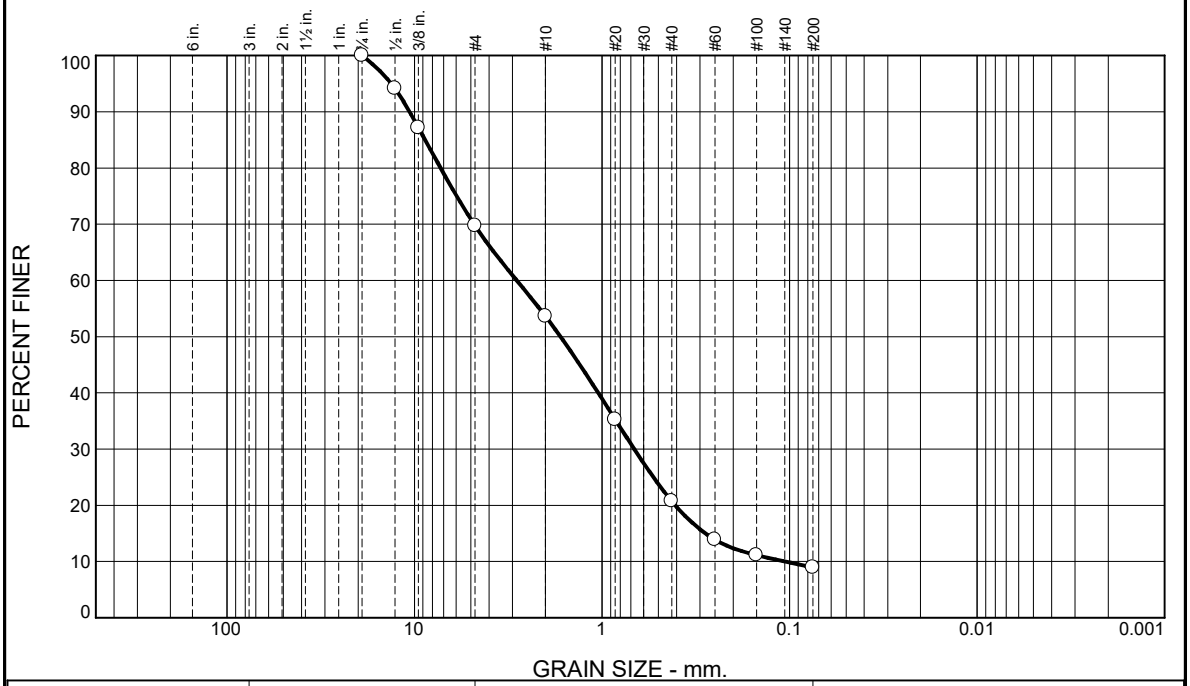
Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 2

Thielsch Engineering Inc.
Cranston, RI

Client: Green International, Inc.
Project: Greenway Extension - Peabody Bikeway
Peabody, MA
Project No: 01.0174019.00 **Figure** S-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.3	16.1	32.9	11.7	9.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.1		
0.375"	87.2		
#4	69.7		
#10	53.6		
#20	35.2		
#40	20.7		
#60	13.9		
#100	11.1		
#200	9.0		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 10.6243 D_{85}= 8.7796 D_{60}= 2.8502
D_{50}= 1.6634 D_{30}= 0.6736 D_{15}= 0.2815
D_{10}= 0.1064 C_u= 26.78 C_c= 1.50

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

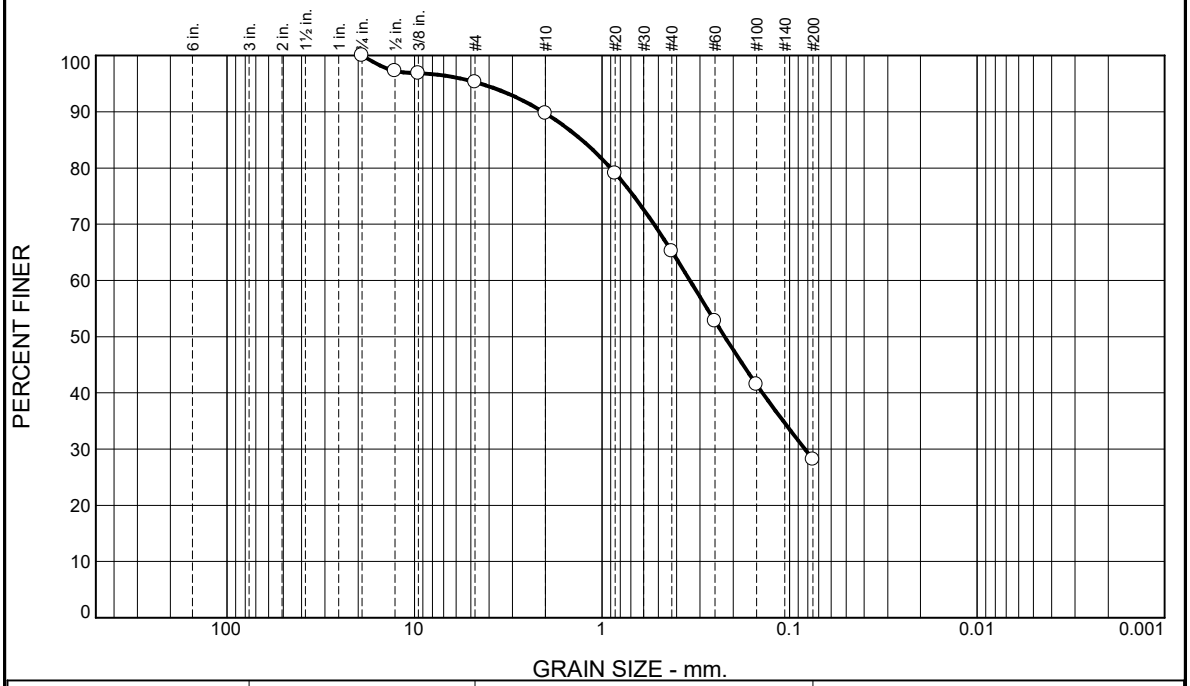
Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 3

Thielsch Engineering Inc.
Cranston, RI

Client: Green International, Inc.
Project: Greenway Extension - Peabody Bikeway
Peabody, MA
Project No: 01.0174019.00 **Figure** S-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.7	5.6	24.5	37.1	28.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.2		
0.375"	96.9		
#4	95.3		
#10	89.7		
#20	79.0		
#40	65.2		
#60	52.8		
#100	41.5		
#200	28.1		

* (no specification provided)

Material Description

Brown f-m SAND, some Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 2.0671 D_{85}= 1.2838 D_{60}= 0.3397
D_{50}= 0.2216 D_{30}= 0.0829 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 4

Thielsch Engineering Inc.

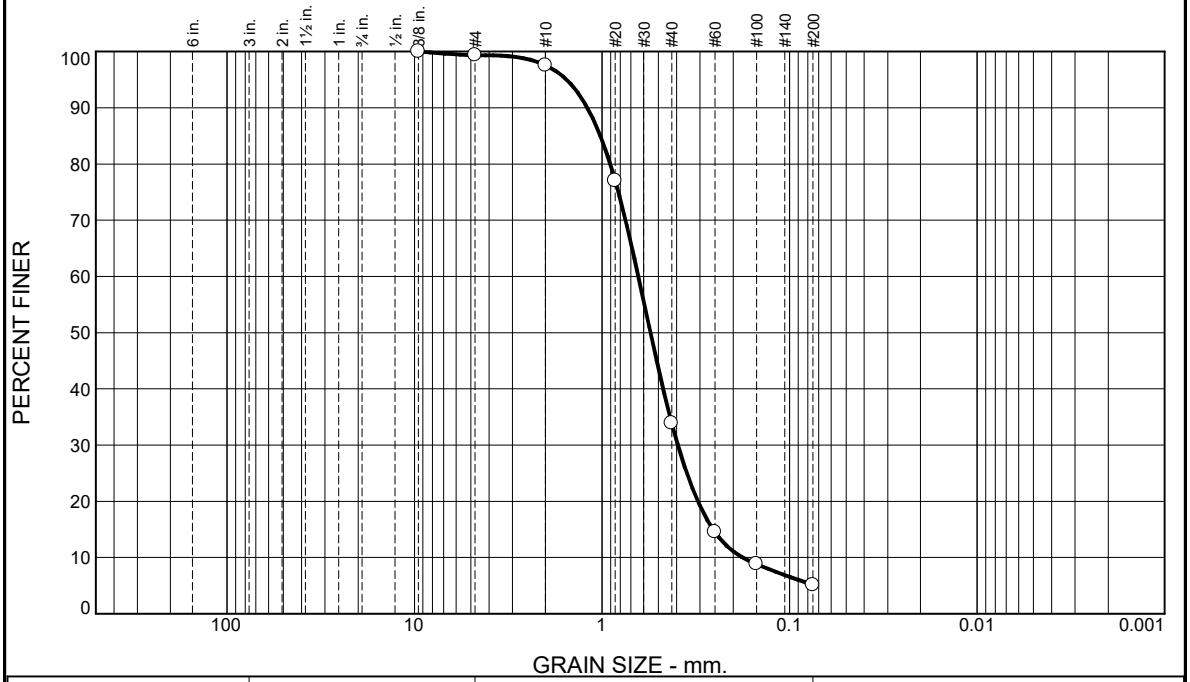
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	1.9	63.6	28.8	5.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.4		
#10	97.5		
#20	77.0		
#40	33.9		
#60	14.5		
#100	8.8		
#200	5.1		

* (no specification provided)

Material Description

Brown f-m SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 1.1977 D_{85}= 1.0207 D_{60}= 0.6404
D_{50}= 0.5512 D_{30}= 0.3941 D_{15}= 0.2556
D_{10}= 0.1779 C_u= 3.60 C_c= 1.36

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

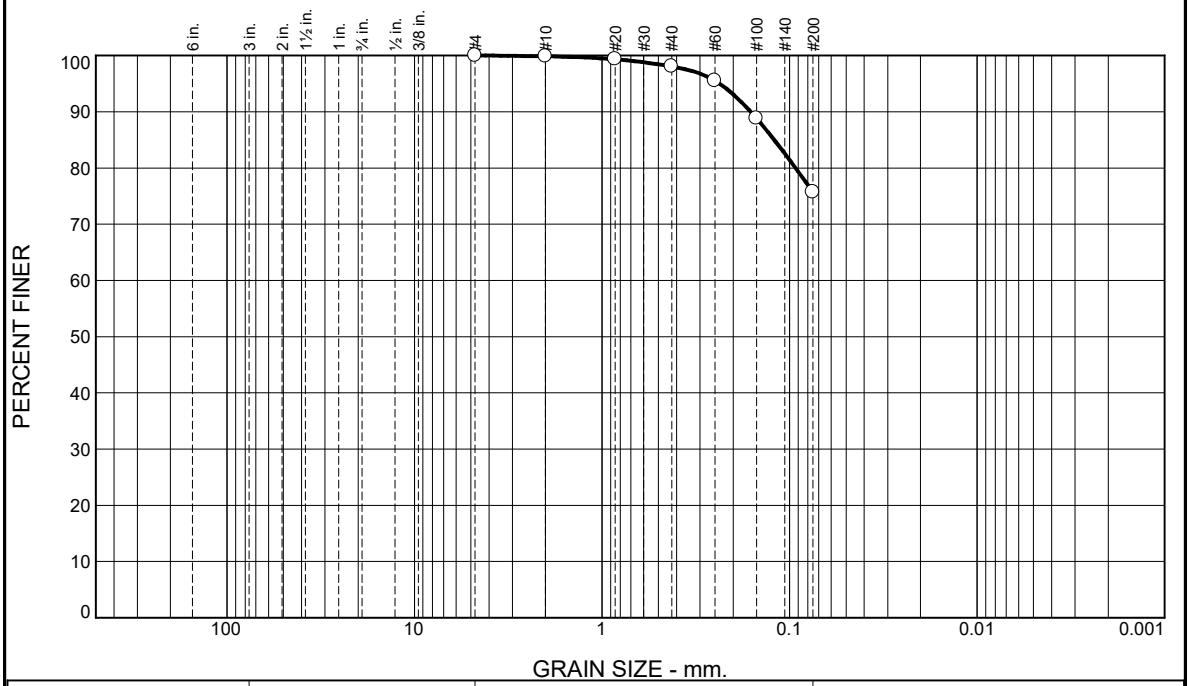
Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 5

Thielsch Engineering Inc.
Cranston, RI

Client: Green International, Inc.
Project: Greenway Extension - Peabody Bikeway
Peabody, MA
Project No: 01.0174019.00 **Figure** S-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.9	22.3	75.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.3		
#40	98.0		
#60	95.5		
#100	88.8		
#200	75.7		

* (no specification provided)

Material Description

Brown SILT, some fine Sand

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.1612 D_{85}= 0.1207 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 6

Thielsch Engineering Inc.

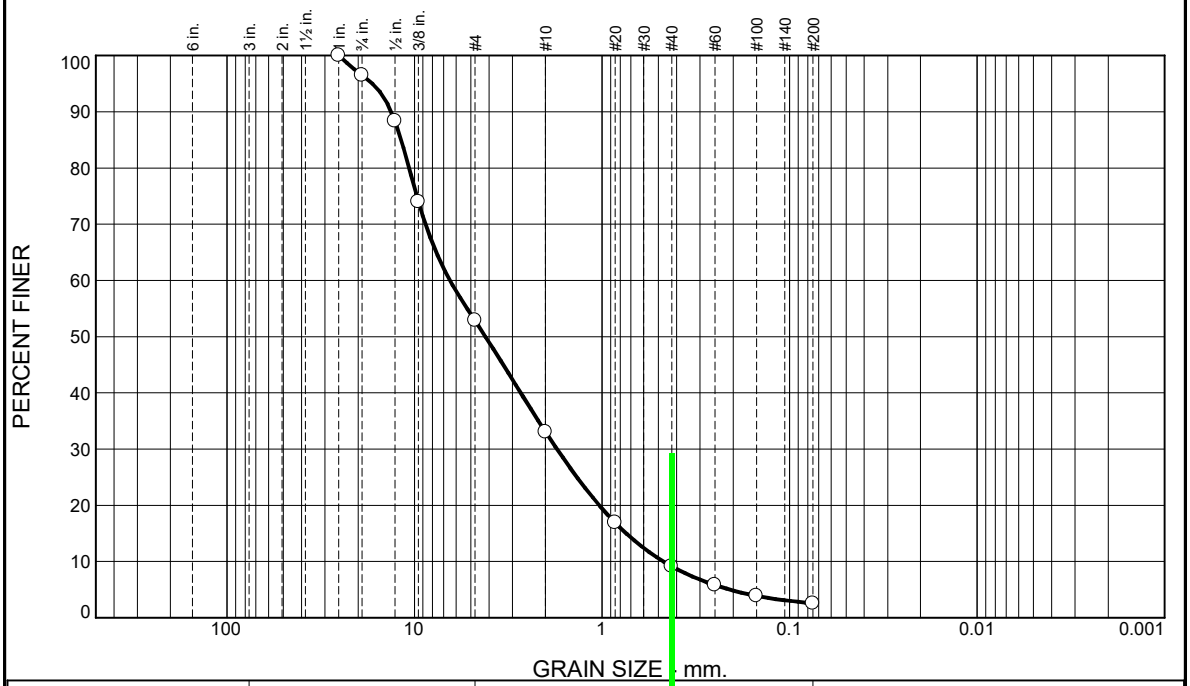
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	43.7	19.8	23.9	6.6	2.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.5		
0.5"	88.3		
0.375"	74.0		
#4	52.8		
#10	33.0		
#20	16.9		
#40	9.1		
#60	5.8		
#100	3.9		
#200	2.5		

* (no specification provided)

Material Description

Brown f-c SAND and fine GRAVEL, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 13.2913 D_{85}= 11.7790 D_{60}= 6.4677
D_{50}= 4.1824 D_{30}= 1.7381 D_{15}= 0.7425
D_{10}= 0.4702 C_u= 13.75 C_c= 0.99

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

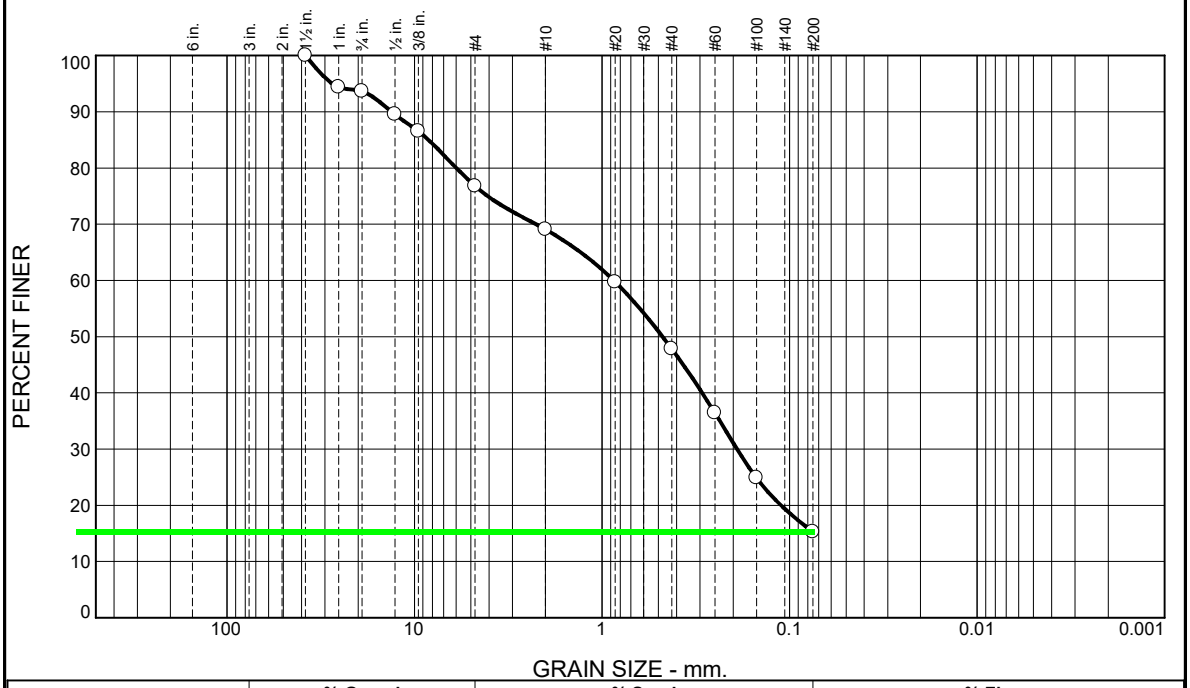
Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 7

Thielsch Engineering Inc.
Cranston, RI

Client: Green International, Inc.
Project: Greenway Extension - Peabody Bikeway
Peabody, MA
Project No: 01.0174019.00 **Figure** S-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.4	16.8	7.7	21.3	32.5	15.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	94.4		
0.75"	93.6		
0.5"	89.5		
0.375"	86.5		
#4	76.8		
#10	69.1		
#20	59.7		
#40	47.8		
#60	36.4		
#100	24.9		
#200	15.3		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 13.2491 D_{85}= 8.4302 D_{60}= 0.8673
D_{50}= 0.4754 D_{30}= 0.1904 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 8

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-8

GZA GeoEnvironmental, Inc.

Proposal No. 609211-132091

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography provided by the Massachusetts Geographic Information System. This information was created from photography dated 2005.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

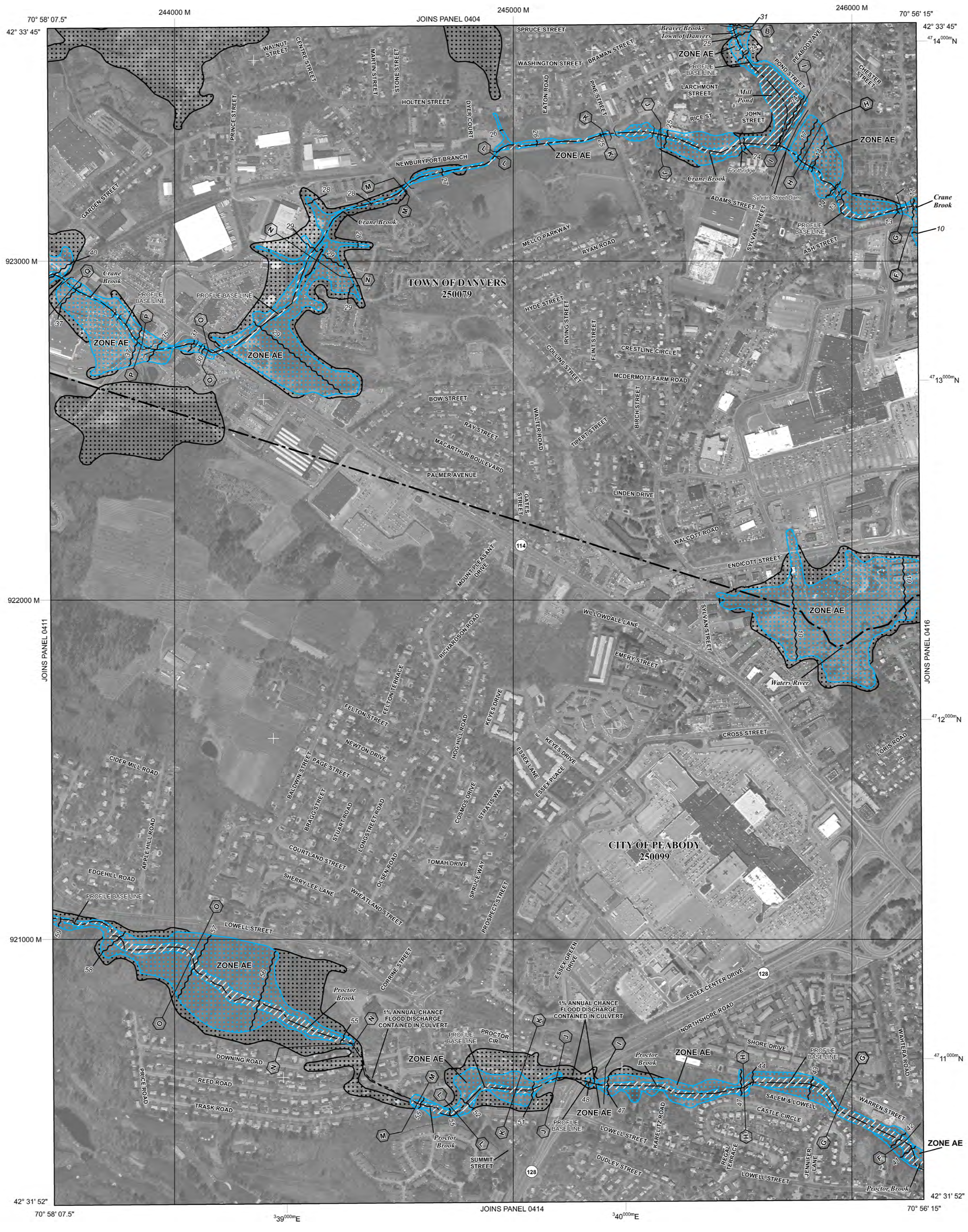
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4989000 M	1000-meter ticks: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection
4989 000mN	1000-meter Universal Transverse Mercator grid values, zone 19N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 3, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0412F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 412 OF 600
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DANVERS, TOWN OF	250079	0412	F
PEABODY, CITY OF	250099	0412	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25009C0412F
EFFECTIVE DATE
JULY 3, 2012

Federal Emergency Management Agency

A00829_347

TABLE 6 – SUMMARY OF DISCHARGES-continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
unnamed Tributary downstream of Abandoned dam					
NORTH BEVERLY DRAINAGE DITCH					
Upstream of Boston and Maine Railroad embankment in	1.16	174	253	290	393
NORTH RIVER AND PROCTOR BROOK					
At Salem corporate Limits	9.96	640	990	1,140	1,620
Upstream of Strongwater Brook	8.86	580	880	1,030	1,470
Upstream of Goldthwaite Brook	3.52	240	360	420	610
Upstream of State Route 128	2.52	170	260	310	450
Upstream of Downing Road	2.10	150	240	280	420
150 feet upstream of Downing Road	1.48	140	220	260	380
Downstream of Albert Road	1.22	130	200	230	340
NORTH TRIBUTARY BROOK					
At Pikes Bridge Road	1.35	70	125	150	170
PARKERS RIVER(TOWN OF BOXFORD)					
At downstream Corporate Limits	3.60	170	270	325	460

Appendix C: Supporting Calculations

- Recharge Volume Calculations
- Water Quality Calculations
- TSS Removal Calculations
- Pretreatment Calculations
- HydroCAD Storage Table
- Rip Rap Sizing for Culverts

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

RECHARGE VOLUME CALCULATIONS

Date: October 11, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Recharge Volume Design

Objective: Size infiltration BMPs that will approximate the annual recharge from the existing conditions.

Methodology: MA Department of Environmental Protection (DEP) Massachusetts Stormwater Handbook (Vol.3, Ch.1)

Design Criteria: Required recharge volume equals a depth of runoff corresponding to the soil type times the increase in impervious areas covering that soil type at the post-development site.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Grou	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Essex County of Massachusetts. The site is comprised of 'A' and 'B' soils.

Required Drawdown Time: Maximum of 72 Hours using the following equation:

$$\text{Drawdown Time} = \frac{R_v}{(KxA_{Bot})}$$

R_v = Required Recharge Volume
K = Permeability
A_{Bot} = Bottom area of trench

Calculation Results:

Designation	Total Volume Required (cf)	Net Increase Volume Required (cf)	Receiving Volume Required (cf)	Volume Provided (cf)
Infiltration Trench 1	**8,000**	**2,348**	**926**	**1,415**

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

Recharge Volume
Required: **Total Impervious Area Recharge Required for Entire Projecct**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	3.455	0.60	7,525
B	0.374	0.35	475
C	0.000	0.25	0
D	0.000	0.10	0
Total	3.829		**8,000**

Recharge Volume
Required: **Net Increase Impervious Area Recharge Required**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	1.078	0.60	2,348
B	0.000	0.35	0
C	0.000	0.25	0
D	0.000	0.10	0
Total	1.078		**2,348**

Recharge Volume
Required: **Receiving Impervious Area Required**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	0.425	0.60	926
B	0.000	0.35	0
C	0.000	0.25	0
D	0.000	0.10	0
Total	0.425		**926**

Recharge Volume
Provided: **METHOD USED:** STATIC

Drainage Area to Infiltration Trench

R_v = storage below lowest outlet (weir) = **1,415** cf (Elev. 51.20'*)
A_{Bot} = bottom area (irregular) = 1,600 sf (Elev. 48.52'*)
*See HydroCAD

R_v cf	K in/hr	A_{Bot} sf	Drawdown Time Hours		
926	2.41	1,600	**2.88**	**<**	**72 Hours**

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

WATER QUALITY CALCULATIONS

Date: October 11, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Objective: To determine the required Water Quality Volume (WQV) for adequate stormwater treatment

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 3, Ch. 1)

Design Criteria: Volume to be treated =0.5" x Post Development Impervious Area

Critical Areas (include ORW, ACEC, recharge areas for public water supplies (Zone Is, Zone IIs and Interim Wellhead Protection Areas for ground water sources and Zone As for surface water sources), bathing beaches, cold water fisheries, shellfish growing areas and LUHPPL's

The project is not within a critical area; therefore,

Volume to be treated = 0.5" x Receiving Impervious Area

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Infiltration Trench 1	**6,864**	**1,415**

Volume to be Treated:

Total proposed receiving impervious area including outside of LOW: **164,744** sf
Total Treatment volume required: **6,864 cf**

WQv = storage provided below lowest outlet = **1,415 cf**

0
0

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Peabody Independence Greenway Extension DP-4

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Trench	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 17118
Prepared By: BV
Date: 1/25/2023

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Proposal No. 609211-132091

A00829 - 355

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

PRETREATMENT CALCULATION

Date: February 2, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Objective: To determine the required pretreatment Volume for adaqute stormwater treatment. This project is a redevelopment and is required to meet this Standard (4) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 2, Ch. 2)

Design Criteria: Volume to be treated = (0.1" x Required Water Quality Volume)

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Impervious Area to Infiltration Trench 1	**154**	**251**

Volume to be Treated:

Impervious Area to Infiltration Trench 1

Total Proposed Impervious Area: 18,524 sf
Total Treatment Volume: **154 cf**

Volume Provided:

Pretreatment volume of Crushed Stone Shoulder

Top Elevation = 51.52 Area of contour = 1,670 sf
Bottom Elev = 51.02 Area of contour = 1,670 sf Storage Volume*: **251**

Dewatering check:

Volume cf	K in/hr	A_{Bot} sf	Time Hours		
251	2.41	1,670	**0.75**	<	**72 Hours**

*Assumes 30% voids within crushed stone shoulder for pretreatment

Stage-Area-Storage for Pond 2P: Infiltration Trench (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
50.60	1,600	1,098
50.61	1,600	1,104
50.62	1,600	1,109
50.63	1,600	1,114
50.64	1,600	1,119
50.65	1,600	1,125
50.66	1,600	1,130
50.67	1,600	1,135
50.68	1,600	1,140
50.69	1,600	1,146
50.70	1,600	1,151
50.71	1,600	1,156
50.72	1,600	1,162
50.73	1,600	1,167
50.74	1,600	1,172
50.75	1,600	1,177
50.76	1,600	1,183
50.77	1,600	1,188
50.78	1,600	1,193
50.79	1,600	1,199
50.80	1,600	1,204
50.81	1,600	1,209
50.82	1,600	1,214
50.83	1,600	1,220
50.84	1,600	1,225
50.85	1,600	1,230
50.86	1,600	1,236
50.87	1,600	1,241
50.88	1,600	1,246
50.89	1,600	1,251
50.90	1,600	1,257
50.91	1,600	1,262
50.92	1,600	1,267
50.93	1,600	1,272
50.94	1,600	1,278
50.95	1,600	1,283
50.96	1,600	1,288
50.97	1,600	1,294
50.98	1,600	1,299
50.99	1,600	1,304
51.00	1,600	1,309
51.01	1,600	1,315
51.02	1,600	1,320
51.03	1,600	1,325
51.04	1,600	1,331
51.05	1,600	1,336
51.06	1,600	1,341
51.07	1,600	1,346
51.08	1,600	1,352
51.09	1,600	1,357
51.10	1,600	1,362
51.11	1,600	1,368
51.12	1,600	1,373
51.13	1,600	1,378
51.14	1,600	1,383
51.15	1,600	1,389
51.16	1,600	1,394
51.17	1,600	1,399
51.18	1,600	1,404
51.19	1,600	1,410
51.20	1,600	1,415
51.21	1,600	1,420
51.22	1,600	1,426
51.23	1,600	1,431
51.24	1,600	1,436
51.25	1,600	1,441
51.26	1,600	1,447
51.27	1,600	1,452
51.28	1,600	1,457
51.29	1,600	1,463
51.30	1,600	1,468
51.31	1,600	1,473
51.32	1,600	1,478
51.33	1,600	1,484
51.34	1,600	1,489
51.35	1,600	1,494
51.36	1,600	1,500
51.37	1,600	1,505
51.38	1,600	1,510
51.39	1,600	1,515
51.40	1,600	1,521
51.41	1,600	1,526
51.42	1,600	1,531
51.43	1,600	1,536
51.44	1,600	1,542
51.45	1,600	1,547
51.46	1,600	1,552
51.47	1,600	1,558
51.48	1,600	1,563
51.49	1,600	1,568
51.50	1,600	1,573
51.51	1,600	1,579
51.52	1,600	**1,584**

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft		
g=	32.2	ft/s^2		
Q=	277	cfs		
TW=	0.9	ft		
D_{50}=	0.61	ft		
	7.36	in		
	186.90	mm	Use Class 2	Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length=	4.00 x	5.97	
	24 ft		
Apron Depth=	3.30 x	0.61	
	2.0 ft		
Apron Width=	34 ft		
(Figure 10.4)			

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 340+10		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	2.50	ft		
g=	32.2	ft/s^2		
Q=	55	cfs		
TW=	1	ft		
D_{50}=	0.49	ft		
	5.85	in		
	148.51	mm	Use Class 1	Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length=	4.00	x	2.50
	10	ft	
Apron Depth=	3.50	x	0.49
	1.7	ft	
Apron Width= (Figure 10.4)	14	ft	

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 342+25		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	2.00	ft		
g=	32.2	ft/s^2		
Q=	49	cfs		
TW=	1	ft		
D_{50}=	0.70	ft		
	8.44	in		
	214.29	mm	Use Class 2	Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length=	4.00	x	2.00
	8	ft	
Apron Depth=	3.30	x	0.70
	2.3	ft	
Apron Width= (Figure 10.4)	11	ft	

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.53	ft
g=	32.2	ft/s^2
Q=	134	cfs
TW=	1	ft
D_{50}=	0.25	ft
	3.01	in
	76.37	mm

Use Class 1 Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

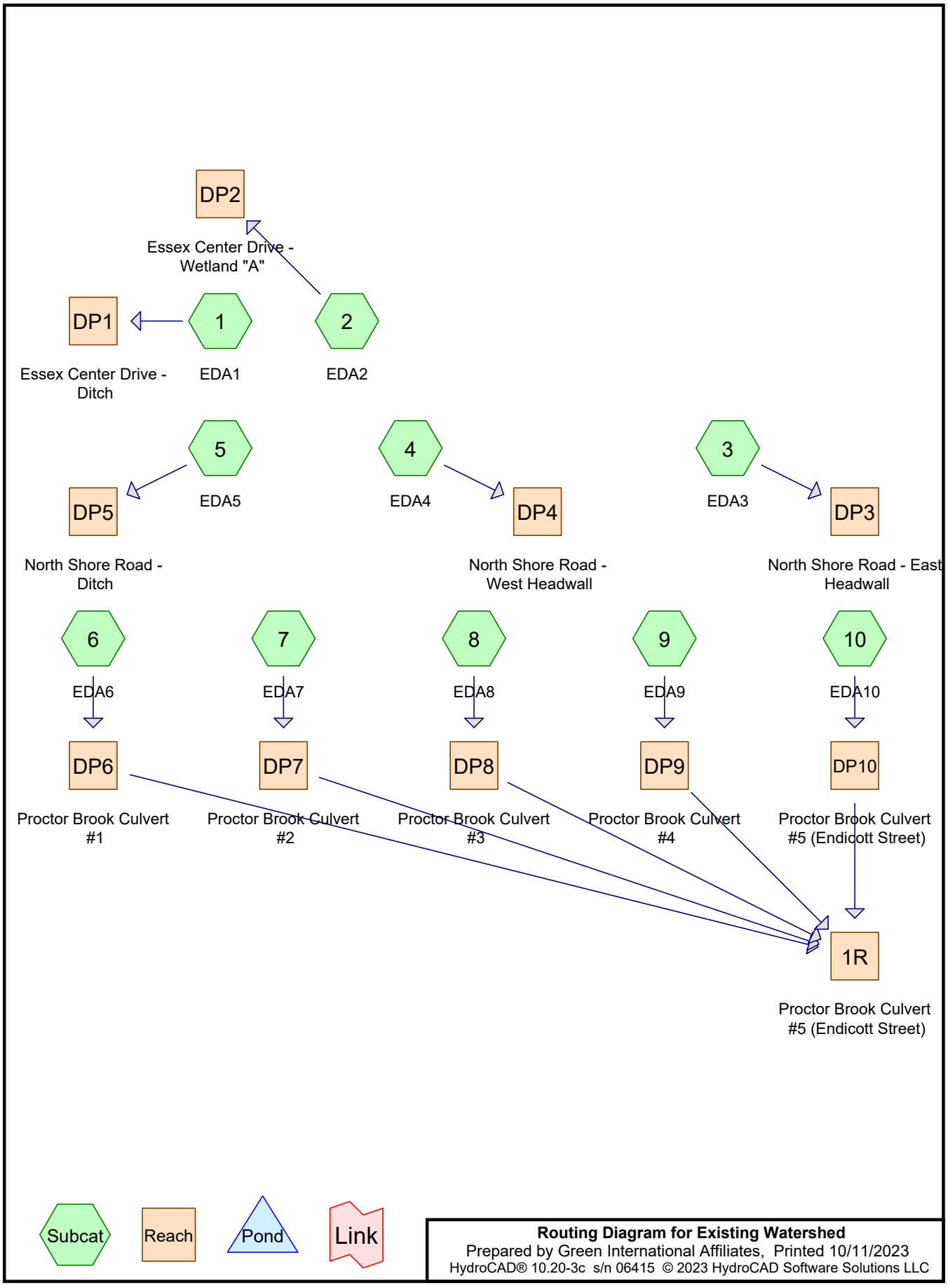
Apron Length= 4.00 x 5.53 = 22 ft

Apron Depth= 3.50 x 0.25 = 1 ft

Apron Width= 31 ft
(Figure 10.4)

Appendix D: Hydraulic and Hydrologic Data

- Existing Conditions HydroCAD Calculations
- Proposed Conditions HydroCAD Calculations
- Proctor Brook StreamStats
- Proctor Brook Culvert Hydraulic and Scour Analysis Summary Report


DP2
Essex Center Drive - Wetland "A"
DP1
1
2
Essex Center Drive - Ditch
EDA1
EDA2
5
4
3
DP5
EDA5
EDA4
DP4
EDA3
DP3
North Shore Road - Ditch
North Shore Road - West Headwall
North Shore Road - East Headwall
6
7
8
9
10
EDA6
EDA7
EDA8
EDA9
EDA10
DP6
DP7
DP8
DP9
DP10
Proctor Brook Culvert #1
Proctor Brook Culvert #2
Proctor Brook Culvert #3
Proctor Brook Culvert #4
Proctor Brook Culvert #5 (Endicott Street)
1R
Proctor Brook Culvert #5 (Endicott Street)
Subcat
Reach
Pond
Link
Routing Diagram for Existing Watershed
Prepared by Green International Affiliates, Printed 10/11/2023
HydroCAD® 10.20-3c s/n 06415 © 2023 HydroCAD Software Solutions LLC

Existing Watershed

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.15	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.83	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.16	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.94	2

Existing Watershed

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.066	49	50-75% Grass cover, Fair, HSG A (1, 3, 4, 5)
0.584	39	>75% Grass cover, Good, HSG A (2)
0.084	76	Gravel roads, HSG A (2)
2.751	98	Unconnected pavement, HSG A (1, 2, 3, 4, 5)
0.200	98	Water Surface, HSG A (7, 9, 10)
1.190	32	Woods/grass comb., Good, HSG A (6, 7, 8)
1.195	69	Woods/grass comb., Good, HSG B/D (6, 7, 8, 9, 10)
10.070	**63**	**TOTAL AREA**

Existing Watershed

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.875	HSG A	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
1.195	HSG B	6, 7, 8, 9, 10
0.000	HSG C	
0.000	HSG D	
0.000	Other	
10.070		**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=0.12"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.04 cfs 0.021 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=1.64"
Tc=6.0 min CN=84 Runoff=4.90 cfs 0.355 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=70 Runoff=0.44 cfs 0.036 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=0.24"
Tc=6.0 min UI Adjusted CN=55 Runoff=0.14 cfs 0.029 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=0.21"
Tc=6.0 min UI Adjusted CN=54 Runoff=0.06 cfs 0.013 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=0.10"
Tc=6.0 min CN=49 Runoff=0.01 cfs 0.007 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=0.07"
Tc=6.0 min CN=47 Runoff=0.01 cfs 0.004 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=70 Runoff=0.28 cfs 0.023 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=1.95"
Tc=6.0 min CN=88 Runoff=0.65 cfs 0.047 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.92 cfs 0.081 af
Outflow=0.92 cfs 0.081 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.04 cfs 0.021 af
Outflow=0.04 cfs 0.021 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.65 cfs 0.047 af
Outflow=0.65 cfs 0.047 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=4.90 cfs 0.355 af
Outflow=4.90 cfs 0.355 af

Reach DP3: North Shore Road - East Headwall Inflow=0.44 cfs 0.036 af
Outflow=0.44 cfs 0.036 af

Reach DP4: North Shore Road - West Headwall Inflow=0.14 cfs 0.029 af
Outflow=0.14 cfs 0.029 af

Reach DP5: North Shore Road - Ditch Inflow=0.06 cfs 0.013 af
Outflow=0.06 cfs 0.013 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.01 cfs 0.007 af
Outflow=0.01 cfs 0.007 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.01 cfs 0.004 af
Outflow=0.01 cfs 0.004 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.28 cfs 0.023 af
Outflow=0.28 cfs 0.023 af

Total Runoff Area = 10.070 ac Runoff Volume = 0.535 af Average Runoff Depth = 0.64"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af, Depth= 0.12"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af, Depth= 1.64"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af, Depth= 0.80"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af, Depth= 0.24"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af, Depth= 0.21"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af, Depth= 0.10"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af, Depth= 0.07"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af, Depth= 0.80"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 1.95"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 0.38" for 2-Year event
Inflow = 0.92 cfs @ 12.10 hrs, Volume= 0.081 af
Outflow = 0.92 cfs @ 12.10 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af
Outflow = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 1.64" for 2-Year event
Inflow = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af
Outflow = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af
Outflow = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 0.24" for 2-Year event
Inflow = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af
Outflow = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 0.21" for 2-Year event
Inflow = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af
Outflow = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 0.10" for 2-Year event
Inflow = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af
Outflow = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 0.07" for 2-Year event
Inflow = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af
Outflow = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=0.62"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.88 cfs 0.111 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=3.12"
Tc=6.0 min CN=84 Runoff=9.24 cfs 0.675 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=70 Runoff=1.15 cfs 0.085 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=0.90"
Tc=6.0 min UI Adjusted CN=55 Runoff=1.18 cfs 0.109 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=0.84"
Tc=6.0 min UI Adjusted CN=54 Runoff=0.55 cfs 0.053 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=0.57"
Tc=6.0 min CN=49 Runoff=0.31 cfs 0.042 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=47 Runoff=0.18 cfs 0.031 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.11"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.003 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=70 Runoff=0.73 cfs 0.054 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=3.51"
Tc=6.0 min CN=88 Runoff=1.14 cfs 0.084 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.28 cfs 0.215 af
Outflow=2.28 cfs 0.215 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.88 cfs 0.111 af
Outflow=0.88 cfs 0.111 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.14 cfs 0.084 af
Outflow=1.14 cfs 0.084 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=9.24 cfs 0.675 af
Outflow=9.24 cfs 0.675 af

Reach DP3: North Shore Road - East Headwall Inflow=1.15 cfs 0.085 af
Outflow=1.15 cfs 0.085 af

Reach DP4: North Shore Road - West Headwall Inflow=1.18 cfs 0.109 af
Outflow=1.18 cfs 0.109 af

Reach DP5: North Shore Road - Ditch Inflow=0.55 cfs 0.053 af
Outflow=0.55 cfs 0.053 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.31 cfs 0.042 af
Outflow=0.31 cfs 0.042 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.18 cfs 0.031 af
Outflow=0.18 cfs 0.031 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.00 cfs 0.003 af
Outflow=0.00 cfs 0.003 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.73 cfs 0.054 af
Outflow=0.73 cfs 0.054 af

Total Runoff Area = 10.070 ac Runoff Volume = 1.247 af Average Runoff Depth = 1.49"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af, Depth= 0.62"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af, Depth= 3.12"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af, Depth= 1.91"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af, Depth= 0.90"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af, Depth= 0.84"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af, Depth= 0.57"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af, Depth= 0.48"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af, Depth= 0.11"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af, Depth= 1.91"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 3.51"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 1.00" for 10-Year event
Inflow = 2.28 cfs @ 12.11 hrs, Volume= 0.215 af
Outflow = 2.28 cfs @ 12.11 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 0.62" for 10-Year event
Inflow = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af
Outflow = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 3.51" for 10-Year event
Inflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 3.12" for 10-Year event
Inflow = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af
Outflow = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af
Outflow = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 0.90" for 10-Year event
Inflow = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af
Outflow = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 0.84" for 10-Year event
Inflow = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af
Outflow = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 0.57" for 10-Year event
Inflow = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af
Outflow = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 0.48" for 10-Year event
Inflow = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af
Outflow = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af
Outflow = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=1.22"
Tc=6.0 min UI Adjusted CN=50 Runoff=2.44 cfs 0.218 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=4.35"
Tc=6.0 min CN=84 Runoff=12.74 cfs 0.941 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=70 Runoff=1.80 cfs 0.131 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=1.61"
Tc=6.0 min UI Adjusted CN=55 Runoff=2.43 cfs 0.195 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=1.53"
Tc=6.0 min UI Adjusted CN=54 Runoff=1.18 cfs 0.096 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=1.15"
Tc=6.0 min CN=49 Runoff=0.92 cfs 0.085 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=47 Runoff=0.65 cfs 0.065 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.38"
Tc=6.0 min CN=37 Runoff=0.04 cfs 0.009 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=70 Runoff=1.15 cfs 0.083 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=88 Runoff=1.53 cfs 0.115 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=4.20 cfs 0.357 af
Outflow=4.20 cfs 0.357 af

Reach DP1: Essex Center Drive - Ditch Inflow=2.44 cfs 0.218 af
Outflow=2.44 cfs 0.218 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.53 cfs 0.115 af
Outflow=1.53 cfs 0.115 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=12.74 cfs 0.941 af
Outflow=12.74 cfs 0.941 af

Reach DP3: North Shore Road - East Headwall Inflow=1.80 cfs 0.131 af
Outflow=1.80 cfs 0.131 af

Reach DP4: North Shore Road - West Headwall Inflow=2.43 cfs 0.195 af
Outflow=2.43 cfs 0.195 af

Reach DP5: North Shore Road - Ditch Inflow=1.18 cfs 0.096 af
Outflow=1.18 cfs 0.096 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.92 cfs 0.085 af
Outflow=0.92 cfs 0.085 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.65 cfs 0.065 af
Outflow=0.65 cfs 0.065 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.04 cfs 0.009 af
Outflow=0.04 cfs 0.009 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.15 cfs 0.083 af
Outflow=1.15 cfs 0.083 af

Total Runoff Area = 10.070 ac Runoff Volume = 1.939 af Average Runoff Depth = 2.31"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af, Depth= 1.22"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af, Depth= 4.35"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 2.93"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af, Depth= 1.61"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af, Depth= 1.53"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af, Depth= 1.15"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af, Depth= 1.00"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Depth= 0.38"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af, Depth= 2.93"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 4.78"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 1.66" for 25-Year event
Inflow = 4.20 cfs @ 12.10 hrs, Volume= 0.357 af
Outflow = 4.20 cfs @ 12.10 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 1.22" for 25-Year event
Inflow = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af
Outflow = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 4.78" for 25-Year event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 4.35" for 25-Year event
Inflow = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af
Outflow = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af
Outflow = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 1.61" for 25-Year event
Inflow = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af
Outflow = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 1.53" for 25-Year event
Inflow = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af
Outflow = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 1.15" for 25-Year event
Inflow = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af
Outflow = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 1.00" for 25-Year event
Inflow = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af
Outflow = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.38" for 25-Year event
Inflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af
Outflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=2.84"
Tc=6.0 min UI Adjusted CN=50 Runoff=6.63 cfs 0.507 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=84 Runoff=20.06 cfs 1.516 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=70 Runoff=3.25 cfs 0.236 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=3.44"
Tc=6.0 min UI Adjusted CN=55 Runoff=5.64 cfs 0.418 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=3.32"
Tc=6.0 min UI Adjusted CN=54 Runoff=2.81 cfs 0.209 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=2.72"
Tc=6.0 min CN=49 Runoff=2.60 cfs 0.201 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=2.49"
Tc=6.0 min CN=47 Runoff=2.04 cfs 0.161 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=1.36"
Tc=6.0 min CN=37 Runoff=0.32 cfs 0.033 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=70 Runoff=2.07 cfs 0.150 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=7.49"
Tc=6.0 min CN=88 Runoff=2.33 cfs 0.180 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=9.32 cfs 0.725 af
Outflow=9.32 cfs 0.725 af

Reach DP1: Essex Center Drive - Ditch Inflow=6.63 cfs 0.507 af
Outflow=6.63 cfs 0.507 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.33 cfs 0.180 af
Outflow=2.33 cfs 0.180 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=20.06 cfs 1.516 af
Outflow=20.06 cfs 1.516 af

Reach DP3: North Shore Road - East Headwall Inflow=3.25 cfs 0.236 af
Outflow=3.25 cfs 0.236 af

Reach DP4: North Shore Road - West Headwall Inflow=5.64 cfs 0.418 af
Outflow=5.64 cfs 0.418 af

Reach DP5: North Shore Road - Ditch Inflow=2.81 cfs 0.209 af
Outflow=2.81 cfs 0.209 af

Reach DP6: Proctor Brook Culvert #1 Inflow=2.60 cfs 0.201 af
Outflow=2.60 cfs 0.201 af

Reach DP7: Proctor Brook Culvert #2 Inflow=2.04 cfs 0.161 af
Outflow=2.04 cfs 0.161 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.32 cfs 0.033 af
Outflow=0.32 cfs 0.033 af

Reach DP9: Proctor Brook Culvert #4 Inflow=2.07 cfs 0.150 af
Outflow=2.07 cfs 0.150 af

Total Runoff Area = 10.070 ac Runoff Volume = 3.611 af Average Runoff Depth = 4.30"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af, Depth= 2.84"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af, Depth= 7.00"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af, Depth= 5.28"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af, Depth= 3.44"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af, Depth= 3.32"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af, Depth= 2.72"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af, Depth= 2.49"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af, Depth= 1.36"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af, Depth= 5.28"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Depth= 7.49"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 3.37" for 100-Year event
Inflow = 9.32 cfs @ 12.10 hrs, Volume= 0.725 af
Outflow = 9.32 cfs @ 12.10 hrs, Volume= 0.725 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 2.84" for 100-Year event
Inflow = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af
Outflow = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 7.00" for 100-Year event
Inflow = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af
Outflow = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 5.28" for 100-Year event
Inflow = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af
Outflow = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 3.44" for 100-Year event
Inflow = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af
Outflow = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 3.32" for 100-Year event
Inflow = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af
Outflow = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af
Outflow = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 2.49" for 100-Year event
Inflow = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af
Outflow = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 1.36" for 100-Year event
Inflow = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af
Outflow = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

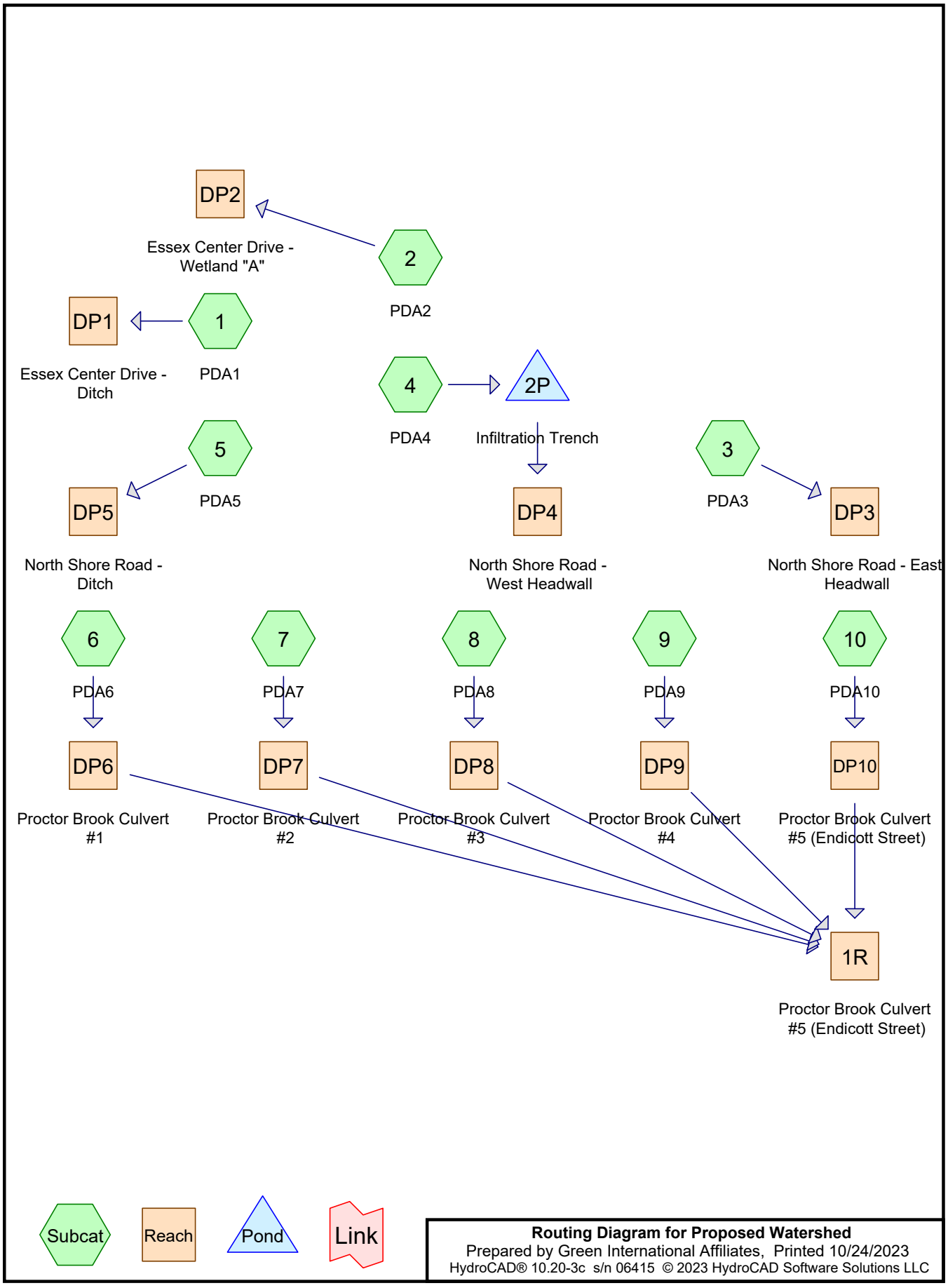
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 5.28" for 100-Year event
Inflow = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af
Outflow = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs


DP2
Essex Center Drive - Wetland "A"
2
PDA2
DP1
1
Essex Center Drive - Ditch
PDA1
4
2P
PDA4
Infiltration Trench
5
3
PDA5
PDA3
DP5
DP4
DP3
North Shore Road - Ditch
North Shore Road - West Headwall
North Shore Road - East Headwall
6
7
8
9
10
PDA6
PDA7
PDA8
PDA9
PDA10
DP6
DP7
DP8
DP9
DP10
Proctor Brook Culvert #1
Proctor Brook Culvert #2
Proctor Brook Culvert #3
Proctor Brook Culvert #4
Proctor Brook Culvert #5 (Endicott Street)
1R
Proctor Brook Culvert #5 (Endicott Street)
Subcat
Reach
Pond
Link
Routing Diagram for Proposed Watershed
Prepared by Green International Affiliates, Printed 10/24/2023
HydroCAD® 10.20-3c s/n 06415 © 2023 HydroCAD Software Solutions LLC

Proposed Watershed

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.15	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.83	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.16	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.94	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.829	49	50-75% Grass cover, Fair, HSG A (1)
2.872	39	>75% Grass cover, Good, HSG A (2, 3, 4, 5, 6, 7, 8)
0.057	70	>75% Grass cover, Good, HSG B (10)
0.400	70	>75% Grass cover, Good, HSG B/D (6, 7, 8, 9)
0.271	88	Gravel roads and pier, HSG B/D (9, 10)
0.530	76	Gravel roads, HSG A (1, 2, 3, 4, 5, 6, 7, 8)
0.290	88	Gravel roads, HSG B/D (6, 7, 8)
3.455	98	Unconnected pavement, HSG A (1, 2, 3, 4, 5, 6, 7, 8)
0.374	98	Unconnected pavement, HSG B/D (6, 7, 8, 9, 10)
10.078	**69**	**TOTAL AREA**

Proposed Watershed

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.686	HSG A	1, 2, 3, 4, 5, 6, 7, 8
1.391	HSG B	6, 7, 8, 9, 10
0.000	HSG C	
0.000	HSG D	
0.000	Other	
10.078		**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=0.12"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.04 cfs 0.019 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=1.57"
Tc=6.0 min CN=83 Runoff=5.07 cfs 0.368 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=0.71"
Tc=6.0 min CN=68 Runoff=0.38 cfs 0.032 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=0.14"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.05 cfs 0.017 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=0.10"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.01 cfs 0.006 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=74 Runoff=0.97 cfs 0.074 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=74 Runoff=0.85 cfs 0.065 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=1.24"
Tc=6.0 min CN=78 Runoff=0.41 cfs 0.030 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=1.79"
Tc=6.0 min CN=86 Runoff=0.70 cfs 0.051 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=1.95"
Tc=6.0 min CN=88 Runoff=0.64 cfs 0.047 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=3.57 cfs 0.267 af
Outflow=3.57 cfs 0.267 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.04 cfs 0.019 af
Outflow=0.04 cfs 0.019 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.64 cfs 0.047 af
Outflow=0.64 cfs 0.047 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=5.07 cfs 0.368 af
Outflow=5.07 cfs 0.368 af

Reach DP3: North Shore Road - East Headwall Inflow=0.38 cfs 0.032 af
Outflow=0.38 cfs 0.032 af

Reach DP4: North Shore Road - West Headwall Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP5: North Shore Road - Ditch Inflow=0.01 cfs 0.006 af
Outflow=0.01 cfs 0.006 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.97 cfs 0.074 af
Outflow=0.97 cfs 0.074 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.85 cfs 0.065 af
Outflow=0.85 cfs 0.065 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.41 cfs 0.030 af
Outflow=0.41 cfs 0.030 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.70 cfs 0.051 af
Outflow=0.70 cfs 0.051 af

Pond 2P: Infiltration Trench Peak Elev=48.53' Storage=8 cf Inflow=0.05 cfs 0.017 af
Discarded=0.04 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.017 af

Total Runoff Area = 10.078 ac Runoff Volume = 0.709 af Average Runoff Depth = 0.84"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af, Depth= 0.12"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af, Depth= 1.57"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af, Depth= 0.71"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 0.05 cfs @ 12.45 hrs, Volume= 0.017 af, Depth= 0.14"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af, Depth= 0.10"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af, Depth= 1.00"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af, Depth= 1.00"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af, Depth= 1.24"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af, Depth= 1.79"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 1.95"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 1.24" for 2-Year event
Inflow = 3.57 cfs @ 12.10 hrs, Volume= 0.267 af
Outflow = 3.57 cfs @ 12.10 hrs, Volume= 0.267 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af
Outflow = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 1.57" for 2-Year event
Inflow = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af
Outflow = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 0.71" for 2-Year event
Inflow = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af
Outflow = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 0.10" for 2-Year event
Inflow = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af
Outflow = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af
Outflow = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 1.24" for 2-Year event
Inflow = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af
Outflow = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 1.79" for 2-Year event
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af
Outflow = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.14" for 2-Year event
Inflow = 0.05 cfs @ 12.45 hrs, Volume= 0.017 af
Outflow = 0.04 cfs @ 12.51 hrs, Volume= 0.017 af, Atten= 5%, Lag= 3.1 min
Discarded = 0.04 cfs @ 12.51 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 48.53' @ 12.51 hrs Surf.Area= 1,600 sf Storage= 8 cf

Plug-Flow detention time= 3.0 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (1,004.7 - 1,001.7)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 12.51 hrs HW=48.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=48.52' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=0.62"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.79 cfs 0.100 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=83 Runoff=9.72 cfs 0.708 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=1.76"
Tc=6.0 min CN=68 Runoff=1.07 cfs 0.080 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=0.68"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.70 cfs 0.082 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=0.57"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.26 cfs 0.036 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=2.23"
Tc=6.0 min CN=74 Runoff=2.25 cfs 0.164 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=2.23"
Tc=6.0 min CN=74 Runoff=1.98 cfs 0.144 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=2.57"
Tc=6.0 min CN=78 Runoff=0.87 cfs 0.063 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=3.31"
Tc=6.0 min CN=86 Runoff=1.28 cfs 0.094 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=3.51"
Tc=6.0 min CN=88 Runoff=1.14 cfs 0.084 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=7.51 cfs 0.550 af
Outflow=7.51 cfs 0.550 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.79 cfs 0.100 af
Outflow=0.79 cfs 0.100 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.14 cfs 0.084 af
Outflow=1.14 cfs 0.084 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=9.72 cfs 0.708 af
Outflow=9.72 cfs 0.708 af

Reach DP3: North Shore Road - East Headwall Inflow=1.07 cfs 0.080 af
Outflow=1.07 cfs 0.080 af

Reach DP4: North Shore Road - West Headwall Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP5: North Shore Road - Ditch Inflow=0.26 cfs 0.036 af
Outflow=0.26 cfs 0.036 af

Reach DP6: Proctor Brook Culvert #1 Inflow=2.25 cfs 0.164 af
Outflow=2.25 cfs 0.164 af

Reach DP7: Proctor Brook Culvert #2 Inflow=1.98 cfs 0.144 af
Outflow=1.98 cfs 0.144 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.87 cfs 0.063 af
Outflow=0.87 cfs 0.063 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.28 cfs 0.094 af
Outflow=1.28 cfs 0.094 af

Pond 2P: Infiltration Trench Peak Elev=50.74' Storage=1,174 cf Inflow=0.70 cfs 0.082 af
Discarded=0.09 cfs 0.082 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.082 af

Total Runoff Area = 10.078 ac Runoff Volume = 1.556 af Average Runoff Depth = 1.85"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af, Depth= 0.62"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af, Depth= 3.02"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af, Depth= 1.76"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 0.70 cfs @ 12.13 hrs, Volume= 0.082 af, Depth= 0.68"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af, Depth= 0.57"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af, Depth= 2.23"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af, Depth= 2.23"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Depth= 2.57"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 3.31"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 3.51"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 2.55" for 10-Year event
Inflow = 7.51 cfs @ 12.09 hrs, Volume= 0.550 af
Outflow = 7.51 cfs @ 12.09 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 0.62" for 10-Year event
Inflow = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af
Outflow = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 3.51" for 10-Year event
Inflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 3.02" for 10-Year event
Inflow = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af
Outflow = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 1.76" for 10-Year event
Inflow = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af
Outflow = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 0.57" for 10-Year event
Inflow = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af
Outflow = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af
Outflow = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af
Outflow = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 3.31" for 10-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.68" for 10-Year event
Inflow = 0.70 cfs @ 12.13 hrs, Volume= 0.082 af
Outflow = 0.09 cfs @ 12.05 hrs, Volume= 0.082 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.09 cfs @ 12.05 hrs, Volume= 0.082 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 50.74' @ 15.12 hrs Surf.Area= 1,600 sf Storage= 1,174 cf

Plug-Flow detention time= 139.5 min calculated for 0.082 af (100% of inflow)
Center-of-Mass det. time= 139.4 min (1,053.6 - 914.2)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 12.05 hrs HW=48.61' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=48.52' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=1.22"
Tc=6.0 min UI Adjusted CN=50 Runoff=2.19 cfs 0.196 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=83 Runoff=13.51 cfs 0.994 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=2.74"
Tc=6.0 min CN=68 Runoff=1.71 cfs 0.125 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=1.30"
Tc=6.0 min UI Adjusted CN=51 Runoff=1.81 cfs 0.157 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=1.15"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.78 cfs 0.072 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=3.32"
Tc=6.0 min CN=74 Runoff=3.37 cfs 0.244 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=3.32"
Tc=6.0 min CN=74 Runoff=2.96 cfs 0.215 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=3.72"
Tc=6.0 min CN=78 Runoff=1.26 cfs 0.091 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=86 Runoff=1.74 cfs 0.130 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=88 Runoff=1.52 cfs 0.115 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=10.85 cfs 0.795 af
Outflow=10.85 cfs 0.795 af

Reach DP1: Essex Center Drive - Ditch Inflow=2.19 cfs 0.196 af
Outflow=2.19 cfs 0.196 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.52 cfs 0.115 af
Outflow=1.52 cfs 0.115 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=13.51 cfs 0.994 af
Outflow=13.51 cfs 0.994 af

Reach DP3: North Shore Road - East Headwall Inflow=1.71 cfs 0.125 af
Outflow=1.71 cfs 0.125 af

Reach DP4: North Shore Road - West Headwall Inflow=1.15 cfs 0.052 af
Outflow=1.15 cfs 0.052 af

Reach DP5: North Shore Road - Ditch Inflow=0.78 cfs 0.072 af
Outflow=0.78 cfs 0.072 af

Reach DP6: Proctor Brook Culvert #1 Inflow=3.37 cfs 0.244 af
Outflow=3.37 cfs 0.244 af

Reach DP7: Proctor Brook Culvert #2 Inflow=2.96 cfs 0.215 af
Outflow=2.96 cfs 0.215 af

Reach DP8: Proctor Brook Culvert #3 Inflow=1.26 cfs 0.091 af
Outflow=1.26 cfs 0.091 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.74 cfs 0.130 af
Outflow=1.74 cfs 0.130 af

Pond 2P: Infiltration Trench Peak Elev=51.34' Storage=1,489 cf Inflow=1.81 cfs 0.157 af
Discarded=0.09 cfs 0.106 af Primary=1.15 cfs 0.052 af Outflow=1.24 cfs 0.158 af

Total Runoff Area = 10.078 ac Runoff Volume = 2.340 af Average Runoff Depth = 2.79"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af, Depth= 1.22"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af, Depth= 4.24"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af, Depth= 2.74"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 1.81 cfs @ 12.11 hrs, Volume= 0.157 af, Depth= 1.30"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af, Depth= 1.15"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af, Depth= 3.32"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 3.32"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af, Depth= 3.72"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af, Depth= 4.56"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 4.78"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 3.69" for 25-Year event
Inflow = 10.85 cfs @ 12.09 hrs, Volume= 0.795 af
Outflow = 10.85 cfs @ 12.09 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 1.22" for 25-Year event
Inflow = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af
Outflow = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 4.78" for 25-Year event
Inflow = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 4.24" for 25-Year event
Inflow = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af
Outflow = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 2.74" for 25-Year event
Inflow = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af
Outflow = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.43" for 25-Year event
Inflow = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af
Outflow = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 1.15" for 25-Year event
Inflow = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af
Outflow = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 3.32" for 25-Year event
Inflow = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af
Outflow = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 3.32" for 25-Year event
Inflow = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af
Outflow = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 3.72" for 25-Year event
Inflow = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 4.56" for 25-Year event
Inflow = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af
Outflow = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 1.30" for 25-Year event
Inflow = 1.81 cfs @ 12.11 hrs, Volume= 0.157 af
Outflow = 1.24 cfs @ 12.32 hrs, Volume= 0.158 af, Atten= 32%, Lag= 12.5 min
Discarded = 0.09 cfs @ 11.85 hrs, Volume= 0.106 af
Primary = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 51.34' @ 12.30 hrs Surf.Area= 1,600 sf Storage= 1,489 cf

Plug-Flow detention time= 136.2 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 138.0 min (1,026.2 - 888.2)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 11.85 hrs HW=48.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.00 cfs @ 12.32 hrs HW=51.34' (Free Discharge)
└**2=Culvert** (Passes 1.00 cfs of 5.43 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 1.00 cfs @ 0.96 fps)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=2.84"
Tc=6.0 min UI Adjusted CN=50 Runoff=5.96 cfs 0.456 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=6.88"
Tc=6.0 min CN=83 Runoff=21.44 cfs 1.613 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=68 Runoff=3.16 cfs 0.229 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=2.96"
Tc=6.0 min UI Adjusted CN=51 Runoff=4.74 cfs 0.359 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=2.72"
Tc=6.0 min UI Adjusted CN=49 Runoff=2.22 cfs 0.171 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=74 Runoff=5.81 cfs 0.425 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=74 Runoff=5.11 cfs 0.373 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=6.27"
Tc=6.0 min CN=78 Runoff=2.09 cfs 0.154 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=7.25"
Tc=6.0 min CN=86 Runoff=2.70 cfs 0.206 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=7.49"
Tc=6.0 min CN=88 Runoff=2.33 cfs 0.180 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=18.03 cfs 1.338 af
Outflow=18.03 cfs 1.338 af

Reach DP1: Essex Center Drive - Ditch Inflow=5.96 cfs 0.456 af
Outflow=5.96 cfs 0.456 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.33 cfs 0.180 af
Outflow=2.33 cfs 0.180 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=21.44 cfs 1.613 af
Outflow=21.44 cfs 1.613 af

Reach DP3: North Shore Road - East Headwall Inflow=3.16 cfs 0.229 af
Outflow=3.16 cfs 0.229 af

Reach DP4: North Shore Road - West Headwall Inflow=4.64 cfs 0.233 af
Outflow=4.64 cfs 0.233 af

Reach DP5: North Shore Road - Ditch Inflow=2.22 cfs 0.171 af
Outflow=2.22 cfs 0.171 af

Reach DP6: Proctor Brook Culvert #1 Inflow=5.81 cfs 0.425 af
Outflow=5.81 cfs 0.425 af

Reach DP7: Proctor Brook Culvert #2 Inflow=5.11 cfs 0.373 af
Outflow=5.11 cfs 0.373 af

Reach DP8: Proctor Brook Culvert #3 Inflow=2.09 cfs 0.154 af
Outflow=2.09 cfs 0.154 af

Reach DP9: Proctor Brook Culvert #4 Inflow=2.70 cfs 0.206 af
Outflow=2.70 cfs 0.206 af

Pond 2P: Infiltration Trench Peak Elev=51.49' Storage=1,569 cf Inflow=4.74 cfs 0.359 af
Discarded=0.09 cfs 0.129 af Primary=4.64 cfs 0.233 af Outflow=4.73 cfs 0.361 af

Total Runoff Area = 10.078 ac Runoff Volume = 4.167 af Average Runoff Depth = 4.96"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af, Depth= 2.84"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af, Depth= 6.88"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af, Depth= 5.04"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 4.74 cfs @ 12.10 hrs, Volume= 0.359 af, Depth= 2.96"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af, Depth= 2.72"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af, Depth= 5.77"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af, Depth= 5.77"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af, Depth= 6.27"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af, Depth= 7.25"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Depth= 7.49"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 18.03 cfs @ 12.09 hrs, Volume= 1.338 af
Outflow = 18.03 cfs @ 12.09 hrs, Volume= 1.338 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 2.84" for 100-Year event
Inflow = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af
Outflow = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 6.88" for 100-Year event
Inflow = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af
Outflow = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 5.04" for 100-Year event
Inflow = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af
Outflow = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 1.92" for 100-Year event
Inflow = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af
Outflow = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af
Outflow = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 5.77" for 100-Year event
Inflow = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af
Outflow = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 5.77" for 100-Year event
Inflow = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af
Outflow = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 6.27" for 100-Year event
Inflow = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af
Outflow = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 7.25" for 100-Year event
Inflow = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 2.96" for 100-Year event
Inflow = 4.74 cfs @ 12.10 hrs, Volume= 0.359 af
Outflow = 4.73 cfs @ 12.09 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.09 cfs @ 11.30 hrs, Volume= 0.129 af
Primary = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 51.49' @ 12.09 hrs Surf.Area= 1,600 sf Storage= 1,569 cf

Plug-Flow detention time= 74.3 min calculated for 0.359 af (100% of inflow)
Center-of-Mass det. time= 78.6 min (939.3 - 860.7)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

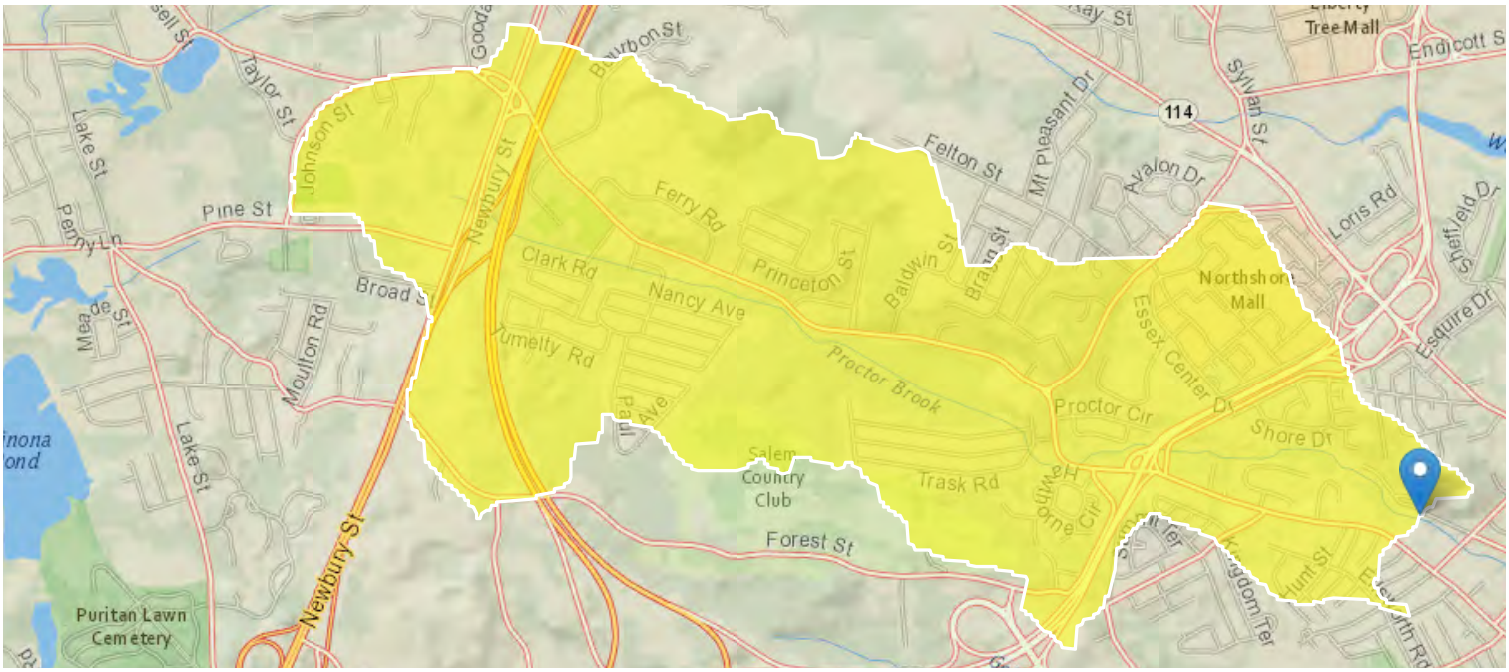
Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 11.30 hrs HW=48.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=4.59 cfs @ 12.09 hrs HW=51.49' (Free Discharge)
└**2=Culvert** (Passes 4.59 cfs of 5.61 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 4.59 cfs @ 1.60 fps)

StreamStats Report

Region ID: MA
Workspace ID: MA20201117121813254000
Clicked Point (Latitude, Longitude): 42.53191, -70.93625
Time: 2020-11-17 07:18:29 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.52	square miles

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.4.0

HYDRAULIC AND SCOUR ANALYSIS SUMMARY REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Prepared for

Massachusetts Department of Transportation

February 2023

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for Proctor Brook along the Independence Greenway Extension. The proposed bikeway crosses Proctor Brook at three (3) locations. The Hydraulic Report submitted to MassDOT in February 2021 described the proposed bridge located approximated 800' west of Endicott Street. This study evaluates the hydraulic performance of the existing and proposed conditions for the remaining project area upstream of this proposed bridge, including the two (2) crossing locations that weren't discussed in the previous report.

This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at brook crossing sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the brook; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations.

This project involves the construction of two (2) new culverts that will cross over Proctor Brook in the City of Peabody, Massachusetts. There were previous culvert structures that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the culverts, and the culvert structures have been washed away over time. The purpose of this report is to present the results of a study conducted for the subject culvert sites to evaluate the hydraulic performance of the proposed structures for these crossings.

The scope of this investigation consists of a review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.45 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any

improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 8-span structure will be approximately 60'-0" long with an out-to-out width of 12'-0" and will provide a clear width of 11'-0" to accommodate two 5-0" wide travel lanes, one in each direction.

2.1 Existing Conditions

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject locations are within NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

Refer to Figure 1 for a locus map of the project area.

The remnants of two (2) culverts remain in the channel. There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the culverts are currently wooded and includes Bordering Vegetated Wetlands.

The existing culverts were studied during FEMA's 1978 FIS study. At the time of the study the culverts had not been washed out and were functioning as hydraulic connections to convey Proctor Brook under the railroad bed. More detailed description of the culverts are as follows:

Culvert at Station 329+85

This culvert is located at cross section H of the FEMA FIS study. The existing culvert is a 25' long double 42" barrel RCP culvert. The culvert hasn't been maintained and the railbed above the culvert has been washed away. The culvert piping has remained in place. Remnants of granite guidebanks remain at the upstream entrance to the culvert and remnants of a granite headwall remain on the downstream end of the culvert

Culvert at Station 346+20

This culvert is located at cross section F of the FEMA FIS study. Review of the FEMA's HEC-2 hydraulic model indicates that the culvert was originally a 6'-5" box culvert. Due to a lack of maintenance along the abandoned railroad bed, the culvert has collapsed, and the remnants remain in the channel.

2.2 Proposed Conditions

Although the culvert crossings have failed to varying degrees, the horizontal alignment of Proctor Brook has remained. The culverts are being replaced at the same locations as the original structures in order to maintain the alignment of Proctor Brook at these crossings. The channel elevation will remain although some sediment will be removed to facilitate construction.

Both of the culverts will be replaced with 8'x4' concrete box culverts. The bottom 1' of each culvert will be filled with streambed material to provide a more natural wildlife habitat. This hydraulic study examines the impact of providing an 8'x3' hydraulic opening at both of these crossings.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 20 Stream Stability at Highway Structures, Fourth Edition, April 2012.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 14 Hydraulic Design of Energy Dissipators for Culverts and Channels, Third Edition, July 2006.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 19, 2021.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- Federal Highway Administration: Hydraulic Toolbox 5.1.4.0 Computer Program

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the culverts have been analyzed to ensure that existing flood elevations will not increase underproposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Figure 2 shows the project location in the flood insurance rate map.

In this hydraulic and scour summary report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. As further described in the Stormwater Water prepared for this project, the peak flow rates have been adjusted to account for the proposed increase in impervious area. Table 4.1 also presents the proposed flow projections for the project area.

Table 4.1 – Summary of Discharges

Description	Alternative	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River andProctor Brook Upstream of Goldthwait Brook	FEMA FIS	240	285	360	420	610
	Proposed Conditions	243	290	366	428	618

4.2 Hydraulic Analysis

Green used a combination of the topographical survey and the proposed design of the brook crossings to create a proposed conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA.

Table 4.2 shows a comparison between the results of the HEC-2 data received from FEMA and Green's proposed model.

Table 4.2 – Comparison of FEMA and Proposed Base Flood Elevations (BFE - referenced to NAVD88) at several cross sections near the Proposed Structures

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Published Data* (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
34	-	-	46.50	
33	-	-	46.33	
32	-	-	46.33	
31	H	46.89	46.33	0.56
30	-	-	46.23	
29.5	Culvert at Sta 329+85			
29.4	-	-	42.54	
29.3	-	-	42.44	
28	-	-	42.57	
27	G	42.50	42.50	0.00
26.5	-	-	42.00	
26	F	41.96	41.39	0.57
25	-		41.40	
24.5	Culvert at Sta 346+20			
24.4	-		40.74	
24.3	-		40.12	
23	-		40.28	
22	E	40.84	40.24	0.6
21.7	-		40.11	
21.6	-		40.11	
21.5	Bridge			
21.4			39.90	
21.35	-		39.75	

21.3	-		39.80	
21.2	-		39.66	
19	-		39.66	
18	D	39.60	39.60	0.00

Adjusted datum to NAVD 88

As shown in Table 4.2, Proctor Brook will not have an increase in the Water Surface Elevation (WSEL) for the FEMA Base Flood Elevation.

Attachment A includes the 1977 HEC-2 model input/output report received from FEMA Headquarters. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed Independence Greenway Extension boardwalkover Proctor Brook with the new crossing culverts.

4.3 Scour Safety/Stability Analyses

We calculated the scour hole dimensions (length, width, and depth) using the Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 5: "Estimating Scour at Culvert Outlets" and using equation 5.1 for cohesionless soils shown below:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right) \left(\frac{Q}{\sqrt{g}(R_c^{2.5})}\right)^{\beta} \left(\frac{t}{316}\right)^{\theta}$$

We used the river's 100-year flood as the scour design in this analysis. No scour potential under current conditions was assessed, as one of the structures has washed away and based on evidence, there are no indications of vertical or horizontal instability.

Peak 100-year flood proposed discharge used in this analysis was taken from Table 4.1.

Soil samples were taken at points within the brook, upstream of the culverts and the banks of the brook. These samples were analyzed, and the results are included in Attachment C. The grain size (D_x) was estimated for each soil sample. The D_x results of the samples were used in the scour analysis.

The results of the scour analyses are shown on Table 4.3.

Table 4.3 – Summary of Calculated Scour at Proposed Culverts

Alternative	Return Frequency (year)	Scour Hole Depth (Feet)	Scour Hole Width (Feet)	Scour Hole Length (Feet)	Scour Hole Volume (Cubic Feet)	Location of Maximum Scour (Feet)
Sta 329+85	Incipient	5.89	32.00	57.82	8,133.98	23.13
Sta 346+20	Incipient	4.69	23.64	44.11	3,527.78	17.65

Scour Countermeasures

The scour/stability analyses were performed using Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 10: "Riprap Basins and Aprons" and using equation 10.4 shown below:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

Table 4.4 displays dimensions for riprap apron at the proposed culverts.

Table 4.4 – Summary of Scour Countermeasure Design at Proposed Culverts

Alternative	Riprap Size D_{50} (Inches)	Riprap Class	Riprap Apron Length (Feet)	Riprap Apron Depth (Feet)	Riprap Apron Width (Feet)
Sta 329+85	6	2	24	2	34
Sta 346+20	5	1	22	1	31

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The HEC-RAS model under proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile, and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.

B. The natural stream bed will result in a scour depth at culvert at Station 329+85 of 5.89' during incipient flow.

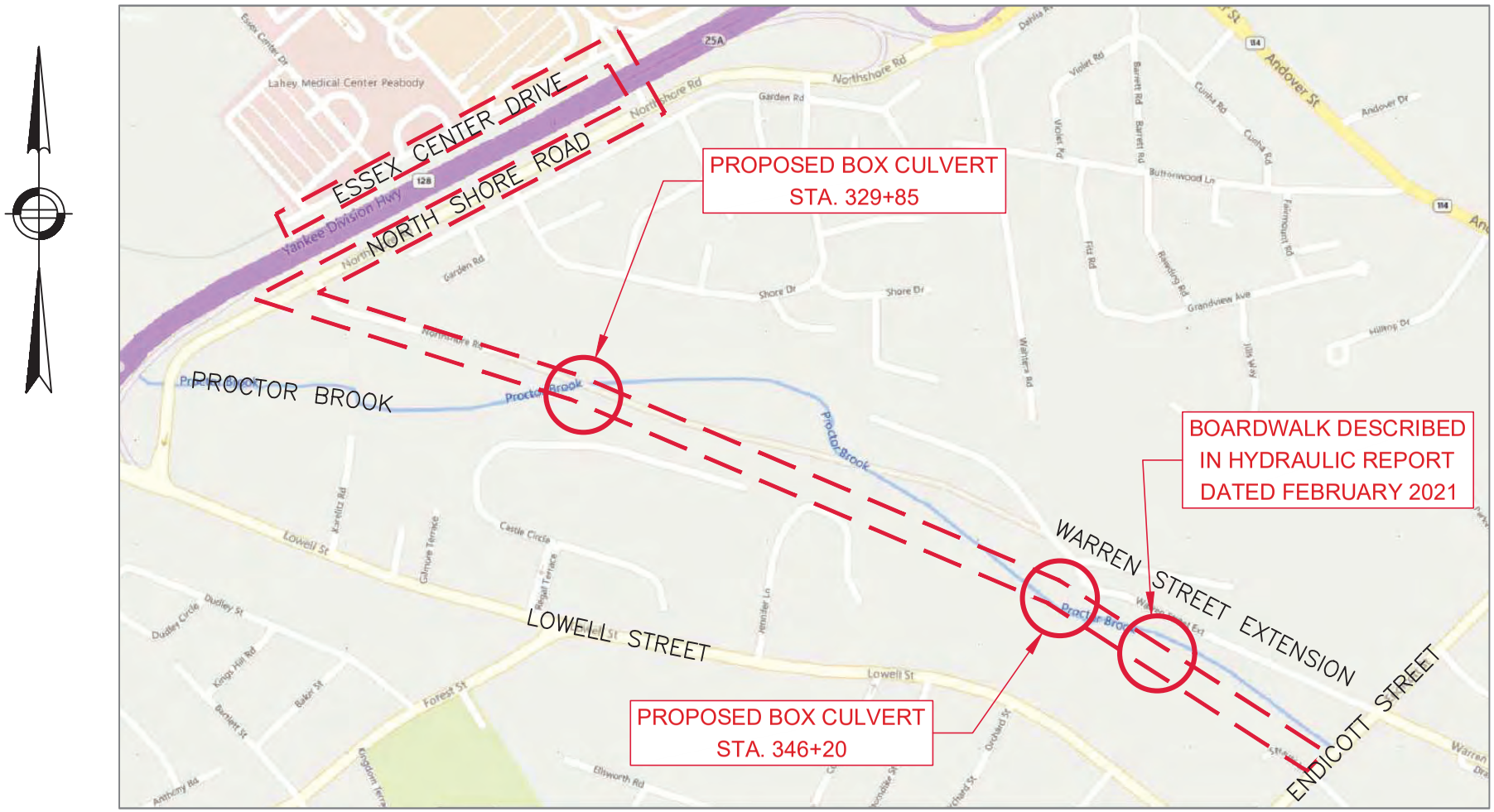
C. The natural stream bed will result in a scour depth at culvert at Station 340+26 of 4.69' during incipient flow.

D. Riprap Countermeasures are proposed to mitigate against the risk of scour. The countermeasures have been designed in accordance with HEC-14 and HEC-23.

E. By placing riprap revetment at the ends of the culvert, it is anticipated that the scour depth will be negligible.

FIGURES

FIGURE 1



LEGEND:

Project Limits

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS TEWKSBURY, MASSACHUSETTS

MASSDOT
PEABODY BIKEWAY EXTENSION
NORTH SHORE MALL TO ENDICOTT STREET
PEABODY, MA

CULVERT LOCATION LOCUS MAP
NOT TO SCALE

F:\Projects\2013\13033\13033.10X-Weymouth Bridge St\Survey\Research\Utilities\UTility Request\Locus Map.dwg

A00829 - 458

Proposal No. 609211-132091

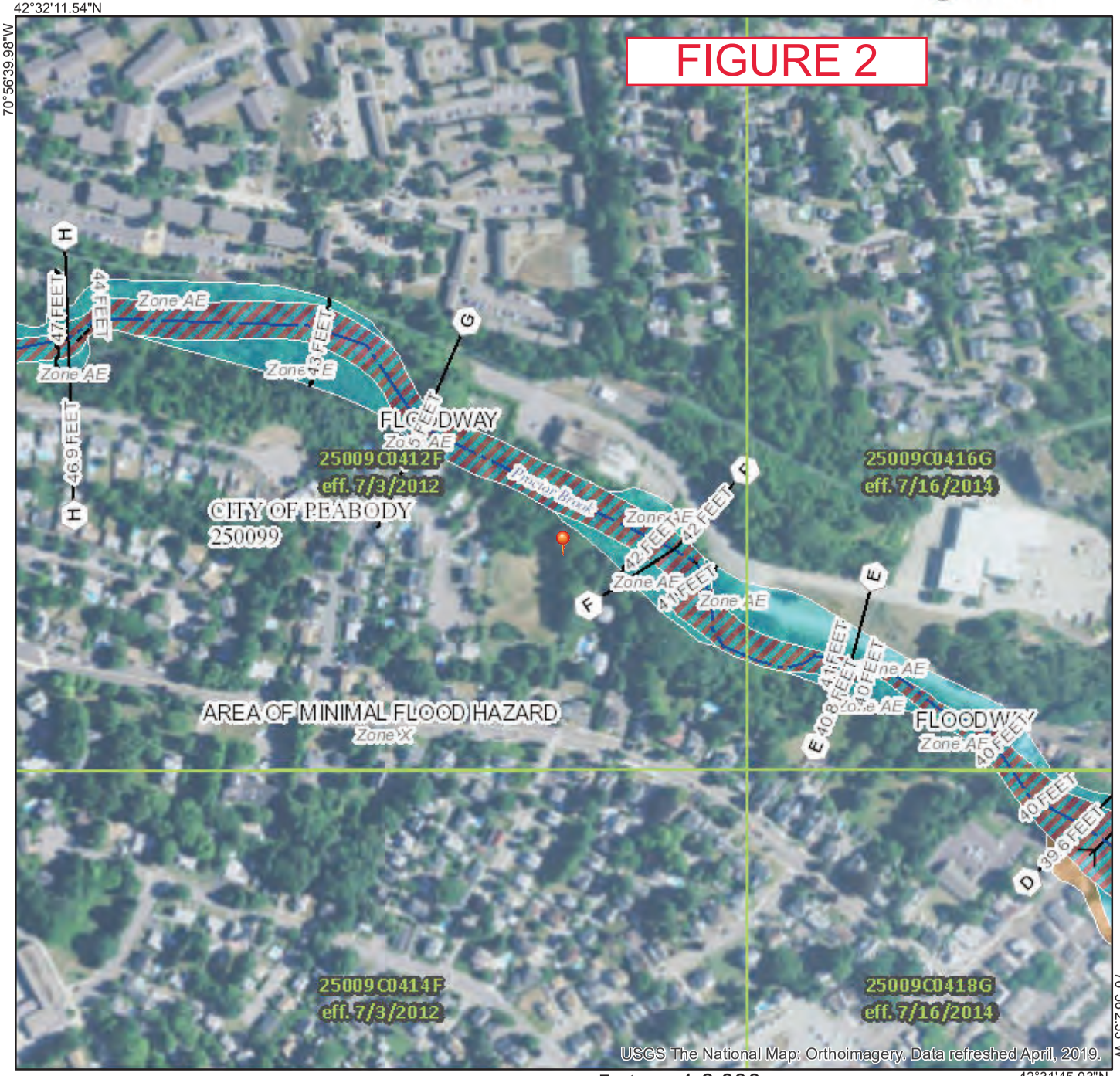
National Flood Hazard Layer FIRMette

FEMA

42°32'11.54"N

70°56'39.98"W

FIGURE 2



42°31'45.03"N

70°56'2.53"W

Feet

0 250 500 1,000 1,500 2,000

1:6,000

A00829 - 459

Proposal No. 609211-132091

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/24/2019 at 9:07:12 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT A: 1977 HEC-2 MODEL INPUT/RESULTS

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

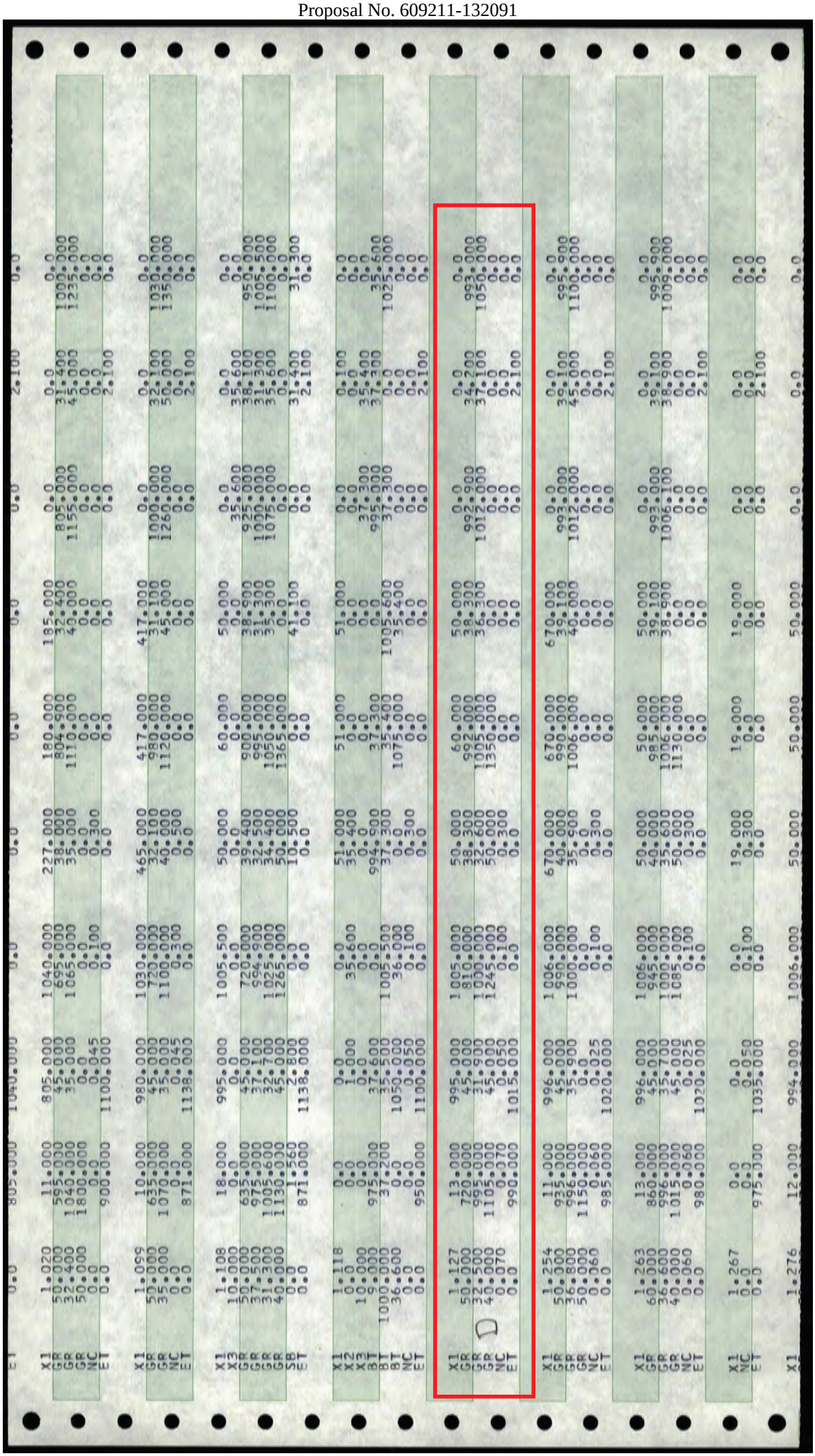
B.W. FINAL

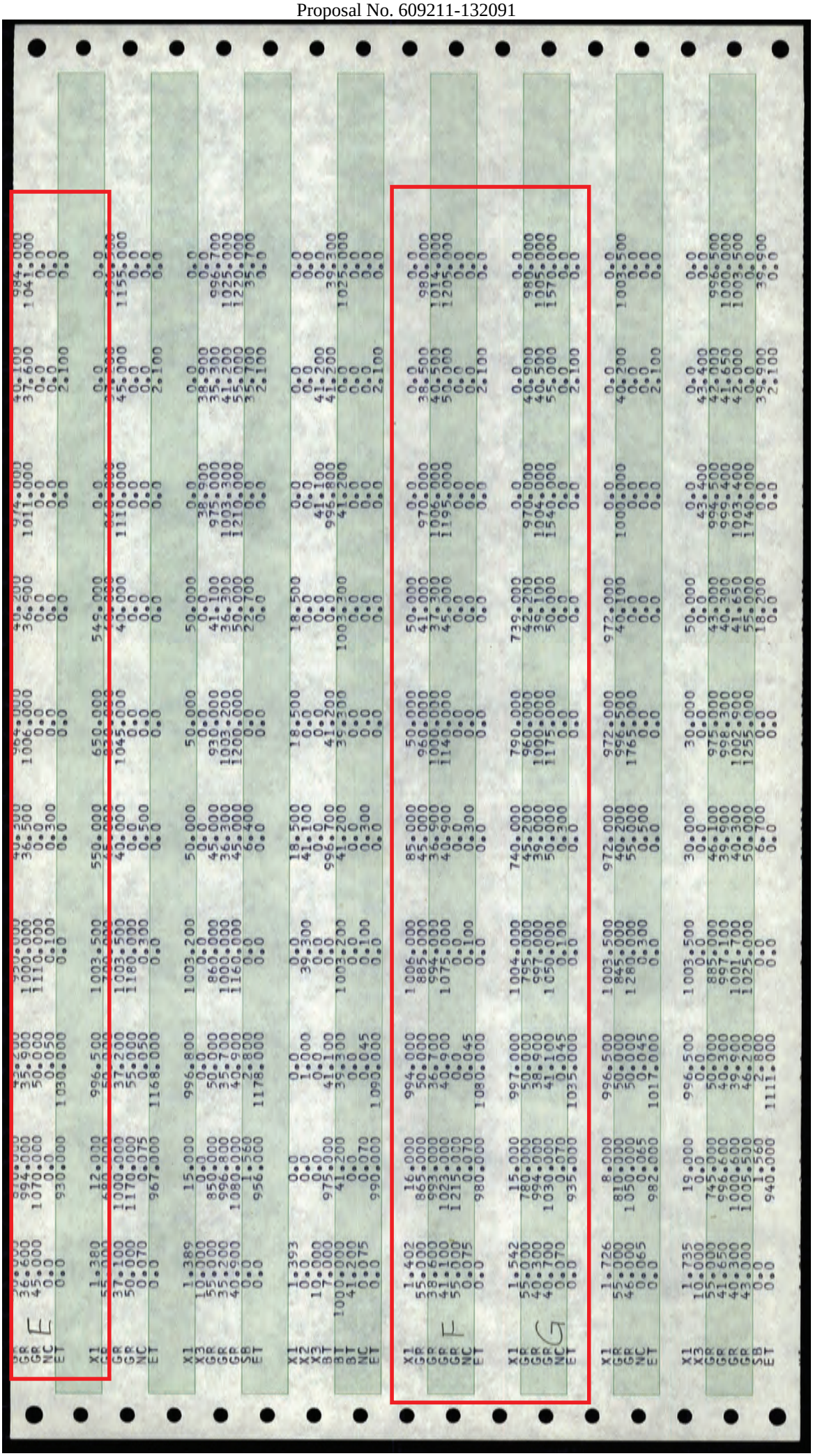
70'

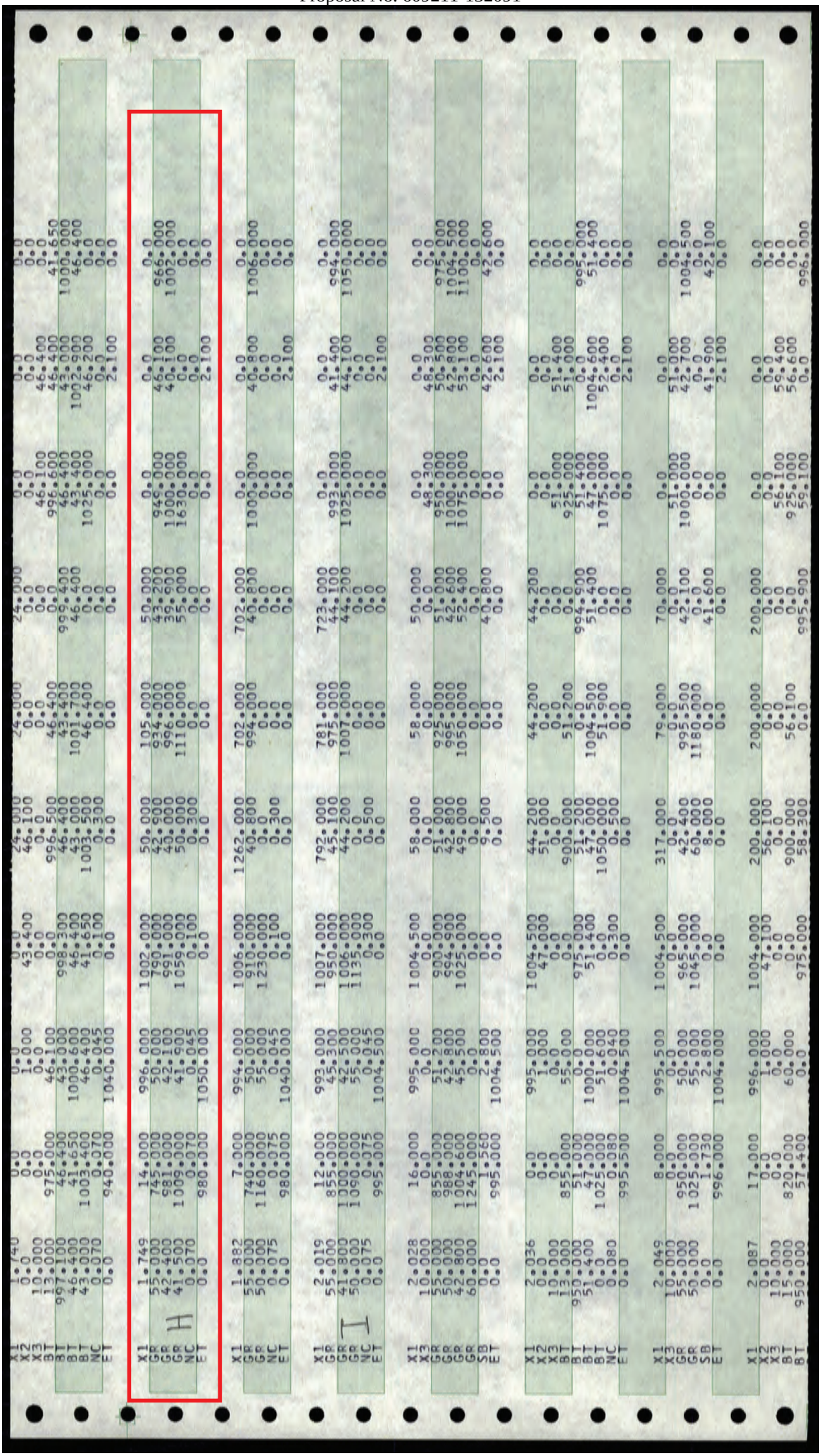
```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**************************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0.       2.        0.        0.  0.0             0.0       0.0       0.     9.200     0.0
J2  NPROF      IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
    1.000        0.0    -1.000       0.0       0.0       0.0       0.0       0.0       0.0        0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
     38.000     1.000     2.000     3.000    40.000    41.000    42.000    53.000    21.000     4.000

     22.000    54.000    34.000       0.0    38.000     1.000    39.000    50.000    61.000    51.000

     26.000    43.000    13.000    14.000    15.000    27.000    28.000       0.0       0.0       0.0
QT    9.000   640.000   970.000  1140.000  1620.000  1140.000  1140.000  1140.000  1140.000  1140.000
NC    0.080     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.002    17.000   992.500  1005.500       0.0       0.0       0.0       0.0       0.0       0.0
GR   20.000   625.000    15.000   650.000    10.000   750.000    11.200   949.000    11.200   964.000
GR   10.800   979.500     5.400   992.500     4.200  1000.000     4.600  1005.500     5.300  1008.000
GR    8.300  1011.000     8.700  1025.000     8.700  1040.000     8.700  1055.000     9.500  1082.000
GR   10.000  1140.000    40.000  1140.100       0.0       0.0       0.0       0.0       0.0       0.0
NC    0.075     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.056    12.000   994.000  1006.000   340.000   285.000   285.000       0.0       0.0       0.0
GR   20.000   570.000    15.000   630.000    10.000   730.000    10.000   905.000     5.000   980.000
GR    4.800   994.000     4.600  1000.000     4.800  1006.000     5.000  1010.000    10.200  1035.000
GR   10.500  1090.000    40.000  1090.100       0.0       0.0       0.0       0.0       0.0       0.0
NC    0.050     0.050     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.056    10.000   994.000  1006.000     1.000     1.000     1.000       0.0       0.0       0.0
GR   40.000   950.000    10.000   950.100     5.000   980.000     4.800   994.000     4.600  1000.000
GR    4.800  1006.000     5.000  1010.000    10.200  1035.000    10.500  1090.000    40.000  1090.100
NC    0.040     0.045     0.040     0.300     0.500       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.069    15.000   985.700  1014.700    70.000    70.000    69.000       0.0       0.0       0.0
```

A00829 - 461

Proposal No. 609211-132091







	SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
	1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
	1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
	1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
	1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
	1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
	1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
	1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
	1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
	1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
	1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
D	1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
	1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
	1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
	1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
	1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
	1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
	1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
	1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
	1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
	1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
	1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
	1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.22	996.00	35.45	1006.00	1018.47	73.95
	1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
	1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
	1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
	1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
E	1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
	1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
	1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
	1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
	1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
	1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
	1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
	1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
	1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
	1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
	1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
	1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
	1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
	1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
	1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
	1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
F	1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	211.71
	1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

Proposal No. 609211-132091

	SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
G	1.542	42.40	0.0	42.47	0.0	0.0	38.90	969.31	997.00	99.03	1004.00	1068.35	55.08
	1.542	43.01	0.0	43.08	0.0	0.0	38.90	967.31	997.00	109.50	1004.00	1076.80	87.37
	1.542	43.28	0.0	43.35	0.0	0.0	38.90	966.41	997.00	114.18	1004.00	1080.59	104.35
	1.542	44.02	0.0	44.09	0.0	0.0	38.90	963.95	997.00	127.00	1004.00	1090.95	159.05
	1.726	43.86	0.0	43.90	0.0	0.0	40.10	939.96	996.50	92.86	1003.50	1032.82	70.24
	1.726	44.45	0.0	44.51	0.0	0.0	40.10	930.82	996.50	106.75	1003.50	1037.56	100.41
	1.726	44.71	0.0	44.77	0.0	0.0	40.10	926.89	996.50	112.71	1003.50	1039.60	115.47
	1.726	45.41	0.0	45.48	0.0	0.0	40.10	916.11	996.50	129.08	1003.50	1045.19	163.74
*	1.735	43.94	43.94	44.88	0.0	0.0	39.90	988.61	996.50	22.60	1003.50	1011.21	15.83
*	1.735	44.67	44.67	45.64	0.0	0.0	39.90	983.97	996.50	31.72	1003.50	1015.70	25.16
*	1.735	44.94	44.94	45.94	0.0	0.0	39.90	982.27	996.50	35.08	1003.50	1017.35	29.57
*	1.735	45.59	45.59	46.69	0.0	0.0	39.90	978.21	996.50	43.08	1003.50	1021.28	42.48
	1.740	46.70	0.0	46.75	46.10	43.40	39.90	961.25	996.50	93.76	1003.50	1055.01	76.86
	1.740	47.35	0.0	47.41	46.10	43.40	39.90	946.04	996.50	148.87	1003.50	1094.91	111.85
	1.740	47.61	0.0	47.67	46.10	43.40	39.90	940.06	996.50	170.52	1003.50	1110.58	129.89
	1.740	48.32	0.0	48.37	46.10	43.40	39.90	923.80	996.50	229.44	1003.50	1153.24	194.12
H	1.749	46.76	0.0	46.77	0.0	0.0	39.90	855.65	996.00	233.97	1002.00	1089.62	413.41
	1.749	47.43	0.0	47.43	0.0	0.0	39.90	842.21	996.00	251.58	1002.00	1093.79	534.17
	1.749	47.69	0.0	47.69	0.0	0.0	39.90	836.95	996.00	258.47	1002.00	1095.42	586.16
	1.749	48.39	0.0	48.39	0.0	0.0	39.90	822.75	996.00	277.08	1002.00	1099.83	740.34
	1.882	46.80	0.0	46.81	0.0	0.0	40.80	939.19	994.00	167.28	1006.00	1106.48	283.97
	1.882	47.48	0.0	47.49	0.0	0.0	40.80	933.01	994.00	184.79	1006.00	1117.81	367.00
	1.882	47.75	0.0	47.75	0.0	0.0	40.80	930.58	994.00	191.68	1006.00	1122.26	403.31
	1.882	48.47	0.0	48.48	0.0	0.0	40.80	924.01	994.00	210.29	1006.00	1134.31	512.35
I	2.019	46.89	0.0	46.91	0.0	0.0	41.40	934.39	993.00	134.55	1007.00	1068.94	136.65
	2.019	47.59	0.0	47.62	0.0	0.0	41.40	927.52	993.00	146.17	1007.00	1073.69	198.05
	2.019	47.87	0.0	47.90	0.0	0.0	41.40	924.80	993.00	150.78	1007.00	1075.58	225.75
	2.019	48.62	0.0	48.65	0.0	0.0	41.40	917.45	993.00	163.22	1007.00	1080.67	310.20
	2.028	46.63	0.0	47.27	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	27.95
	2.028	47.07	0.0	48.24	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	32.86
	2.028	47.19	0.0	48.69	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	34.13
	2.028	48.55	0.0	48.81	0.0	0.0	42.60	989.39	995.00	57.41	1004.50	1046.79	121.45
	2.036	46.90	0.0	47.46	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	30.96
	2.036	48.23	0.0	48.96	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	46.35
	2.036	48.98	0.0	49.75	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	55.57
	2.036	51.68	0.0	51.73	51.00	47.00	42.60	894.32	995.00	175.38	1004.50	1069.70	335.37
	2.049	47.37	0.0	47.80	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	42.29
	2.049	48.71	0.0	49.32	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	58.97
	2.049	49.44	0.0	50.10	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	68.29
	2.049	51.70	0.0	51.80	0.0	0.0	42.10	959.89	995.50	71.92	1004.50	1031.81	295.82
	2.087	47.87	0.0	48.26	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	46.38
	2.087	50.27	0.0	50.73	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	72.87
	2.087	51.73	0.0	52.17	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	89.33
	2.087	56.80	0.0	56.82	56.10	47.10	41.90	835.94	996.00	168.06	1004.00	1004.00	804.85

Proposal No. 609211-132091

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

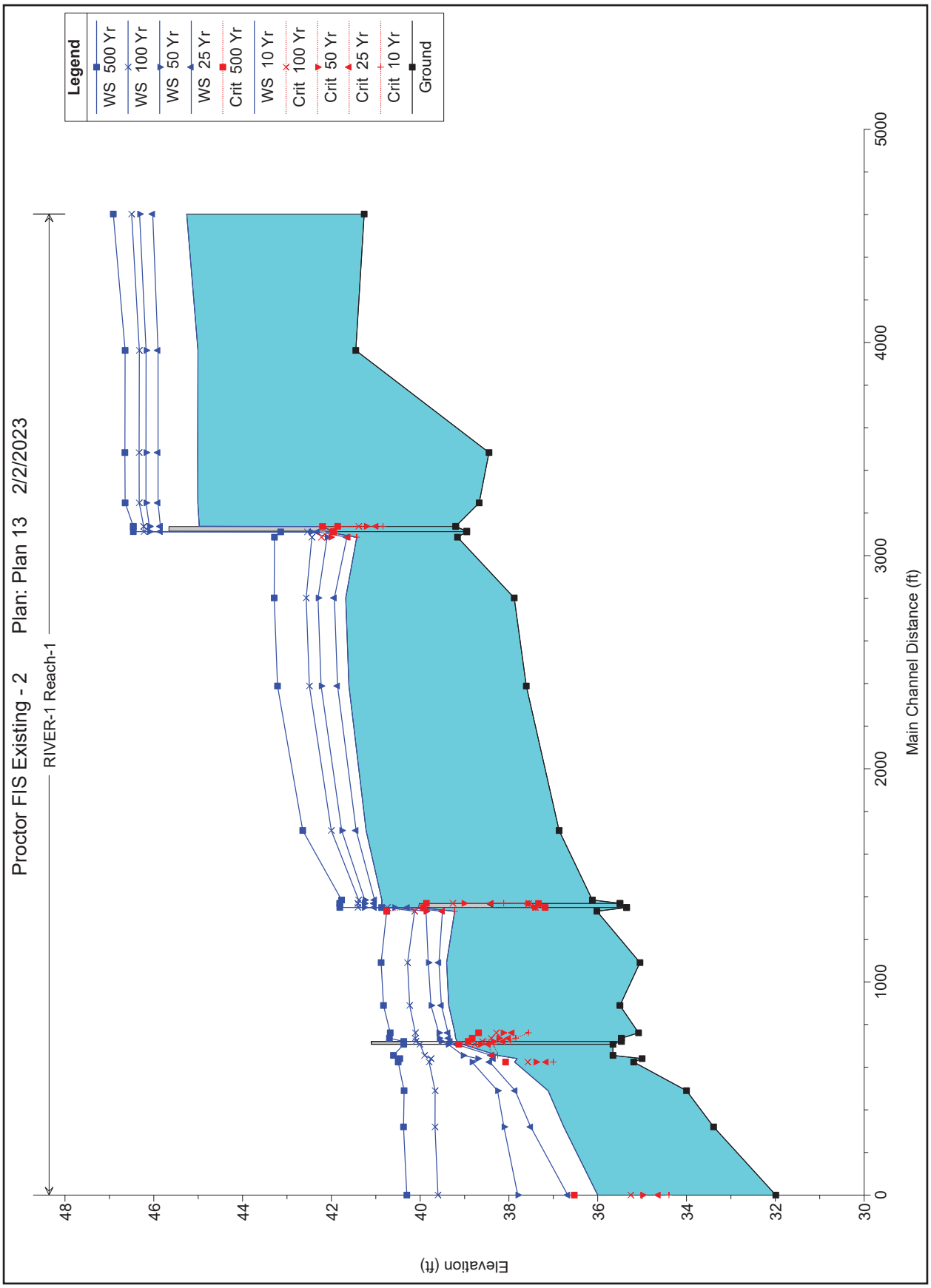
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	34	10 Yr	242.26	41.26	45.26		45.43	0.001879	3.47	97.63	84.71	0.37
Reach-1	34	25 Yr	289.42	41.26	46.02		46.12	0.000911	2.85	165.79	93.11	0.27
Reach-1	34	50 Yr	365.72	41.26	46.32		46.44	0.001017	3.17	193.87	96.36	0.29
Reach-1	34	100 Yr	427.56	41.26	46.50		46.64	0.001136	3.46	211.21	98.32	0.30
Reach-1	34	500 Yr	618.49	41.26	46.91		47.12	0.001543	4.30	252.72	102.84	0.36
Reach-1	33	10 Yr	242.26	41.45	45.01		45.02	0.000267	1.46	319.60	148.08	0.15
Reach-1	33	25 Yr	289.42	41.45	45.90		45.92	0.000140	1.26	461.53	168.49	0.11
Reach-1	33	50 Yr	365.72	41.45	46.17		46.19	0.000173	1.46	508.09	174.67	0.12
Reach-1	33	100 Yr	427.56	41.45	46.33		46.35	0.000206	1.63	534.97	178.14	0.14
Reach-1	33	500 Yr	618.49	41.45	46.64		46.68	0.000327	2.15	592.88	185.39	0.17
Reach-1	32	10 Yr	242.26	38.45	45.01		45.01	0.000006	0.29	871.30	219.19	0.02
Reach-1	32	25 Yr	289.42	38.45	45.90		45.91	0.000005	0.29	1075.76	237.72	0.02
Reach-1	32	50 Yr	365.72	38.45	46.18		46.18	0.000006	0.35	1141.15	243.35	0.03
Reach-1	32	100 Yr	427.56	38.45	46.33		46.33	0.000008	0.39	1178.58	246.52	0.03
Reach-1	32	500 Yr	618.49	38.45	46.65		46.65	0.000014	0.54	1258.64	253.15	0.04
Reach-1	31	10 Yr	242.26	38.67	45.01		45.01	0.000007	0.33	957.81	294.77	0.03
Reach-1	31	25 Yr	289.42	38.67	45.90		45.90	0.000006	0.32	1257.05	373.59	0.02
Reach-1	31	50 Yr	365.72	38.67	46.17		46.18	0.000007	0.39	1361.68	397.48	0.03
Reach-1	31	100 Yr	427.56	38.67	46.33		46.33	0.000009	0.44	1423.28	410.90	0.03
Reach-1	31	500 Yr	618.49	38.67	46.65		46.65	0.000016	0.60	1558.78	438.97	0.04
Reach-1	30	10 Yr	242.26	39.20	44.97	40.84	45.00	0.000123	1.46	233.94	97.19	0.11
Reach-1	30	25 Yr	289.42	39.20	45.85	40.99	45.89	0.000147	1.77	286.00	116.47	0.12
Reach-1	30	50 Yr	365.72	39.20	46.10	41.21	46.16	0.000205	2.14	320.35	168.44	0.15
Reach-1	30	100 Yr	427.56	39.20	46.23	41.38	46.30	0.000261	2.45	344.37	203.35	0.17
Reach-1	30	500 Yr	618.49	39.20	46.46	41.86	46.60	0.000470	3.36	399.49	268.61	0.22
Reach-1	29.5		Culvert									
Reach-1	29.4	10 Yr	242.26	38.95	42.13		42.35	0.002509	3.78	65.97	34.07	0.42
Reach-1	29.4	25 Yr	289.42	38.95	42.32		42.59	0.002777	4.17	71.88	36.81	0.45
Reach-1	29.4	50 Yr	365.72	38.95	42.45		42.84	0.003728	5.00	76.15	38.79	0.53
Reach-1	29.4	100 Yr	427.56	38.95	42.54		43.03	0.004604	5.67	78.75	39.99	0.59
Reach-1	29.4	500 Yr	618.49	38.95	43.14		43.83	0.005019	6.72	97.41	48.63	0.64
Reach-1	29.3	10 Yr	242.26	39.16	41.43	41.43	42.09	0.016855	6.51	37.23	28.61	1.01
Reach-1	29.3	25 Yr	289.42	39.16	41.65	41.62	42.33	0.015409	6.60	43.87	30.87	0.98
Reach-1	29.3	50 Yr	365.72	39.16	42.09	42.01	42.65	0.009391	6.09	75.57	104.97	0.79
Reach-1	29.3	100 Yr	427.56	39.16	42.44	42.22	42.87	0.006204	5.55	119.41	149.42	0.66
Reach-1	29.3	500 Yr	618.49	39.16	43.28		43.51	0.002697	4.55	291.00	258.02	0.46
Reach-1	28	10 Yr	242.26	37.88	41.68		41.69	0.000194	1.04	274.93	163.88	0.12
Reach-1	28	25 Yr	289.42	37.88	41.93		41.95	0.000190	1.11	316.93	165.79	0.12
Reach-1	28	50 Yr	365.72	37.88	42.30		42.32	0.000186	1.20	378.73	168.29	0.12
Reach-1	28	100 Yr	427.56	37.88	42.57		42.59	0.000186	1.27	423.89	170.10	0.12
Reach-1	28	500 Yr	618.49	37.88	43.29		43.32	0.000187	1.45	547.98	174.95	0.13
Reach-1	27	10 Yr	242.26	37.61	41.61		41.62	0.000162	0.94	262.98	122.78	0.11
Reach-1	27	25 Yr	289.42	37.61	41.86		41.88	0.000162	1.01	294.64	125.36	0.11
Reach-1	27	50 Yr	365.72	37.61	42.23		42.25	0.000164	1.11	341.70	129.09	0.11
Reach-1	27	100 Yr	427.56	37.61	42.50		42.52	0.000166	1.18	376.39	131.78	0.12
Reach-1	27	500 Yr	618.49	37.61	43.21		43.24	0.000174	1.39	473.33	138.92	0.12
Reach-1	26.5	10 Yr	242.26	36.87	41.22		41.36	0.001442	3.06	87.17	51.16	0.33
Reach-1	26.5	25 Yr	289.42	36.87	41.44		41.61	0.001540	3.33	99.43	57.56	0.34
Reach-1	26.5	50 Yr	365.72	36.87	41.77		41.97	0.001663	3.72	119.82	68.30	0.36
Reach-1	26.5	100 Yr	427.56	36.87	42.00		42.23	0.001747	3.99	136.75	77.37	0.38
Reach-1	26.5	500 Yr	618.49	36.87	42.64		42.94	0.001857	4.60	194.69	102.52	0.40
Reach-1	26	10 Yr	242.26	36.12	40.86		40.99	0.000887	2.90	97.10	48.82	0.26
Reach-1	26	25 Yr	289.42	36.12	41.03		41.19	0.001086	3.30	105.58	55.12	0.29
Reach-1	26	50 Yr	365.72	36.12	41.25		41.47	0.001415	3.90	118.63	63.60	0.33
Reach-1	26	100 Yr	427.56	36.12	41.39		41.67	0.001704	4.38	127.82	68.95	0.37
Reach-1	26	500 Yr	618.49	36.12	41.77		42.22	0.002529	5.64	157.16	83.79	0.45
Reach-1	25	10 Yr	242.26	35.50	40.87	38.12	40.96	0.000715	2.55	119.60	72.16	0.23
Reach-1	25	25 Yr	289.42	35.50	41.03	38.40	41.15	0.000858	2.88	132.11	78.29	0.26
Reach-1	25	50 Yr	365.72	35.50	41.26	39.01	41.42	0.001087	3.37	150.74	86.62	0.29
Reach-1	25	100 Yr	427.56	35.50	41.40	39.26	41.60	0.001287	3.75	163.64	91.94	0.32
Reach-1	25	500 Yr	618.49	35.50	41.81	39.86	42.11	0.001818	4.73	204.06	106.93	0.39
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	242.26	35.35	40.06		40.30	0.001760	3.99	66.19	24.87	0.36
Reach-1	24.4	25 Yr	289.42	35.35	40.29		40.59	0.002068	4.50	72.65	32.38	0.39

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	24.4	50 Yr	365.72	35.35	40.57		40.99	0.002586	5.26	83.66	44.02	0.44
Reach-1	24.4	100 Yr	427.56	35.35	40.74		41.26	0.003065	5.87	91.57	50.78	0.48
Reach-1	24.4	500 Yr	618.49	35.35	40.87	39.93	41.86	0.005758	8.19	98.31	55.89	0.66
Reach-1	24.3	10 Yr	242.26	36.02	39.22	39.22	40.06	0.016648	7.32	33.08	20.10	1.01
Reach-1	24.3	25 Yr	289.42	36.02	39.50	39.50	40.36	0.014524	7.45	40.48	30.70	0.96
Reach-1	24.3	50 Yr	365.72	36.02	39.87	39.87	40.76	0.012248	7.69	54.77	45.79	0.91
Reach-1	24.3	100 Yr	427.56	36.02	40.12	40.12	41.04	0.011122	7.88	67.75	55.44	0.88
Reach-1	24.3	500 Yr	618.49	36.02	40.75	40.75	41.73	0.009372	8.41	110.23	79.19	0.84
Reach-1	23	10 Yr	242.26	35.05	39.40		39.41	0.000052	0.66	401.39	156.58	0.07
Reach-1	23	25 Yr	289.42	35.05	39.58		39.58	0.000062	0.75	428.63	158.87	0.07
Reach-1	23	50 Yr	365.72	35.05	39.82		39.83	0.000078	0.88	467.37	161.12	0.08
Reach-1	23	100 Yr	427.56	35.05	40.28		40.30	0.000069	0.90	543.40	165.46	0.08
Reach-1	23	500 Yr	618.49	35.05	40.88		40.90	0.000089	1.12	643.56	171.00	0.09
Reach-1	22	10 Yr	242.26	35.50	39.36		39.38	0.000658	1.33	183.03	138.19	0.20
Reach-1	22	25 Yr	289.42	35.50	39.52		39.55	0.000646	1.41	206.41	141.44	0.20
Reach-1	22	50 Yr	365.72	35.50	39.76		39.79	0.000649	1.54	240.00	145.98	0.21
Reach-1	22	100 Yr	427.56	35.50	40.24		40.27	0.000400	1.39	312.34	155.31	0.17
Reach-1	22	500 Yr	618.49	35.50	40.83		40.86	0.000381	1.56	407.24	166.76	0.17
Reach-1	21.7	10 Yr	242.26	35.08	39.22	37.56	39.28	0.000955	1.98	122.64	69.81	0.25
Reach-1	21.7	25 Yr	289.42	35.08	39.37	37.93	39.45	0.001049	2.19	133.79	75.72	0.27
Reach-1	21.7	50 Yr	365.72	35.08	39.58	38.13	39.68	0.001203	2.50	150.44	83.77	0.29
Reach-1	21.7	100 Yr	427.56	35.08	40.11	38.28	40.19	0.000788	2.33	200.47	104.22	0.25
Reach-1	21.7	500 Yr	618.49	35.08	40.67	38.68	40.79	0.000846	2.73	262.26	114.10	0.26
Reach-1	21.6	10 Yr	242.26	35.46	39.20	37.85	39.24	0.001125	1.61	151.05	126.87	0.26
Reach-1	21.6	25 Yr	289.42	35.46	39.36	38.01	39.40	0.001123	1.70	171.47	134.62	0.26
Reach-1	21.6	50 Yr	365.72	35.46	39.57	38.23	39.62	0.001149	1.83	201.40	145.23	0.27
Reach-1	21.6	100 Yr	427.56	35.46	40.11	38.40	40.15	0.000579	1.53	287.30	168.00	0.20
Reach-1	21.6	500 Yr	618.49	35.46	40.69	38.83	40.74	0.000482	1.67	387.91	179.91	0.19
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	242.26	35.66	38.25	38.25	38.69	0.018701	5.36	49.29	69.69	1.00
Reach-1	21.4	25 Yr	289.42	35.66	38.40	38.38	38.84	0.015829	5.45	59.82	75.85	0.94
Reach-1	21.4	50 Yr	365.72	35.66	39.03		39.26	0.004572	4.02	116.63	102.92	0.55
Reach-1	21.4	100 Yr	427.56	35.66	39.90		40.01	0.001307	2.84	221.82	139.83	0.31
Reach-1	21.4	500 Yr	618.49	35.66	40.60		40.71	0.001041	2.98	325.78	155.54	0.29
Reach-1	21.35	10 Yr	242.26	35.00	37.81		38.18	0.004617	4.84	50.10	20.60	0.55
Reach-1	21.35	25 Yr	289.42	35.00	38.35		38.69	0.003646	4.71	61.40	21.66	0.49
Reach-1	21.35	50 Yr	365.72	35.00	38.70		39.14	0.004131	5.29	69.16	22.36	0.53
Reach-1	21.35	100 Yr	427.56	35.00	39.75		39.95	0.003457	3.54	120.75	67.51	0.47
Reach-1	21.35	500 Yr	618.49	35.00	40.46		40.66	0.002652	3.59	172.05	77.22	0.42
Reach-1	21.3	10 Yr	242.26	35.19	37.87	37.00	38.07	0.003009	3.56	68.12	35.00	0.45
Reach-1	21.3	25 Yr	289.42	35.19	38.43	37.16	38.60	0.002006	3.27	88.47	37.88	0.38
Reach-1	21.3	50 Yr	365.72	35.19	38.83	37.39	39.02	0.001886	3.47	118.41	103.01	0.37
Reach-1	21.3	100 Yr	427.56	35.19	39.80	37.57	39.90	0.000750	2.69	226.91	122.06	0.25
Reach-1	21.3	500 Yr	618.49	35.19	40.49	38.08	40.61	0.000756	3.03	316.67	135.81	0.26
Reach-1	21.2	10 Yr	242.26	34.00	37.12		37.53	0.005100	5.16	46.99	19.03	0.58
Reach-1	21.2	25 Yr	289.42	34.00	37.86		38.18	0.004995	4.54	63.78	31.80	0.56
Reach-1	21.2	50 Yr	365.72	34.00	38.26		38.59	0.005840	4.64	78.83	43.52	0.61
Reach-1	21.2	100 Yr	427.56	34.00	39.66		39.77	0.001224	2.63	167.44	82.49	0.30
Reach-1	21.2	500 Yr	618.49	34.00	40.36		40.49	0.001111	2.91	231.71	101.78	0.29
Reach-1	19	10 Yr	242.26	33.39	36.76		36.91	0.002162	3.10	78.03	37.25	0.38
Reach-1	19	25 Yr	289.42	33.39	37.51		37.59	0.002064	2.22	130.62	103.19	0.35
Reach-1	19	50 Yr	365.72	33.39	38.11		38.17	0.000996	1.85	197.34	117.88	0.25
Reach-1	19	100 Yr	427.56	33.39	39.66		39.68	0.000173	1.04	409.41	155.64	0.11
Reach-1	19	500 Yr	618.49	33.39	40.37		40.40	0.000181	1.18	525.96	172.92	0.12
Reach-1	18	10 Yr	242.26	31.99	36.00	34.40	36.21	0.002151	3.71	65.28	23.13	0.39
Reach-1	18	25 Yr	289.42	31.99	36.68	34.63	36.84	0.002605	3.25	93.05	65.81	0.41
Reach-1	18	50 Yr	365.72	31.99	37.80	34.99	37.88	0.000776	2.41	195.57	116.43	0.24
Reach-1	18	100 Yr	427.56	31.99	39.60	35.26	39.63	0.000159	1.49	478.02	197.41	0.12
Reach-1	18	500 Yr	618.49	31.99	40.30	36.53	40.34	0.000184	1.75	627.24	228.91	0.13

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Reach-1	29.5 Culvert #1	10 Yr	45.00	44.97	45.15	45.00	45.67	242.26		2.85	10.09	10.09
Reach-1	29.5 Culvert #1	25 Yr	45.89	45.85	45.92	45.89	45.67	270.18	19.24	3.53	11.26	11.26
Reach-1	29.5 Culvert #1	50 Yr	46.16	46.10	46.16	46.16	45.67	274.98	90.74	3.64	11.46	11.46
Reach-1	29.5 Culvert #1	100 Yr	46.30	46.23	46.28	46.30	45.67	277.33	150.23	3.69	11.56	11.56
Reach-1	29.5 Culvert #1	500 Yr	46.61	46.46	46.58	46.61	45.67	266.02	352.47	3.32	11.08	11.08
Reach-1	24.5 Culvert #1	10 Yr	40.97	40.87	40.58	40.97	40.06	139.22	103.04	0.81	5.80	5.80
Reach-1	24.5 Culvert #1	25 Yr	41.16	41.03	40.83	41.16	40.06	136.42	153.00	0.75	5.68	5.68
Reach-1	24.5 Culvert #1	50 Yr	41.43	41.26	41.12	41.43	40.06	134.93	230.79	0.68	5.62	5.62
Reach-1	24.5 Culvert #1	100 Yr	41.61	41.40	41.32	41.61	40.06	133.78	293.78	0.66	5.57	5.57
Reach-1	24.5 Culvert #1	500 Yr	42.11	41.81	41.88	42.11	40.06	112.70	505.79	0.94	4.70	4.70


Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
Crit 500 Yr
WS 10 Yr
Crit 100 Yr
Crit 50 Yr
Crit 25 Yr
Crit 10 Yr
Ground
Proctor FIS Existing - 2 Plan: Plan 13 2/2/2023
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
48
46
44
42
40
38
36
34
32
30
0
1000
2000
3000
4000
5000

Appendix E: O&M Plan, LTPPP, and IDCS

- Stormwater Management System Operation and Maintenance (O&M) Plan
- Long Term Pollution Prevention Plan (LTPPP)
- Illicit Discharge Compliance Statement (IDCS)

To:	Brendan Callahan, City of Peabody, Assistant Director of Planning
Cc:	
From:	Danielle Spicer, P.E. Green International Affiliates, Inc. (Green)
Date:	February 2, 2023
Revised:	
Project:	Independence Greenway Extension – Peabody, MA (Green No. 17118)
Subject:	Stormwater Operation and Maintenance Plan & Long-Term Pollution Prevention Plan

Operation & Maintenance Plan

All Operation and Maintenance shall be done in accordance with the relevant O&M plan per the Department of Public Services for the City of Peabody, in addition to the items noted below.

OPERATION & MAINTENANCE PLAN – OUTFALLS

Level spreaders are required at the point of discharge to limit erosion. Outfalls should be inspected every six months during the first year and annually thereafter for sediment buildup, bare spots and vegetation health. Any erosion or low spots in the level spreader must be repaired.

OPERATION & MAINTENANCE PLAN – CATCH BASINS

Catch basins require regular cleaning. Inspect the catch basins at least four times per year, including at the end of foliage- and snow removal-season. Sediment must also be removed when the depth of deposits is greater than or equal to half of the depth from the bottom of the invert of the lowest pipe in the catch basin. More frequent cleaning may be necessary in critical areas or areas with higher potential pollutant loads. Vacuum trucks are preferable to clamshell buckets for cleaning, as vacuuming is faster and removes more sediment and supernatant.

OPERATION & MAINTENANCE PLAN – INFILTRATION TRENCH

Infiltration trenches shall be inspected after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months once established. Routinely remove leaves and accumulated sediment from the surface of the trench.

When inspecting infiltration trenches look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench surface is clogged. To address surface clogging, remove and replace the first 6” layer of stone aggregate. If water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.

Long-Term Pollution Prevention Plan

In general, long-term pollution prevention and related maintenance activities will be conducted consistent with the City of Peabody's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit.

This LTPPP satisfies the requirements related to pollution prevention under Massachusetts Stormwater Standards 4, 5, 6, and 10.

Practices for Long-Term Pollution Prevention

For the facilities covered, long-term pollution prevention includes the following measures:

Litter Pick-up

The City of Peabody will conduct litter pick-up from the stormwater management facilities in conjunction with routine road maintenance activities.

Routine Inspection and Maintenance of SCMs

The City of Peabody will conduct inspection and maintenance of the stormwater control measures in accordance with the Project's O&M plan and Peabody's Department of Public Services (DPS) O&M for the City.

Maintenance of Landscaped Areas

Routine mowing will be conducted according to standard DPS practices. Embankments designed to impound water should be mowed as required to prevent establishment of woody vegetation.

Except in rare circumstances, the City does not use fertilizers, herbicides, and pesticides for the maintenance of facilities. Exceptions include using fertilizer to ensure the survival of new plantings and herbicides to control invasive plants. Use of fertilizers and herbicides shall be reviewed and approved by DPS prior to application. Local Conservation Commission review may also be required.

Snow and Ice Management

Snow and Ice Management will be conducted consistent with the practices outlined in the City's Snow and Ice Control Program.

Street Sweeping

Routine highway cleaning, with a brush-type street sweeper, will be conducted in accordance with standard DPS practices. Sweeping will occur annually in the Spring.

Prohibition of Illicit Discharges

The MassDEP Stormwater Management Standards prohibit illicit discharges to the stormwater management system. Illicit discharges are discharges that do not consist entirely of stormwater, except for certain specified non-stormwater discharges.

Examples of discharges from the following sources are not considered illicit discharges:

- Firefighting activities*
- Foundation drains
- Water line flushing
- Footing drains
- Landscape irrigation
- Residential car washing
- Uncontaminated groundwater
- Rising groundwater
- Riparian habitats/wetlands
- Potable water sources
- Dechlorinated swimming pool water
- Street sweeping
- Wash water from buildings (without detergents)
- Condensation from air conditioning units
- Run-on from private driveways caused by precipitation
- Lawn watering

*Water from firefighting activities is allowed under this permit and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

There are no known or proposed illicit connections associated with the project limits.

Spill Prevention and Response

This project does not discharge to a Zone I, Zone II or Zone A surface water supply protection area.

Response procedures will be implemented at the proposed infiltration trench for any significant release of hazardous materials such as fuels, oils, or chemical materials that have the potential of discharging to Proctor Brook.

Reportable quantities will immediately be reported to the applicable Federal, State, and local agencies as required by law. Reportable quantities of chemical, fuels, or oils are established under the Clean Water Act and enforced through MassDEP. The MassDEP Emergency Response Program shall be immediately notified in accordance with required procedures for the report of a release (telephone 888-304-1133).

In the case of a spill, applicable containment and clean-up procedures will be performed immediately. The Peabody Fire Department will be the first responders. Spill material collected during the response will be promptly removed and disposed of in accordance with Federal, State, and local requirements. If necessary, a licensed emergency response contractor will assist in cleanup of releases depending on the amount of the release and the ability of the responsible party to perform the required response.

Illicit Discharge Compliance Statement

Per Standard 10 of the Massachusetts Stormwater Handbook, the following is an Illicit Discharge Compliance Statement:

The design plans submitted for the Notice of Intent have been designed in full compliance with current standards.

The Long-Term Pollution Prevention Plan is part of the Operation and Maintenance Plan and includes measures to prevent illicit discharges. There are no known combined sewer outfalls and to the best of our knowledge all closed stormwater systems discharge per Massachusetts DEP requirements. Based on observations during a site visit in November 2022 the site does not contain any known existing illicit discharges.

Registered Professional Engineer Block and Signature

2/3/2023

Signature and Date

APPENDIX H – WQC/ACOE SUBMISSION PLANS (BOUND SEPARATELY)

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	142
PROJECT FILE NO.	609211		

TITLE SHEET & INDEX

PLAN AND PROFILE OF

INDEPENDENCE GREENWAY EXTENSION
BRIDGE P-03-020 (CAK)

IN THE CITY OF

PEABODY

ESSEX COUNTY

FEDERAL AID PROJECT NO.

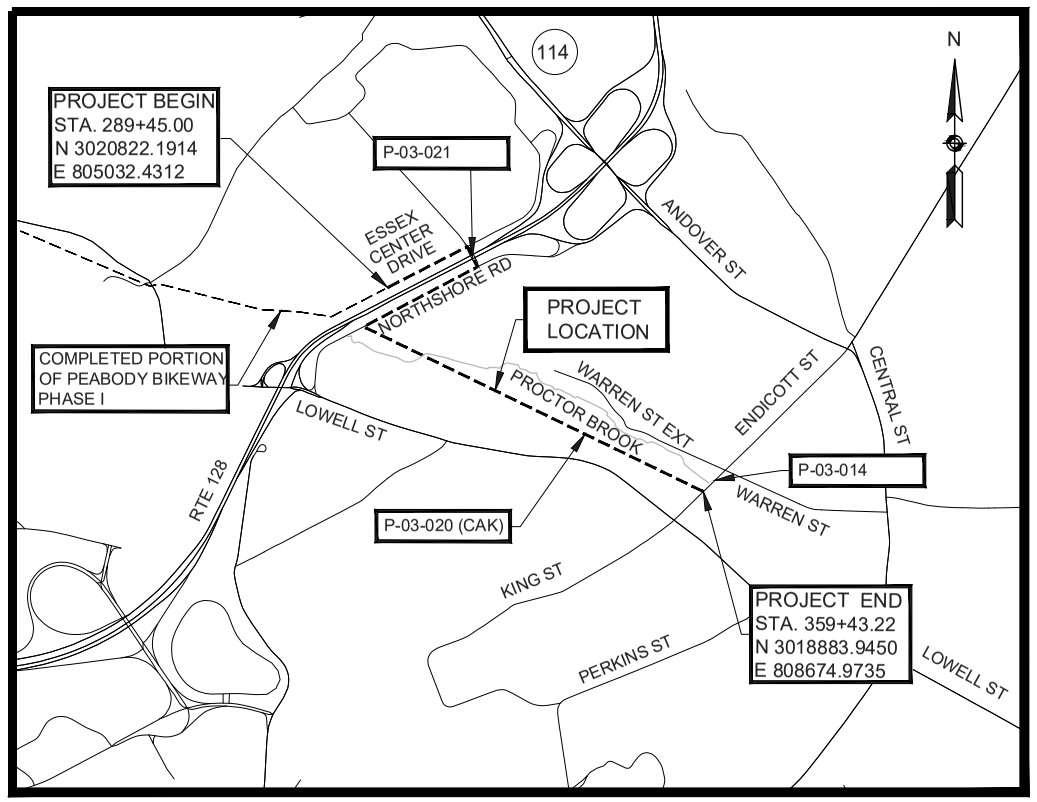
PS&E SUBMITTAL

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

WQC/ACOE PLAN SET
May 15, 2024

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	LEGEND & ABBREVIATIONS
3	GENERAL NOTES
4	KEY PLAN
5 - 6	BORING LOGS
7 - 8	TYPICAL SECTIONS & DETAILS 1
9 - 16	CONSTRUCTION PLANS & PROFILES
~~17 - 20~~	~~CURB TIE & GRADING PLANS~~
21 - 24	DRAINAGE AND UTILITY PLANS
~~25 - 31~~	~~PAVEMENT MARKINGS AND SIGNING PLANS~~
32	COMPENSATORY FLOOD STORAGE PLAN
33	WETLAND REPLICATION PLAN
34 - 39	CULVERT PLANS
40 - 43	CONSTRUCTION DETAILS
46 - 50	LANDSCAPE PLANS
~~51~~	~~LIGHTING & ELECTRICAL PLANS~~
~~52 - 59~~	~~TEMPORARY TRAFFIC CONTROL PLANS~~
60-76	BRIDGE PLANS (SELECTED SHEETS)
~~77 - 142~~	~~CROSS SECTIONS~~



LENGTH OF PROJECT = 6998.22 FEET = 1.325 MILES

DESIGN DESIGNATION

	ESSEX CENTER DRIVE	NORTHSHORE ROAD	ENDICOTT STREET
ADT (2019)	6,302	6,917	7,427
ADT (2041)	6,963	7,643	8,206
DESIGN SPEED (MPH)	30	35	35
K	8.8	8.7	7.8
D	55%	63%	55%
T (PEAK HOUR)	6%	2%	5%
T (AVERAGE DAY)	6%	2%	5%
DHV	613	665	640
DDHV	337	419	352
FUNCTIONAL CLASSIFICATION	LOCAL ROADWAY	LOCAL ROADWAY	URBAN COLLECTOR

DATE	DESCRIPTION	REV #
4/19/2024	REVISED PS&E SUBMISSION	5
2/2/2024	PS&E DESIGN SUBMISSION	4
11/7/2023	100% DESIGN SUBMISSION	3
2/2/2023	75% DESIGN SUBMISSION	2
4/20/2021	25% DESIGN SUBMISSION	1

massDOT Massachusetts Department of Transportation Highway Division

APPROVED

CHIEF ENGINEER _____ DATE _____

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
TRANSPORTATION | STRUCTURAL | WATER RESOURCES | CIVIL/SITE

WQC/ACOE PLAN SHEET 1 OF 63

Proposal No. 609211-132091

A00829 - 479

Proposal No. 609211-132091

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
		CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
C	C	CABLE MANHOLE
D	D	DRAINAGE MANHOLE
E	E	ELECTRIC MANHOLE
G	G	GAS MANHOLE
M	M	MISC MANHOLE
S	S	SEWER MANHOLE
T	T	TELEPHONE MANHOLE
W	W	WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		SEDIMENT CONTROL BARRIER
		COIR LOG
		TREE LINE
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT

TRAFFIC SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
1	1	CONTROLLER PHASE ACTUATED
		TRAFFIC SIGNAL HEAD (SIZE AS NOTED)
		WIRE LOOP DETECTOR (6' x 6' TYP UNLESS OTHERWISE SPECIFIED)
		VIDEO DETECTION CAMERA
		MICROWAVE DETECTOR
		PEDESTRIAN PUSH BUTTON, SIGN (DIRECTIONAL ARROW AS SHOWN) AND SADDLE
	*	EMERGENCY PREEMPTION CONFIRMATION STROBE LIGHT
		VEHICULAR SIGNAL HEAD
		VEHICULAR SIGNAL HEAD, OPTICALLY PROGRAMMED
		FLASHING BEACON
		PEDESTRIAN SIGNAL HEAD, (TYPE AS NOTED OR AS SPECIFIED)
RRSG	RRSG	RAILROAD SIGNAL
OR		SIGNAL POST AND BASE (ALPHA-NUMERIC DESIGNATION NOTED)
	20'	MAST ARM, SHAFT AND BASE (ARM LENGTH AS NOTED)
		HIGH MAST POLE OR TOWER
		SIGN AND POST
		SIGN AND POST (2 POSTS)
	20'	MAST ARM WITH LUMINAIRE
		OPTICAL PRE-EMPTION DETECTOR
		CONTROL CABINET, GROUND MOUNTED
		CONTROL CABINET, POLE MOUNTED
		FLASHING BEACON CONTROL AND METER PEDESTAL
		LOAD CENTER ASSEMBLY
		PULL BOX 12"x12" (OR AS NOTED)
		ELECTRIC HANDHOLE 12"x24" (OR AS NOTED)
		TRAFFIC SIGNAL CONDUIT
		INFORMATIONAL SIGN

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
ONLY	ONLY	LEGEND "ONLY" - WHITE
	SL	STOP LINE (12")
	CW	CROSSWALK
	SWL	SOLID WHITE LINE (6")
	SYL	SOLID YELLOW LINE (6")
	BWL	BROKEN WHITE LINE (10' LINE SEGMENT, 30' GAP)
	BYL	BROKEN YELLOW LINE (10' LINE SEGMENT, 30' GAP)
	DWL	DOTTED WHITE LINE (3' LINE SEGMENT, 9' GAP)
	DYL	DOTTED YELLOW LINE (3' LINE SEGMENT, 9' GAP)
	DWLEx	DOTTED WHITE LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DYLEx	DOTTED YELLOW LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DBWL	DOUBLE WHITE LINE (6")
	DBYL	DOUBLE YELLOW LINE (6")

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	142
PROJECT FILE NO.	609211		

LEGEND & ABBREVIATIONS

ABBREVIATIONS (cont.)

GENERAL

PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
RMD	REMODEL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SGE	SLOPED GRANITE EDGING
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STATION
STD	STANDARD
STW	SPRING TENSION WIRE
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE OR TOP OF SEDIMENT
TOW	TOP OF WATER
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION
DGCB	DOUBLE GRATE CATCH BASIN

TRAFFIC SIGNAL ABBREVIATIONS

CAB	CABINET
CCVE	CLOSED CIRCUIT VIDEO EQUIPMENT
DW	STEADY UPRAISED HAND
FDW	FLASHING UPRAISED HAND
FR	FLASHING CIRCULAR RED
FRL	FLASHING RED LEFT ARROW
FRR	FLASHING RED RIGHT ARROW
FY	FLASHING CIRCULAR YELLOW
FYL	FLASHING YELLOW LEFT ARROW
FYR	FLASHING YELLOW RIGHT ARROW
G	STEADY CIRCULAR GREEN
GL	STEADY GREEN LEFT ARROW
GR	STEADY GREEN RIGHT ARROW
GSL	STEADY GREEN SLASH LEFT ARROW
GSR	STEADY GREEN SLASH RIGHT ARROW
GV	STEADY GREEN VERTICAL ARROW
OL	OVERLAP
PED	PEDESTRIAN
PTZ	PAN, TILT, ZOOM
R	STEADY CIRCULAR RED
RL	STEADY RED LEFT ARROW
RR	STEADY RED RIGHT ARROW
TR SIG	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONDUIT
W	STEADY WALKING PERSON
Y	STEADY CIRCULAR YELLOW
YL	STEADY YELLOW LEFT ARROW

WQC/ACOE PLAN SHEET 2 OF 63

A00829 - 480

GENERAL NOTES

1. ALL UTILITY POLES REQUIRING RELOCATION ARE TO BE RELOCATED BY OTHERS.
2. THE CONTRACTOR SHALL MAINTAIN COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD AT ALL OBSTRUCTIONS.
3. PEDESTRIAN CURB RAMPS SHALL CONFORM TO THE CURRENT MASSDOT STANDARDS.
4. TRANSITION GRANITE CURB SHALL BE INSTALLED AT PROJECT LIMITS TO MATCH EXISTING ELEVATIONS (PAVEMENT OR EXISTING CURB).
5. THE CONTRACTOR SHALL RETAIN ALL CURBS, FENCES, WALLS, TREES, SHRUBS, POSTS, LANDSCAPE FEATURES, AND OTHER MISCELLANEOUS ITEMS WITHIN ABUTTING PROPERTIES, UNLESS OTHERWISE NOTED. WHEN RETAINING THOSE ITEMS IS NOT PRACTICAL IN THE OPINION OF THE ENGINEER, THE CONTRACTOR SHALL REMOVE, STOCKPILE, PROTECT AND RESET THE ITEMS. THE CONTRACTOR SHALL REPLACE ITEMS DAMAGED DURING REMOVAL, STOCKPILING, OR RESETTING DUE TO NEGLIGENCE, CARELESSNESS, OR MISHANDLING WITH EQUIVALENT NEW ITEMS AT NO COST TO THE OWNER.
6. ALL TREES WITHIN THE SLOPE LIMIT SHALL BE RETAINED AND PROTECTED UNLESS OTHERWISE NOTED.
7. ALL TREES CALLED OUT TO BE RETAINED SHALL BE PROTECTED USING ITEM NO. 102.511 TREE PROTECTION - ARMORING AND PRUNING AND ITEM NO. 102.521 TREE AND PLANT PROTECTION FENCE.
8. CONTRACTOR SHALL PROTECT ALL PROPERTY MARKERS OF ABUTTERS.
9. TREATMENT OF SLOPE AREAS SHALL BE REPLACED IN KIND UNLESS OTHERWISE NOTED.
10. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN EXCAVATING ALONG THE ABUTMENT FOR THE SHARED-USE PATH AT THE ROUTE 128 UNDERPASS.

UTILITY NOTES:

1. THE LOCATION OF ALL UNDERGROUND UTILITIES ARE SHOWN APPROXIMATE AND WERE COMPILED USING FIELD SURVEY INFORMATION AND AVAILABLE RECORD INFORMATION. THE LOCATION OF EXISTING PIPES OR OTHER UNDERGROUND STRUCTURES OR PROPERTY LINES ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. THE CONTRACTOR SHALL CALL "DIG SAFE" (1-888-344-7233) AND NOTIFY THE CITY OF PEABODY AND MASSDOT AT LEAST 72 HOURS (EXCLUDING SATURDAYS, SUNDAYS AND HOLIDAYS) PRIOR TO ANY EXCAVATION TO OBTAIN ACCURATE UTILITY LOCATIONS.
2. RECORD UTILITY INFORMATION FROM THE VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES ARE APPROXIMATE ONLY AND ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD.
3. THE COMPLETION AND ACCURACY OF LATERAL UTILITY SERVICES IS NOT GUARANTEED AND MUST BE VERIFIED BY THE CONTRACTOR IN THE FIELD.
4. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE MUST BE NOTIFIED, INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN, (SEE CHAPTER 370, ACTS OF 1963, MASSACHUSETTS) PRIOR TO DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORING OR REPAVING.
5. SUBSURFACE UTILITY LOCATIONS HAVE BEEN PLOTTED TO MEET UTILITY QUALITY LEVEL "C" AS DESCRIBED IN ASCE STANDARD 38-02 AND SUMMARIZED ON THIS SHEET. THE UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS BASED ON ABOVE-GROUND FIELD OBSERVATION AND EXISTING RECORD INFORMATION RECEIVED FROM UTILITY STAKE-HOLDERS.
6. INVERTS SHOWN ON PLAN ARE NOT GUARANTEED TO BE ACCURATE. DUE TO THE LIMITATIONS OF FIELD OBSERVATION AND SURVEY TECHNIQUES THE INVERTS ARE SHOWN AS APPROXIMATE ONLY AND SHALL NOT BE WARRANTED TO BE CORRECT. ADDITIONAL FIELD INVESTIGATION IS NECESSARY WHERE ACCURATE MEASUREMENTS ARE REQUIRED FOR DESIGN OF CRITICAL AREAS.
7. WHERE AN EXISTING UTILITY IS FOUND TO BE IN CONFLICT WITH THE PROPOSED WORK, THE CONTRACTOR SHALL ACCURATELY DETERMINE THE LOCATION, ELEVATION AND SIZE OF THE UTILITY AND FURNISH THE INFORMATION TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
8. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHEN EXCAVATING NEAR AND BACKFILLING IN THE VICINITY OF EXISTING UTILITIES. THE CONTRACTOR SHALL USE HAND EXCAVATION WHERE APPROPRIATE TO PROTECT EXISTING UTILITIES.
9. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING UTILITIES IN SERVICE AT ALL TIMES UNLESS NOTED ON THE PLANS OR APPROVED BY THE ENGINEER.
10. THE CONTRACTOR SHALL SUPPORT AND PROTECT EXISTING UTILITIES IN AND AROUND EXCAVATIONS, AND IN PARTICULAR, WHEN CROSSING OVER OR UNDER ANY DUCT OR PIPE. ALL PROTECTIVE MEASURES SHALL BE CONSIDERED INCIDENTAL WORK.
11. IF THE CONTRACTOR DAMAGES ANY UTILITY SYSTEM, HE OR SHE SHALL IMMEDIATELY NOTIFY THE RESPECTIVE UTILITY COMPANY AND SHALL REPAIR/REPLACE THE AFFECTED SYSTEM AT HIS OR HER OWN EXPENSE.
12. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE UTILITY COMPANIES AND MAKE ARRANGEMENTS FOR ADJUSTMENTS, ALTERATIONS AND REPLACEMENT OF PRIVATE UTILITIES.
13. BELOW GROUND STRUCTURES ARE SHOWN SYMBOLIC UNLESS DIMENSIONED.
14. THE EXISTING CONDITIONS PLAN IS TO BE USED FOR THE SPECIFIED PROJECT ONLY AND IS NOT WARRANTED TO BE COMPLETE FOR ANY OTHER FUTURE PROJECTS.
15. THE EXISTING SEWER LINE WITHIN THE PROJECT LIMITS SHALL BE INSPECTED USING CLOSED CIRCUIT TV (CCTV) AT THE BEGINNING OF THE PROJECT, PRIOR TO ANY MAJOR WORK ACTIVITIES OR LARGE EQUIPMENT MOBILIZING ON SITE. A CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE SAME LIMITS SHALL ALSO BE PERFORMED AT THE END OF CONSTRUCTION TO CONFIRM ITS CONDITION HAS NOT CHANGED OVER THE COURSE OF THE PROJECT.
IN ADDITION TO THE PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE PROJECT LIMITS, INTERIM CCTV INSPECTION OF CERTAIN SEGMENTS OF THE SEWER LINE SHALL BE PERFORMED FOR SPECIFIC VIBRATION GENERATING ACTIVITIES. CCTV INSPECTION SHALL BE PERFORMED AT THE FOLLOWING LOCATIONS AND PROPOSED CONSTRUCTION ITEMS FOR EXCAVATION AND STONE INSTALLATION ACTIVITIES:

- STA 329+85 BOX CULVERT NO. 1
- STA 340+05 36" DIP PIPE CULVERT
- STA 342+25 24" DIP PIPE CULVERT
- STA 346+20 BOX CULVERT NO. 2
- STA 351+10 BOARDWALK WEST ABUTMENT
- STA 355+48 BOARDWALK EAST ABUTMENT
- STA 358+50 16" DUCTILE IRON PIPE

SUMMARY OF UTILITY MAPPING QUALITY LEVELS:

THE FOLLOWING IS A SUMMARY OF THE SURVEY MAPPING LEVELS FOR UTILITIES AS DESCRIBED IN ASCE STANDARD 38-02, "STANDARD GUIDELINE FOR THE DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". THESE GUIDELINES ARE MORE FULLY DESCRIBED IN THE ASCE STANDARD.

UTILITY QUALITY LEVEL A:
PRECISE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES OBTAINED BY THE ACTUAL EXPOSURE (OR VERIFICATION OF PREVIOUSLY EXPOSED AND SURVEYED UTILITIES) AND SUBSEQUENT MEASUREMENT OF SUBSURFACE UTILITIES, USUALLY AT A SPECIFIC POINT. MINIMALLY INTRUSIVE EXCAVATION EQUIPMENT IS TYPICALLY USED TO MINIMIZE THE POTENTIAL FOR UTILITY DAMAGE. A PRECISE HORIZONTAL AND VERTICAL LOCATION, AS WELL AS OTHER UTILITY ATTRIBUTES, IS SHOWN ON PLAN DOCUMENTS. ACCURACY IS TYPICALLY SET TO 15-MM VERTICAL AND TO APPLICABLE HORIZONTAL SURVEY AND MAPPING ACCURACY AS DEFINED OR EXPECTED BY THE PROJECT OWNER.

UTILITY QUALITY LEVEL B:
INFORMATION OBTAINED THROUGH THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND APPROXIMATE HORIZONTAL POSITION OF SUBSURFACE UTILITIES. QUALITY LEVEL B DATA SHOULD BE REPRODUCIBLE BY SURFACE GEOPHYSICS AT ANY POINT OF THEIR DEPICTION. THIS INFORMATION IS SURVEYED TO APPLICABLE TOLERANCES DEFINED BY THE PROJECT AND REDUCED ONTO PLAN DOCUMENTS.

UTILITY QUALITY LEVEL C:
INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D INFORMATION.

UTILITY QUALITY LEVEL D:
INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS.

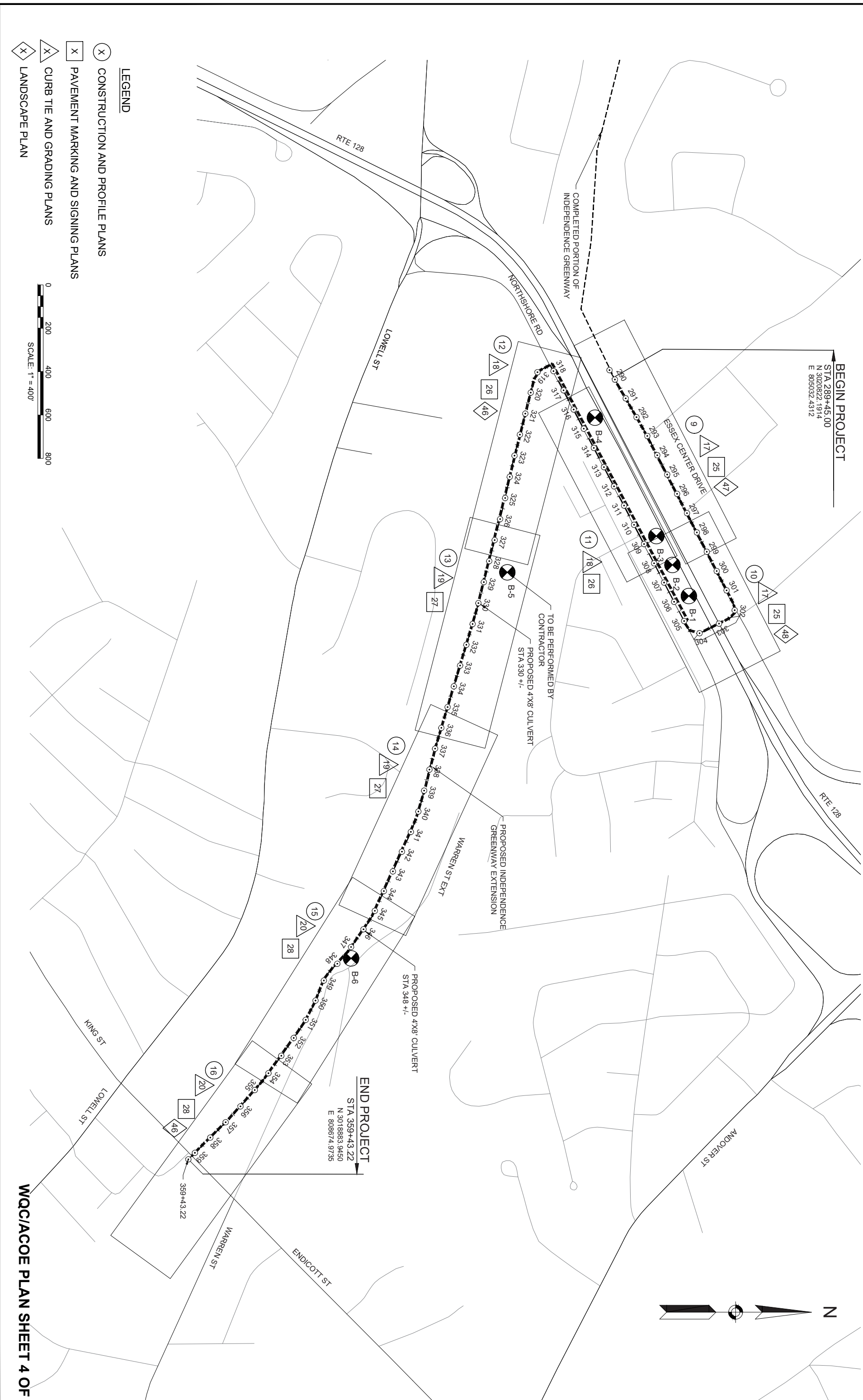
SURVEY NOTES

1. THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULT OF AN ARIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON THE GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.
2. HORIZONTAL DATUM IS BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, VERTICAL DATUM IS NAVD88. THE UNIT OF MEASUREMENTS IS US SURVEY FEET.
3. WETLANDS WERE DELINEATED BY GREEN ON 2/15/2018 AND REFLAGGED BY ECOSYSTEMS-SOLUTIONS IN 2022 ACCORDANCE WITH THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION AND FIELD LOCATED BY GREEN ON 2/20/2018. REFLAGGING DETERMINED BOUNDARIES HAD NOT CHANGED.
4. THE RIGHT OF WAY LINES SHOWN ON THIS PLAN ARE THE DIRECT RESULT OF AN INSTRUMENT SURVEY PERFORMED ON THE GROUND BY GREEN INTERNATIONAL AFFILIATES, INC. WITH AN ERROR OF CLOSURE LESS THAN 1:15,000, AND FROM PLANS AND DEEDS OF RECORD. PRIVATE PROPERTY LINES ARE COMPILED FROM DEEDS AND PLANS AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE SAID PARCELS SHOWN HERE ARE SUBJECT TO RIGHTS AND EASEMENTS AS CONTAINED IN THE VARIOUS DEEDS OF RECORD DESCRIBING SAID PREMISES. THE LOCATIONS AND EXTENT OF SAID RIGHTS AND EASEMENTS ARE NOT THE SUBJECT OF THIS SURVEY.

EROSION AND SEDIMENT CONTROL

1. ALL EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE START OF ANY LAND DISTURBANCE/EARTHWORK ACTIVITIES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE, REPAIR AND REPLACEMENT OF ALL SEDIMENTATION/EROSION CONTROL MEASURES UNTIL ALL DISTURBED AREAS ARE STABILIZED.

Proposal No. 609211-132091
A00829 - 481



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	142
PROJECT FILE NO.	609211		

WQC/ACOE PLAN SHEET 4 OF 63

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021910.4030, E 806262.1626
Ground Surface Elev. (ft.): 68.6
Final Boring Depth (ft.): 15.3
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1030	6.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	14	1 2 2 3	4	S-1: (Top 7") Dry, dark brown, fine SAND and SILT, trace Roots. (TOPSOIL) (Bottom 7") Dry, brown, fine SAND, some Silt, trace Roots. (SUBSOIL)	1 2			FILL	
5		S-2	5-7	24	13	8 19 86 22	R	S-2: (Top 3") Moist, brown, fine to medium SAND, some Silt. (FILL) (Bottom 10") Moist, brown, fine to coarse SAND, little Silt, trace Gravel. (Piece of gravel stuck in tip of spoon.)	3		5.3		63.3'
		S-3	7-9	24	10	38 42 45 50	87	S-3: Very dense, wet, brown/gray, GRAVEL, some fine to coarse Sand, trace Silt.				GLACIAL DEPOSIT	
10		S-4	9-11	24	7	25 30 13 36	43	S-4: Dense, wet, brown, fine to medium SAND, some Silt, some Gravel.	4				
15		S-5	15-15.1	1	1	100/1"	R	S-5: Very dense, wet, brown/gray, GRAVEL, trace Silt. (Fragment of possible bedrock stuck in tip of spoon.) Bottom of boring at 15.3 feet.	5 6		15.3		53.3'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Borehole relocated approximately 25 feet from staked location due to access.
3. Driller noted increased drilling resistance at 6.5 feet below ground surface (bgs).
4. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 11 feet bgs.
5. Auger refusal at 15.3 feet bgs on possible bedrock. Borehole terminated.
6. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021834.6298, E 806118.9857
Ground Surface Elev. (ft.): 68.4
Final Boring Depth (ft.): 10.5
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1230	10	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	18	1 4 27 36	31	S-1: (Top 10") Dry, dark brown, fine SAND, some Silt, trace Roots. (TOPSOIL) (Bottom 8") Dry, dark brown/black, fine to medium SAND, little Silt, trace Gravel.	1			FILL	
		S-2	2-4	24	20	30 56 40 36	96	S-2: Very dense, moist, black/gray, fine to coarse SAND, little Silt, trace Gravel.			4		64.4'
5		S-3	4-6	24	9	28 11 19 17	30	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.				GLACIAL DEPOSIT	
		S-4	6-8	24	14	70 25 20 20	45	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.	2				
10		S-5	10-10.3	3	0	100/3"	R	S-5: No recovery. (Fragments of possible bedrock stuck in tip of spoon.) Bottom of boring at 10.5 feet.	3 4		10.5		57.9'
15													
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 6.5 feet below ground surface (bgs).
3. Auger refusal at 10.5 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021760.5337, E 805985.8731
Ground Surface Elev. (ft.): 62.3
Final Boring Depth (ft.): 14.7
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19		Not encountered		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	13	2 3 11 14	14	S-1: Medium dense, dry, dark brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots. (TOPSOIL)	1				
		S-2	2-4	24	18	14 35 72 69	R	S-2: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
5		S-3	4-6	24	14	27 11 12 14	23	S-3: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.				FILL	
		S-4	6-8	24	10	12 14 5 3	19	S-4: Very dense, moist, black with brown, GRAVEL and fine to coarse SAND, trace Silt, trace Ash.			8		54.3'
10		S-5	8-10	24	9	3 6 9 14	15	S-5: Medium dense, moist, brown, fine to coarse SAND, little Gravel, trace Silt.				GLACIAL DEPOSIT	
15		S-6	14.5-14.7	2	0	100/2"	R	S-6: No recovery. Bottom of boring at 14.7 feet.	2 3		14.7		47.6'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Auger refusal at 14.5 feet below ground surface (bgs) on possible bedrock. Advanced split spoon. Split spoon refusal at 14.7 feet bgs. Borehole terminated.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

BORING NOTES

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: ⊗ B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

Proposal No. 609211-132091
A00829 - 483

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021477.6337, E 805439.9424
Ground Surface Elev. (ft.): 51.8
Final Boring Depth (ft.): 17
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1145	9.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	9	3 2 3 2	5	S-1: Loose, dry, dark brown, fine to medium SAND, some Silt, trace Roots.	1				
		S-2	2-4	24	6	2 3 3 14	6	S-2: Loose, moist, brown, fine to coarse SAND, trace Gravel, trace Silt.			3.5	FILL	48.3'
5		S-3	4-6	24	14	12 15 23 17	38	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-4	6-8	24	13	13 20 19 19	39	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	6	15 21 30 21	51	S-5: Very dense, wet, brown, fine to coarse SAND, some Gravel, little Silt.	2			GLACIAL DEPOSIT	
15		S-6	15-16.9	23	12	12 18 69 100/5"	87	S-6: Very dense, wet, brown/gray, fine to coarse SAND, some Gravel, little Silt. (Possible bedrock fragments stuck in tip of spoon.)			17		34.8'
						Bottom of boring at 17 feet.			3 4				
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Driller noted increased drilling effort at 9 feet below ground surface (bgs).
3. Auger refusal at 17 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:HSA/D&W

Boring Location: N 3020353.9560, E 807932.5686
Ground Surface Elev. (ft.): 40.5
Final Boring Depth (ft.): 25.9
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA/HW
I.D/O.D.(in): 2.75/5.75 & 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1530	3.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	4 4 11 5	15	S-1: Medium dense, dry, dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1				
		S-2	2-4	24	14	9 6 5 6	11	S-2: Medium dense, wet, brown, fine to medium SAND and SILT, trace Gravel.			2	FILL	38.5'
5		S-3	4-6	24	14	4 8 10 14	18	S-3: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt.					
		S-4	6-8	24	19	13 16 17 16	33	S-4: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
10		S-5	10-12	24	16	6 11 19 28	30	S-5: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.	2				
15		S-6	14-16	24	7	4 5 6 6	11	S-6: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.				SAND AND GRAVEL	
20		S-7	19-21	24	8	5 6 5 5	11	S-7: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
25		S-8	24-25.9	22	10	16 14 22 100/2"	36	S-8: Dense, wet, brown/gray, fine to coarse SAND and GRAVEL, trace Silt. (Possible bedrock fragments stuck in tip of spoon.)			25.9		14.6'
						Bottom of boring at 25.9 feet.			3				
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Hole appears to have blown in prior to sampling S-5. Blow counts at S-5 may be inaccurate. Driller removed augers and offset 4 feet southeast of staked location and continued hole with 4-inch casing. Samples S-6 through S-8 obtained using drive and wash drilling methods.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-6

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

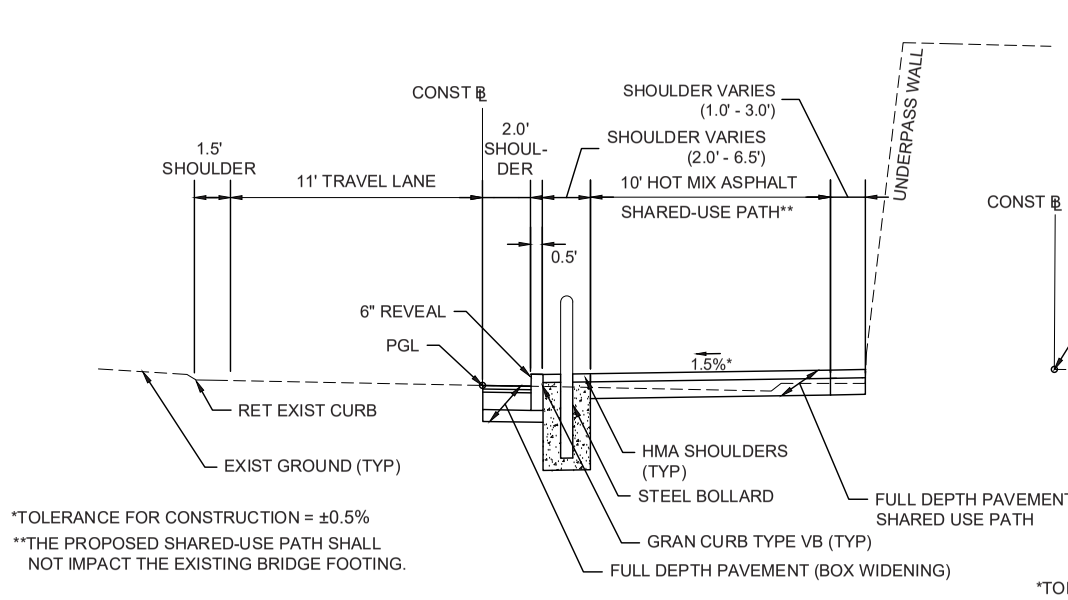
BORING NOTES

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

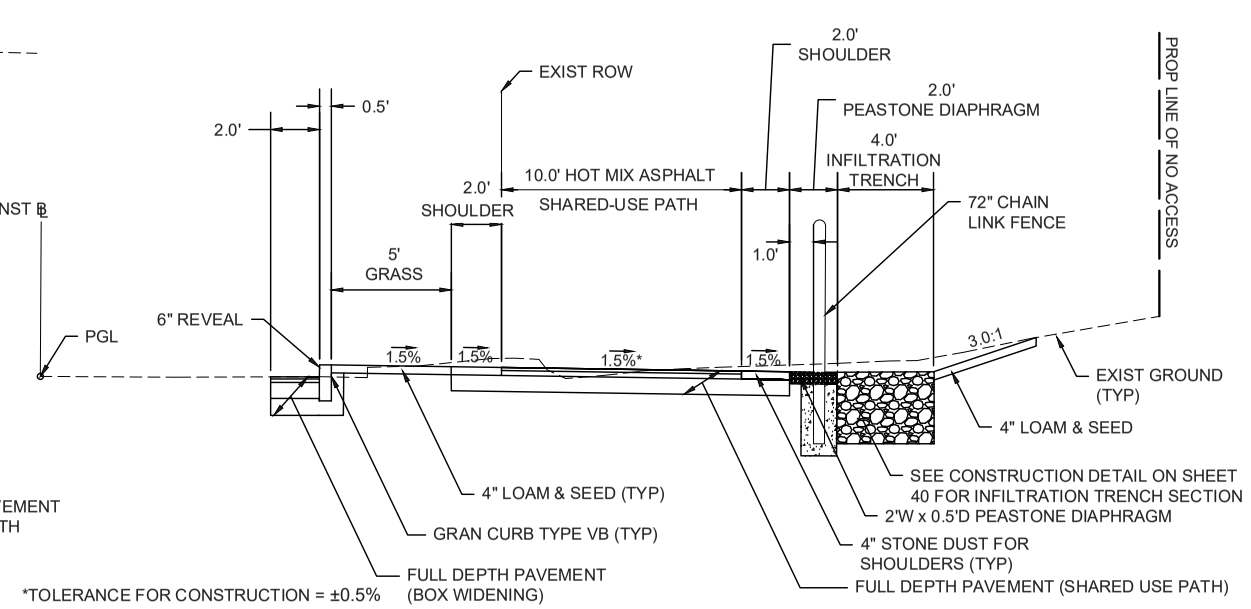
Proposal No. 609211-132091
A00829 - 484

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	142
PROJECT FILE NO.	609211		

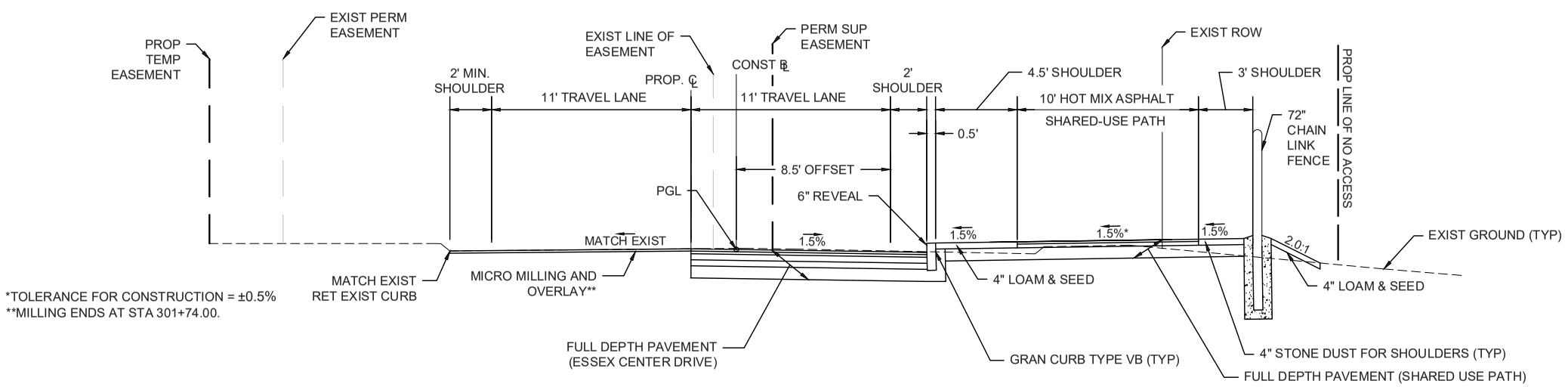
TYPICAL SECTIONS & DETAILS 1



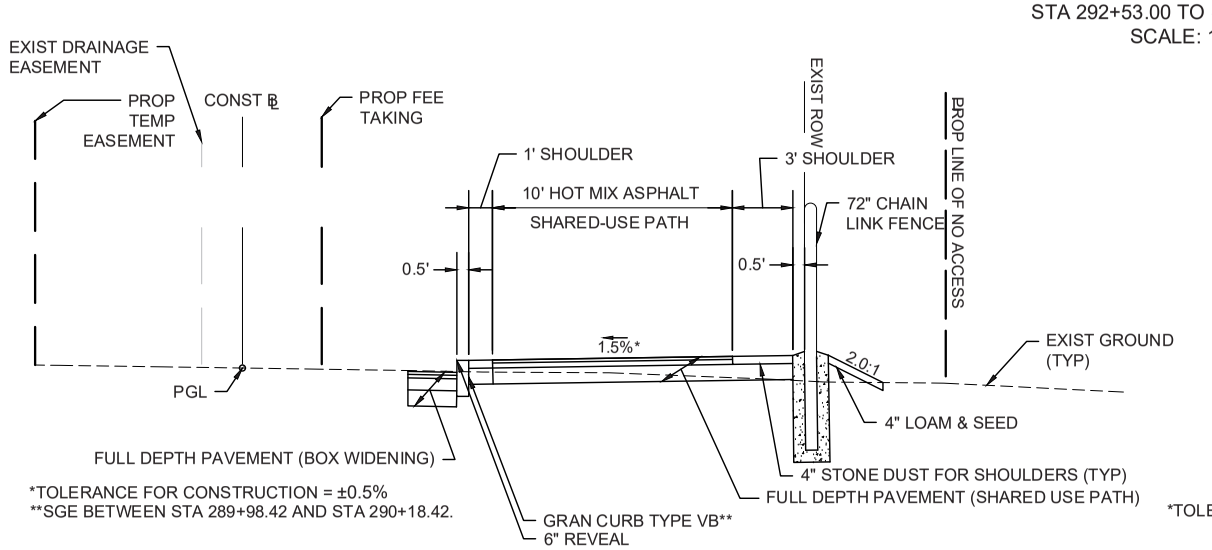
STA 301+70.65 TO STA 304+56.96
SCALE: 1"=8'



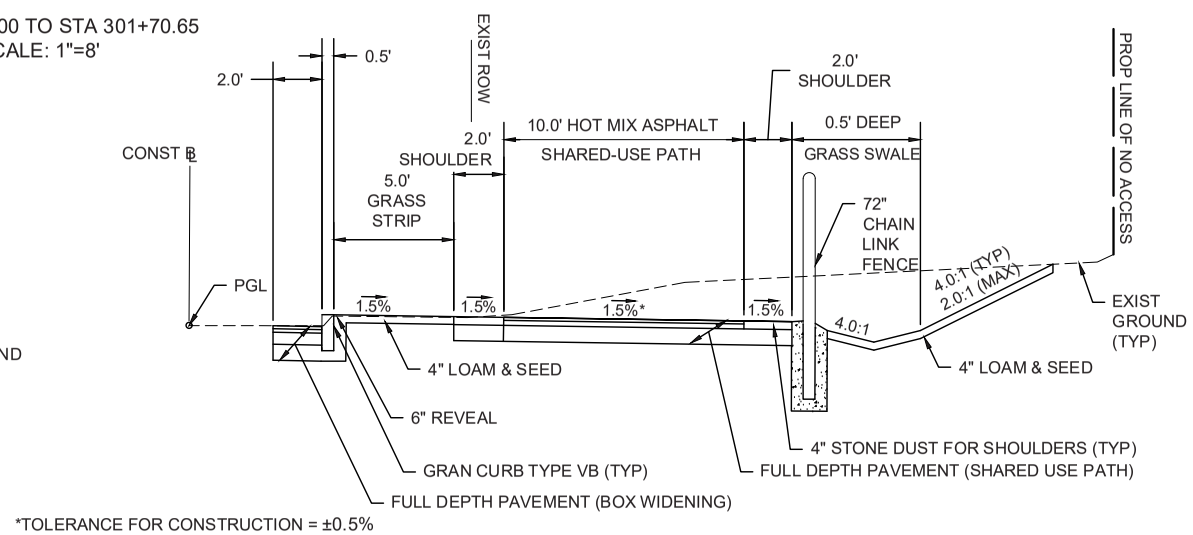
STA 310+39.43 TO STA 314+39.43
SCALE: 1"=8'



STA 292+53.00 TO STA 301+70.65
SCALE: 1"=8'



STA 289+83.24 TO STA 292+53.00
SCALE: 1"=8"



STA 314+39.43 TO STA 318+32.11
SCALE: 1"=8'

PAVEMENT NOTES

PROPOSED FULL DEPTH PAVEMENT (SHARED USE PATH)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

INTERMEDIATE COURSE: 2.5" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH PAVEMENT (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER

BASE COURSE: 4" SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) OVER
4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH PAVEMENT (BOX WIDENING)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER

BASE COURSE: 6" HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED MICRO MILLING AND OVERLAY (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

MILLING COURSE: 1.5" PAVEMENT MICRO MILLING

PROPOSED HMA WALK
SURFACE COURSE: 1.25" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
1.75 SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5)

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA DRIVEWAY
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
2.5" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) (SEE NOTE 2)

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE WALK/PEDESTRIAN CURB RAMP
SURFACE COURSE: 4" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610)

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE REINFORCED PAVEMENT
SURFACE COURSE: 6" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610) WITH WWF 6x6 - W1.4 x W1.4 AT MID DEPTH

SUB-BASE COURSE: 18" GRAVEL BORROW (TYPE B)

NOTES:
1. ALL HMA FOR PATCHING, ASPHALT EMULSION FOR TACK COAT AND HMA JOINT ADHESIVE SHALL BE INSTALLED PER SECTION 450 AND 700.
2. HMA SIDEWALKS, DRIVEWAYS, AND SHARED USE PATH ARE TO BE PAID FOR UNDER ITEM 702.

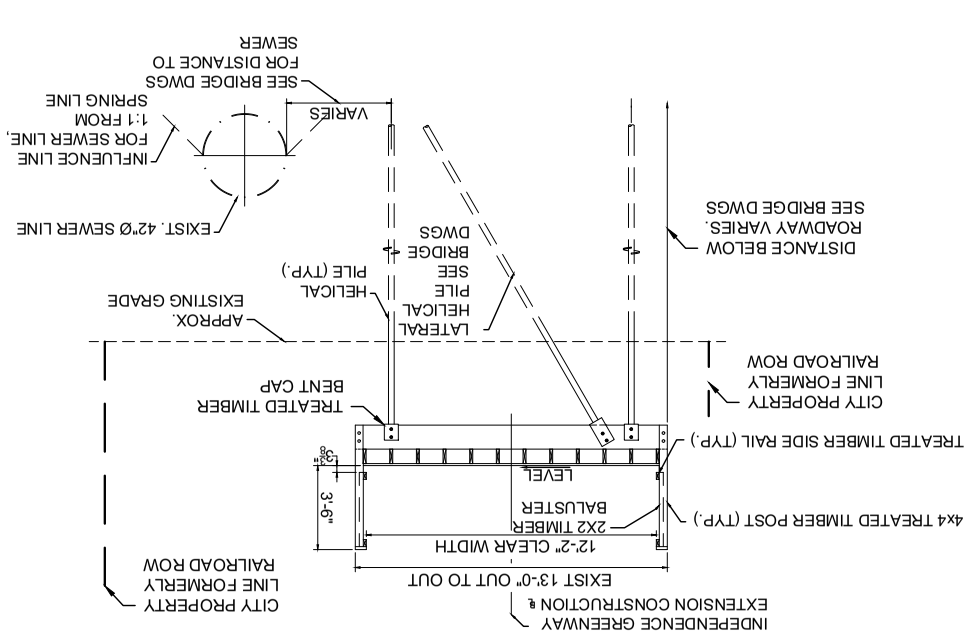
4 0 4 8
SCALE IN FEET

Proposal No. 609211-132091
A00820 - 485

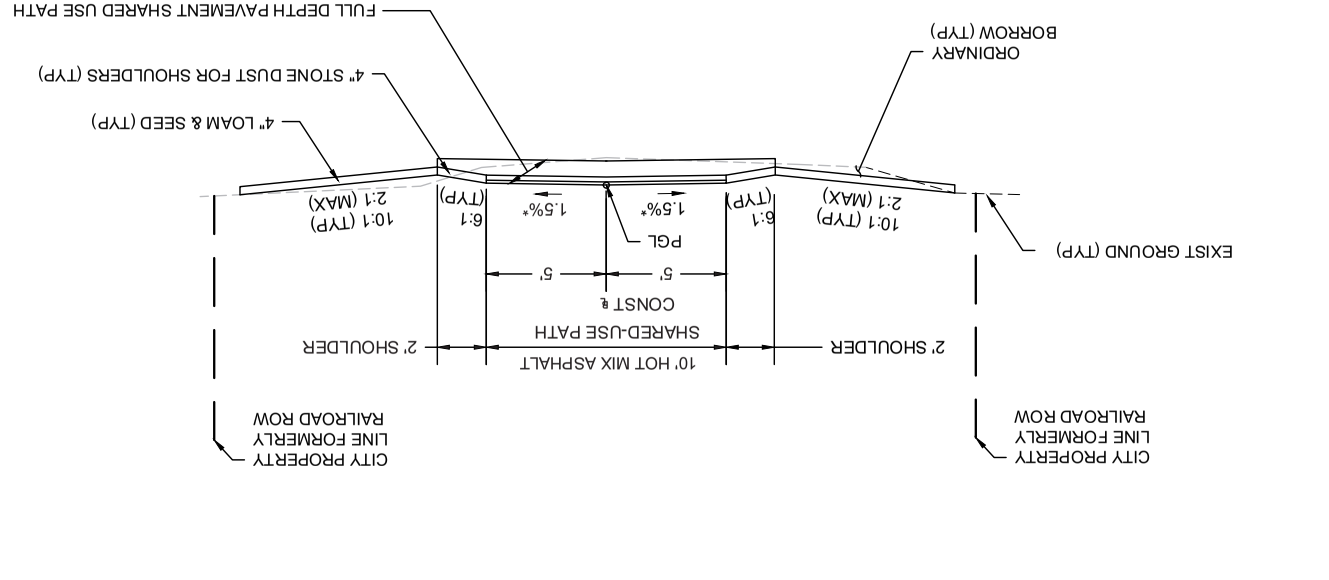
SCALE IN FEET

4 0 4 8

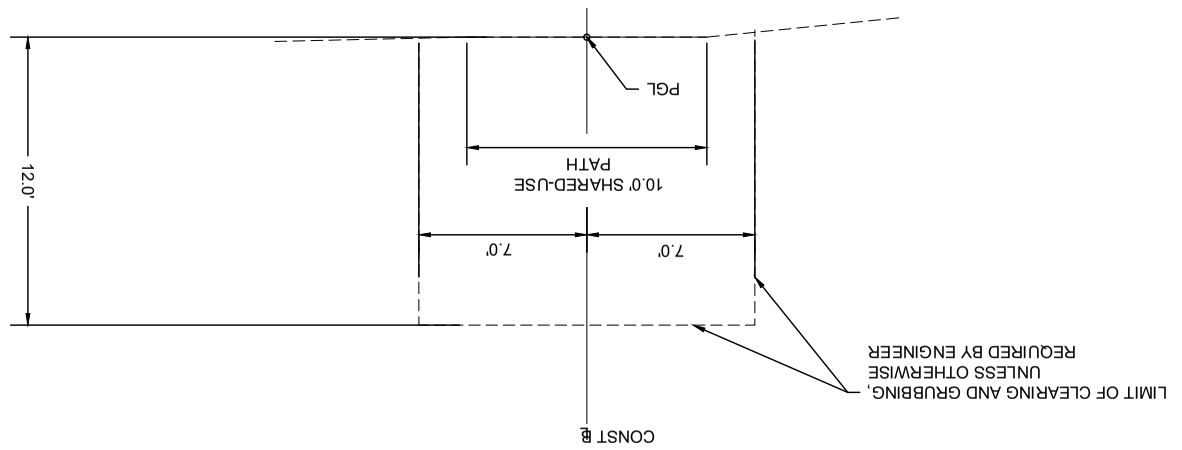
STA 351+09.93 TO STA 355+47.73
SCALE: 1"=8'



STA 355+47.73 TO STA 358+93.89
SCALE: 1"=8'



TYPICAL BIKEWAY CLEARANCE
SCALE: 1"=8'



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	142
	PROJECT FILE NO. 60921 1		

TYPICAL SECTIONS & DETAILS 2

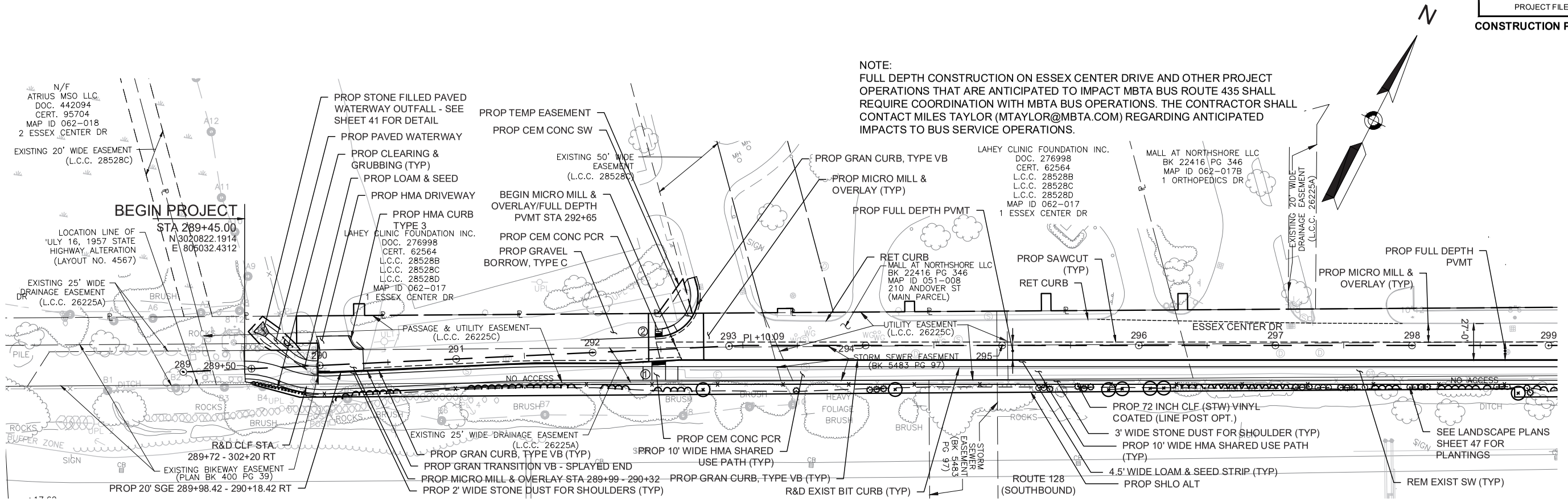
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 1

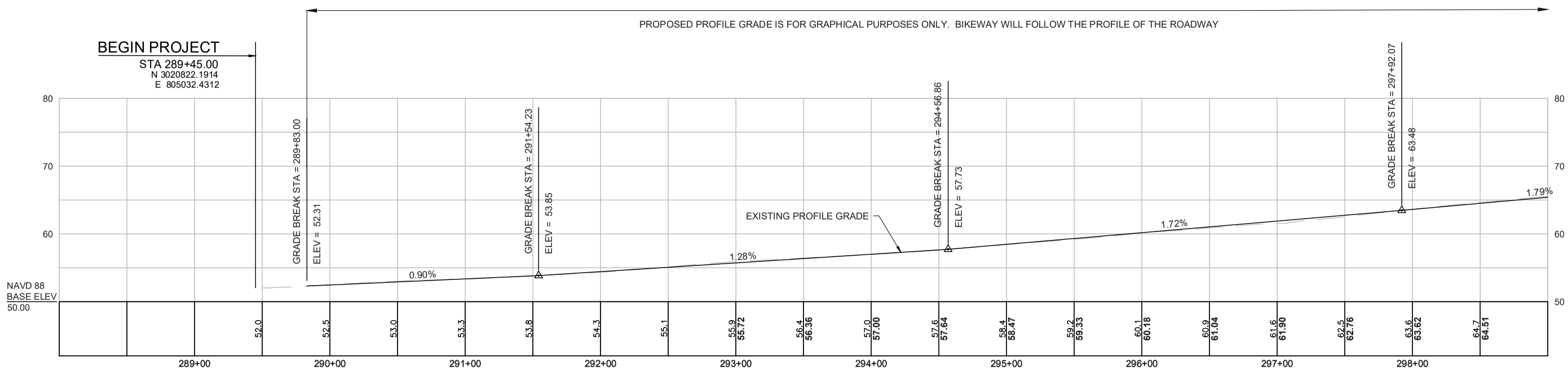
HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

NOTE:
FULL DEPTH CONSTRUCTION ON ESSEX CENTER DRIVE AND OTHER PROJECT OPERATIONS THAT ARE ANTICIPATED TO IMPACT MBTA BUS ROUTE 435 SHALL REQUIRE COORDINATION WITH MBTA BUS OPERATIONS. THE CONTRACTOR SHALL CONTACT MILES TAYLOR (MTAYLOR@MBTA.COM) REGARDING ANTICIPATED IMPACTS TO BUS SERVICE OPERATIONS.



CONTINUED ON SHEET NO. 10

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 9 OF 63

Proposal No. 609211-132091

A00829 - 487

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

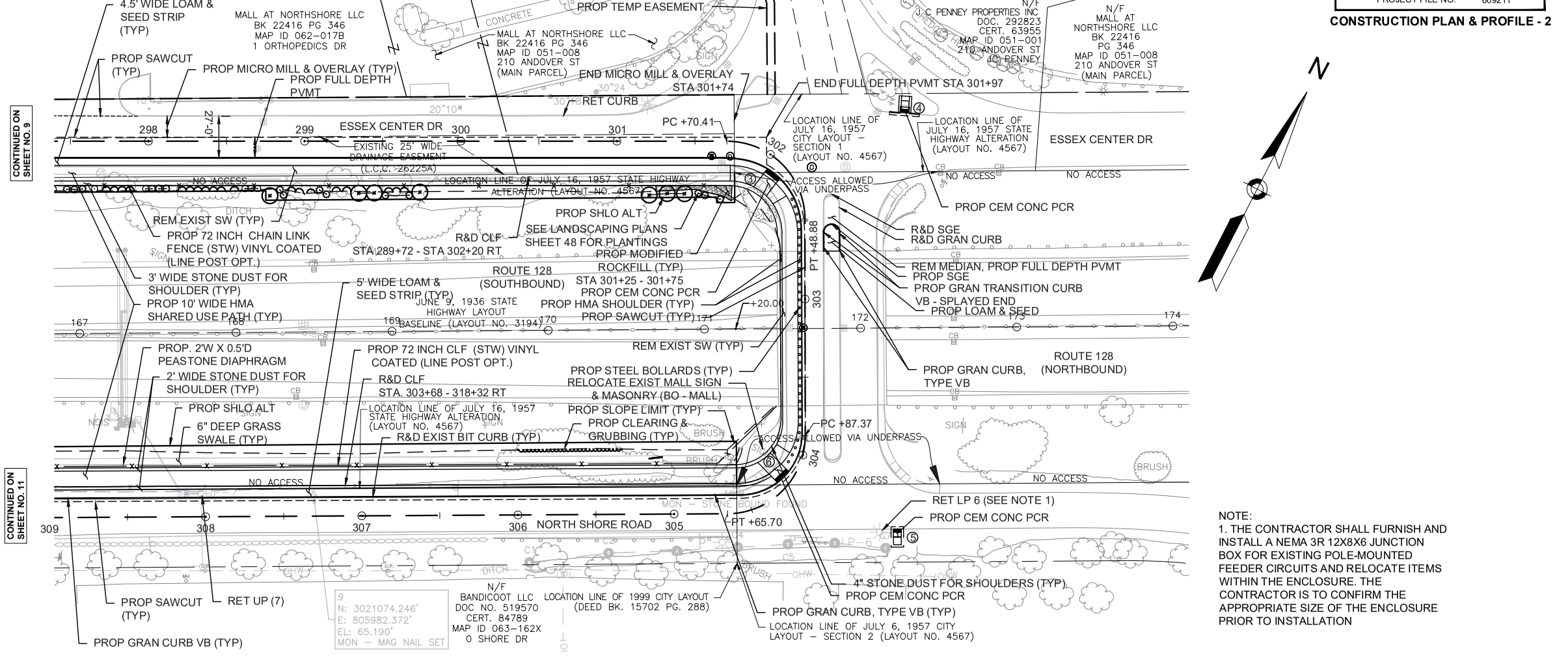
DRAINAGE DETAILS

SHEET 21

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

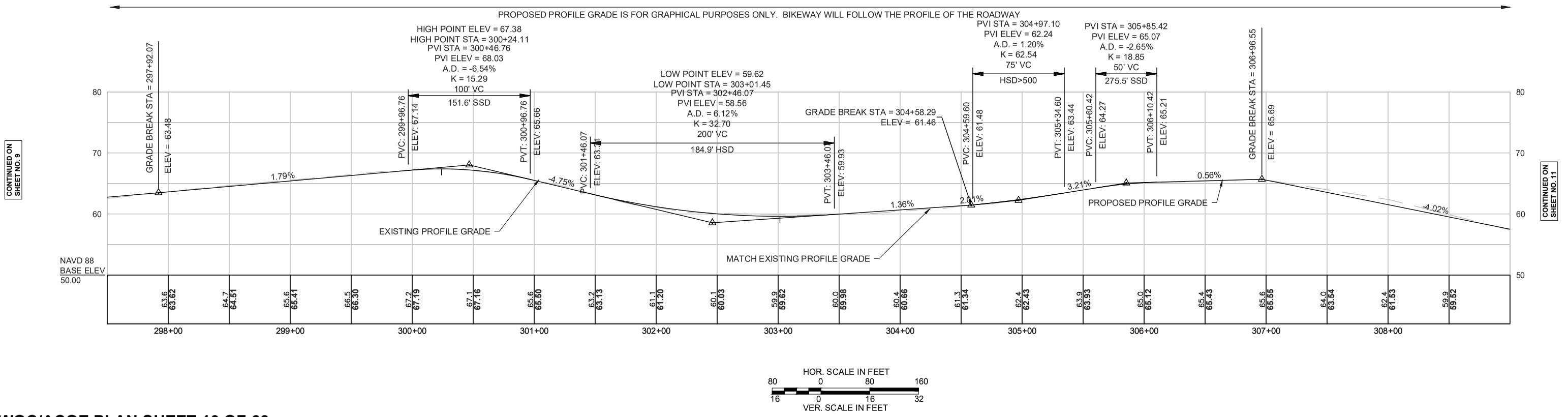
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	10	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 2



NOTE:
1. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA 3R 12X8X6 JUNCTION BOX FOR EXISTING POLE-MOUNTED FEEDER CIRCUITS AND RELOCATE ITEMS WITHIN THE ENCLOSURE. THE CONTRACTOR IS TO CONFIRM THE APPROPRIATE SIZE OF THE ENCLOSURE PRIOR TO INSTALLATION

PEABODY BIKEWAY ALIGNMENT



WQC/ACOE PLAN SHEET 10 OF 63

Proposal No. 609211-132091

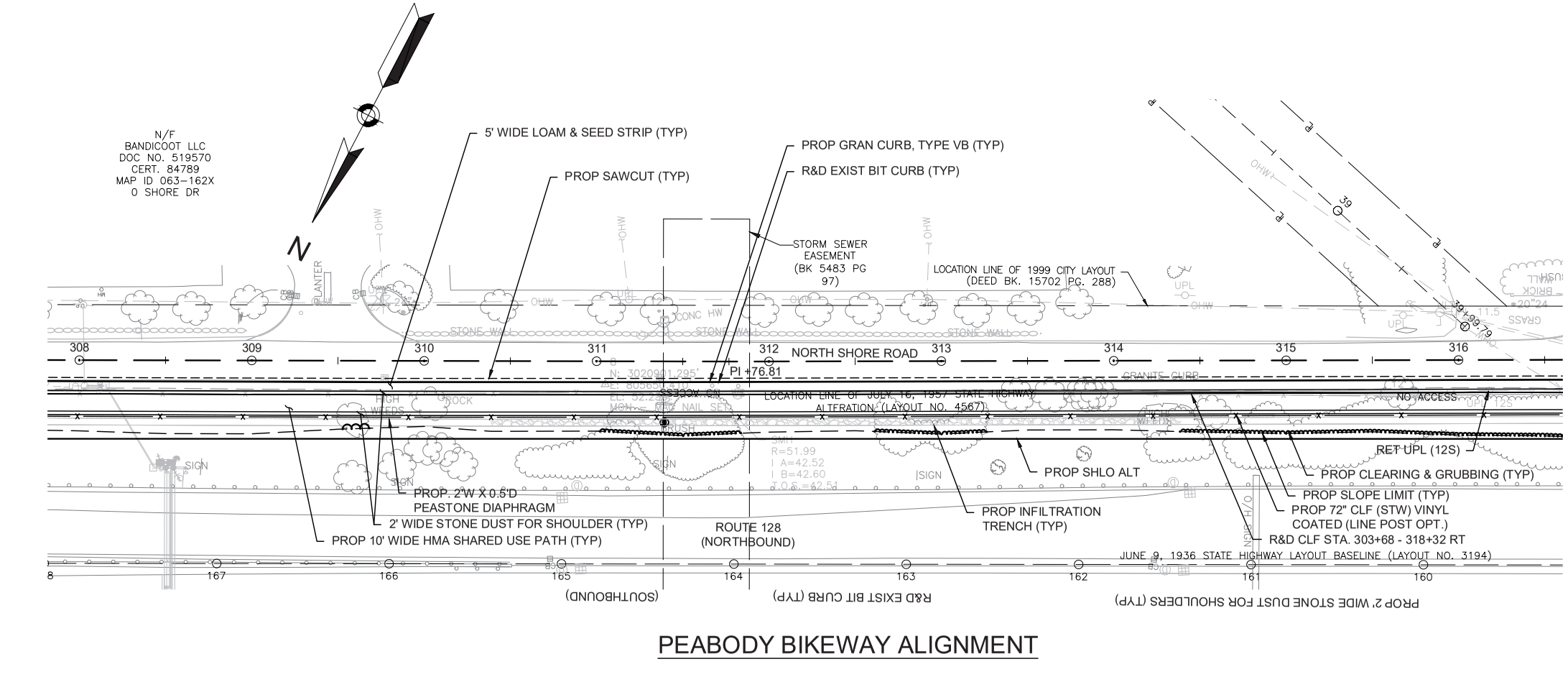
A00829 - 488

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	11	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 3

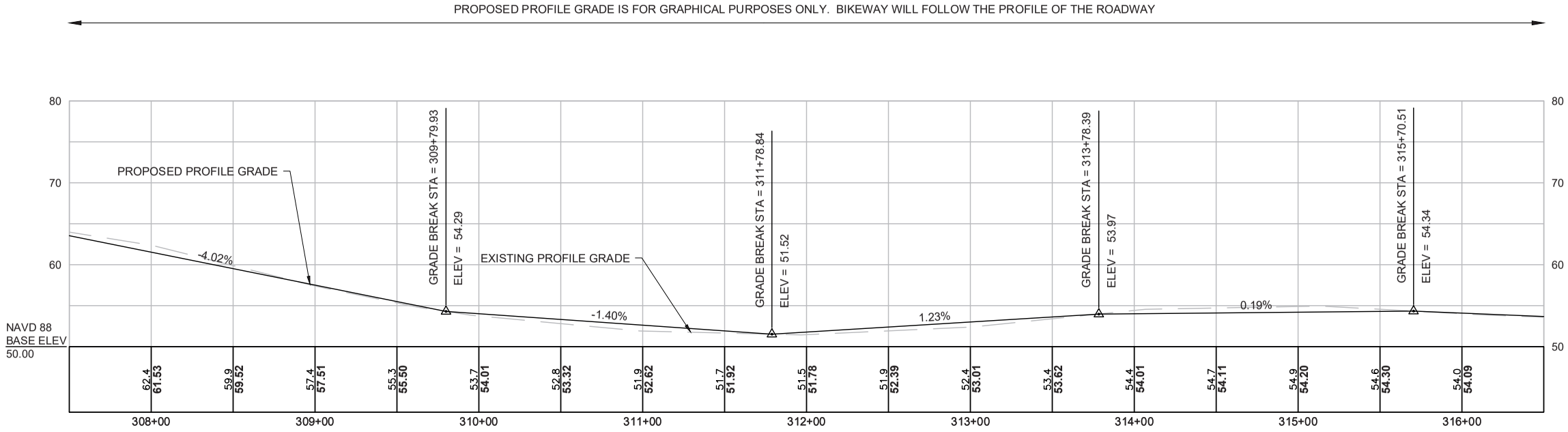


NOTE:
THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

CONTINUED ON SHEET NO. 10

CONTINUED ON SHEET NO. 12

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
16 0 16 32
VER. SCALE IN FEET

WQC/ACOE PLAN SHEET 11 OF 63

Proposal No. 609211-132091

A00829 - 489

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	12	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 4

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

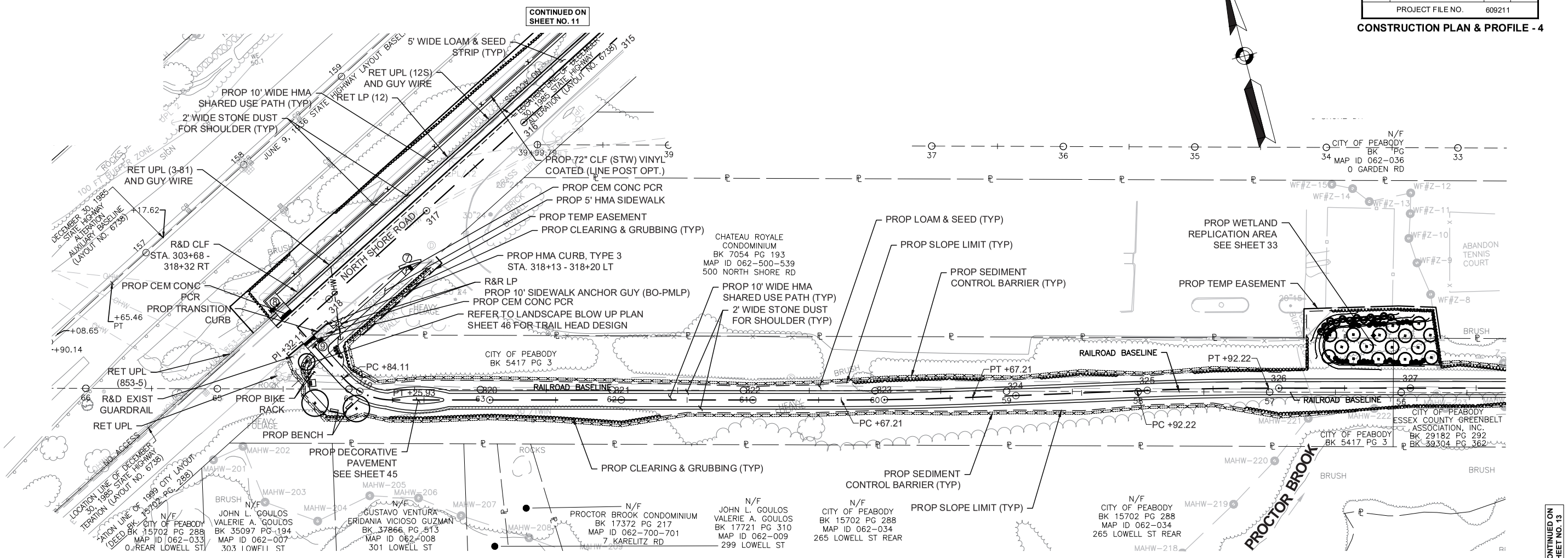
NONE

WATER SUPPLY ALTERATIONS

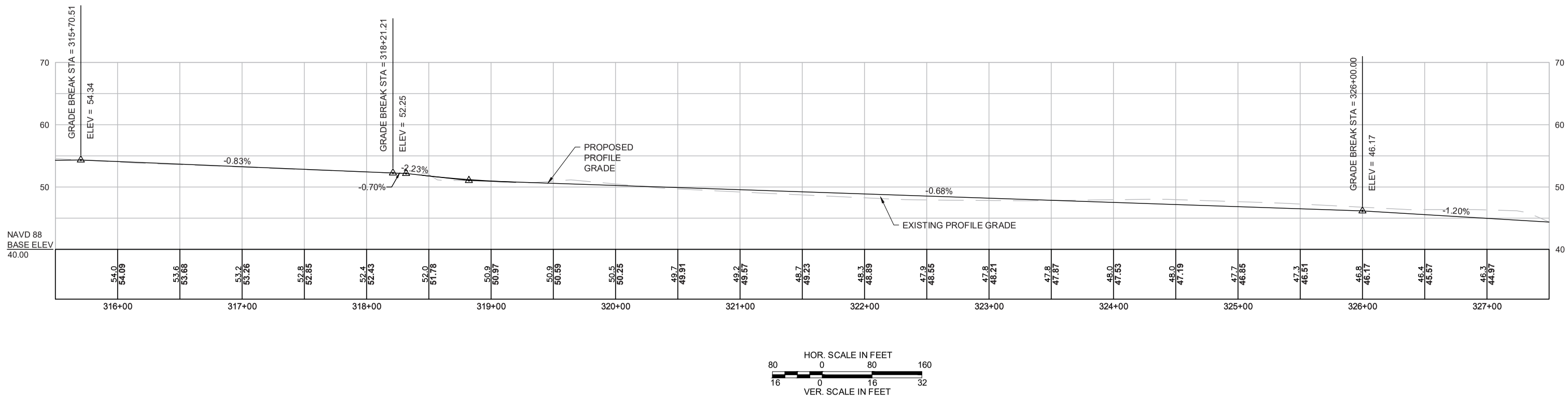
NONE

DRAINAGE DETAILS

NONE



PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 12 OF 63

Proposal No. 609211-132091

A00829 - 490

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	13	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 5

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

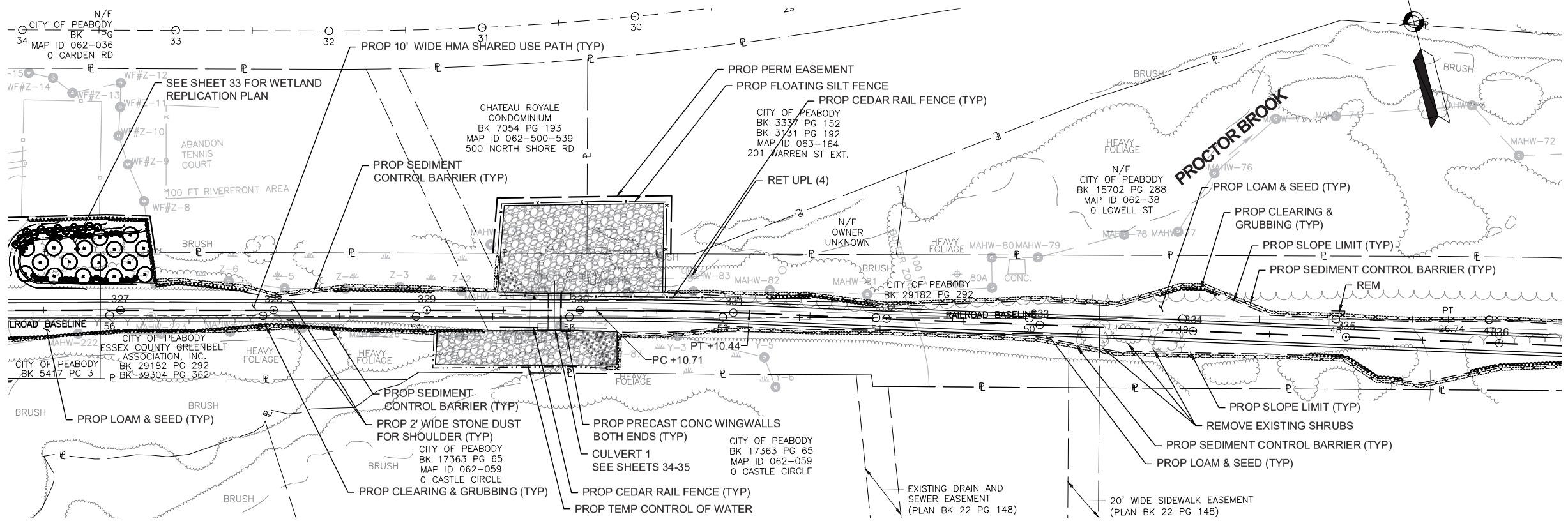
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

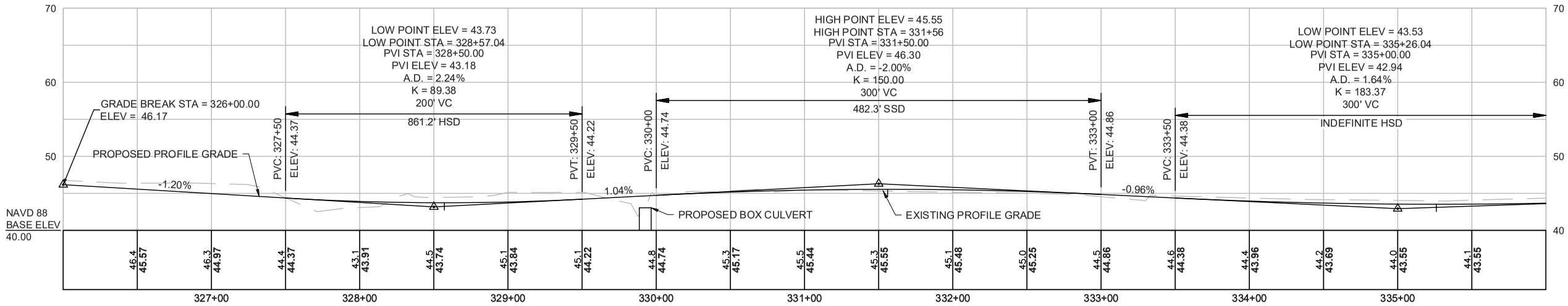
SEE SHEET 23 FOR DRAINAGE DETAILS
SEE SHEETS 34-35 FOR CULVERT DETAILS



CONTINUED ON SHEET NO. 12

CONTINUED ON SHEET NO. 14

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
16 0 16 32
VER. SCALE IN FEET

WQC/ACOE PLAN SHEET 13 OF 63

Proposal No. 609211-132091

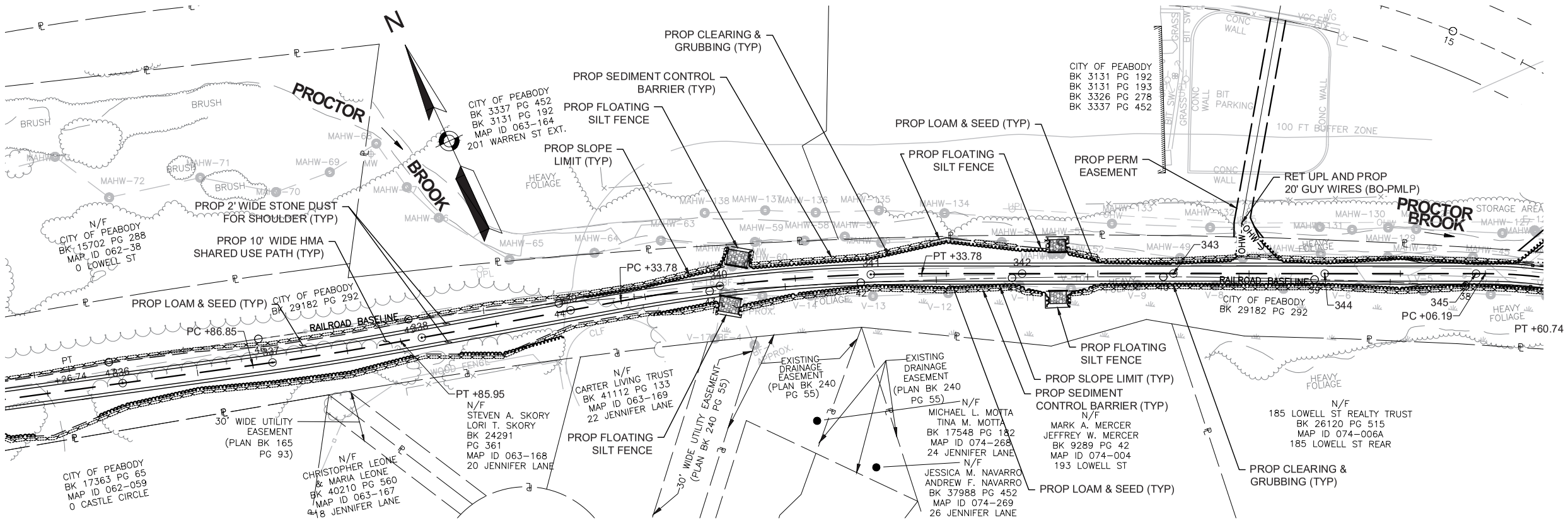
A00829 - 491

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

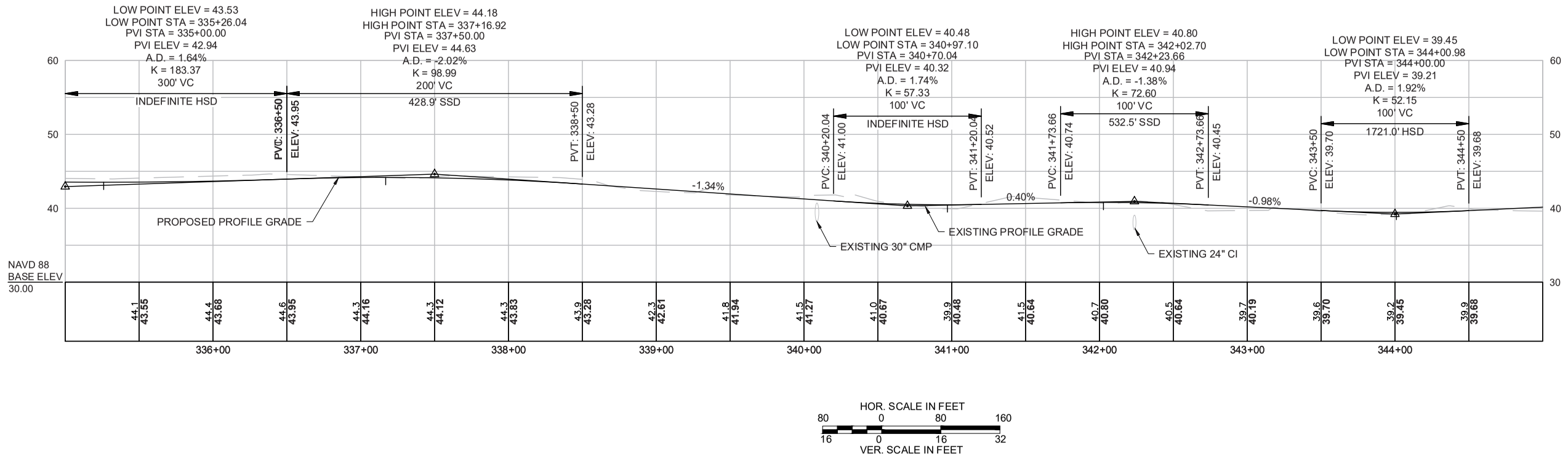
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	14	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 6

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 23



PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 14 OF 63

Proposal No. 609211-132091

A00829 - 492

Proposal No. 609211-132091

HIGHWAY GUARD DETAILS

STA. 347+72 LT - STA. 348+07 LT TANGENT END TREATMENT
STA. 348+07 LT - STA. 348+32 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 348+32 LT - STA. 348+41 LT TRAILING ANCHORAGE
STA. 348+70 LT - STA. 349+11 LT TANGENT END TREATMENT
STA. 349+11 LT - STA. 349+61 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 349+61 LT - STA. 347+70 LT TRAILING ANCHORAGE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

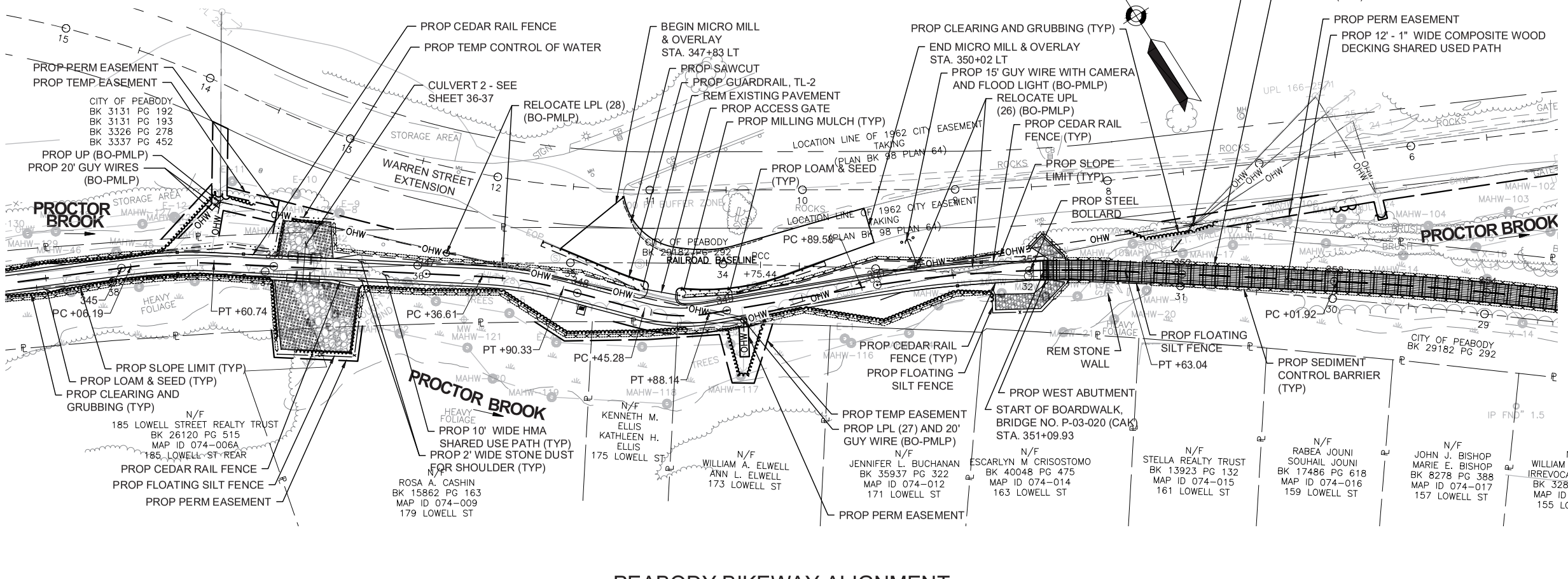
DRAINAGE DETAILS

SEE SHEET 24 FOR DRAINAGE DETAILS
SEE SHEETS 36-37 FOR CULVERT DETAILS

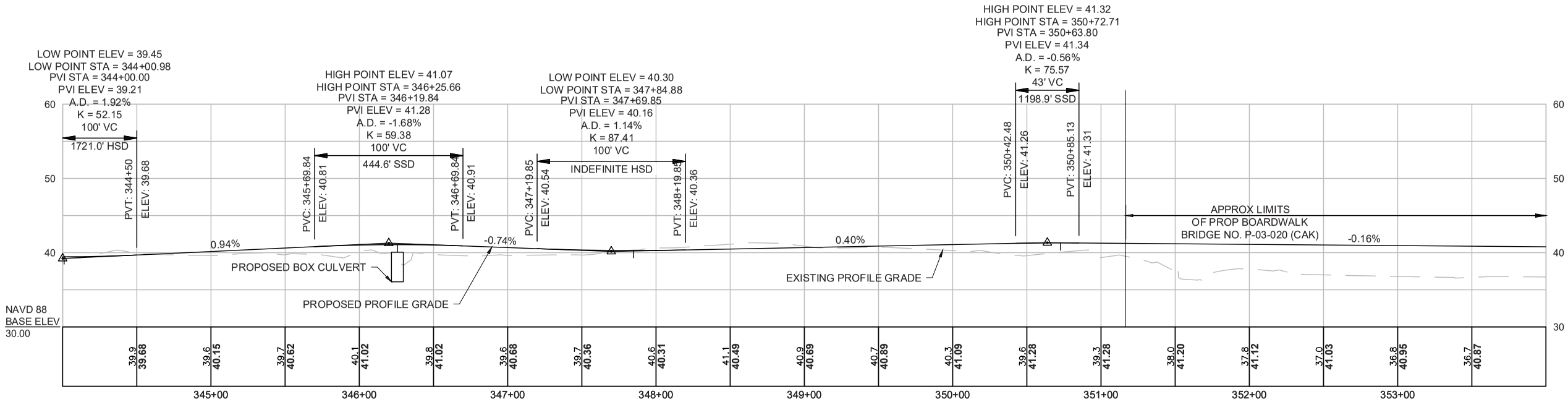
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 7



PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 15 OF 63

A00820-0829 - 493

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 8

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

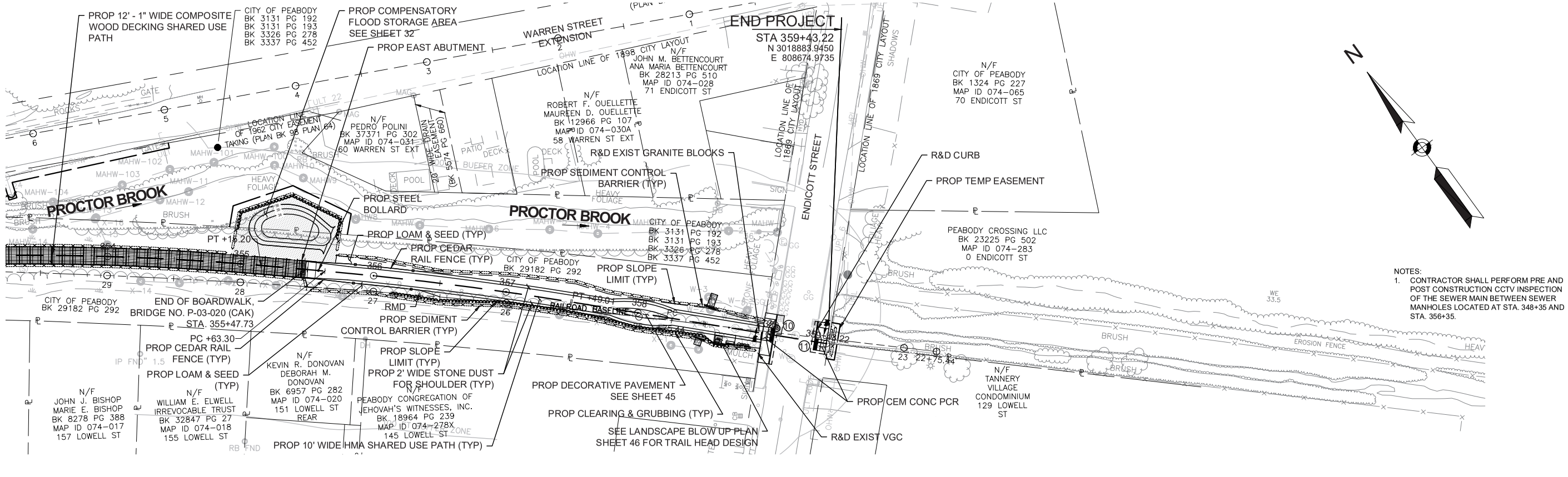
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

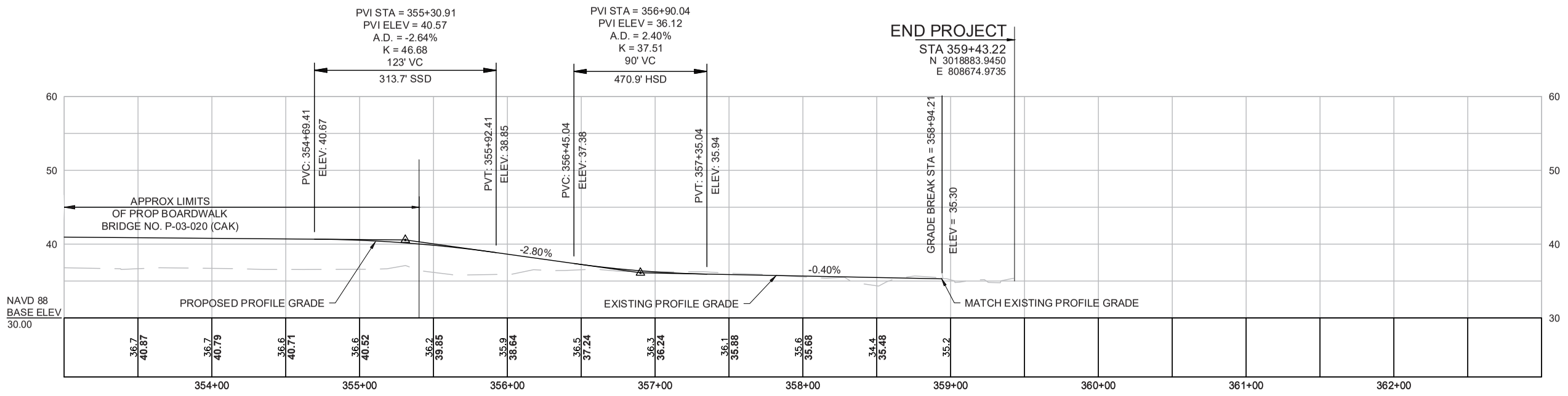
SEE SHEET 24



NOTES:
1. CONTRACTOR SHALL PERFORM PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE SEWER MAIN BETWEEN SEWER MANHOLES LOCATED AT STA. 348+35 AND STA. 356+35.

CONTINUED ON SHEET NO. 15

PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

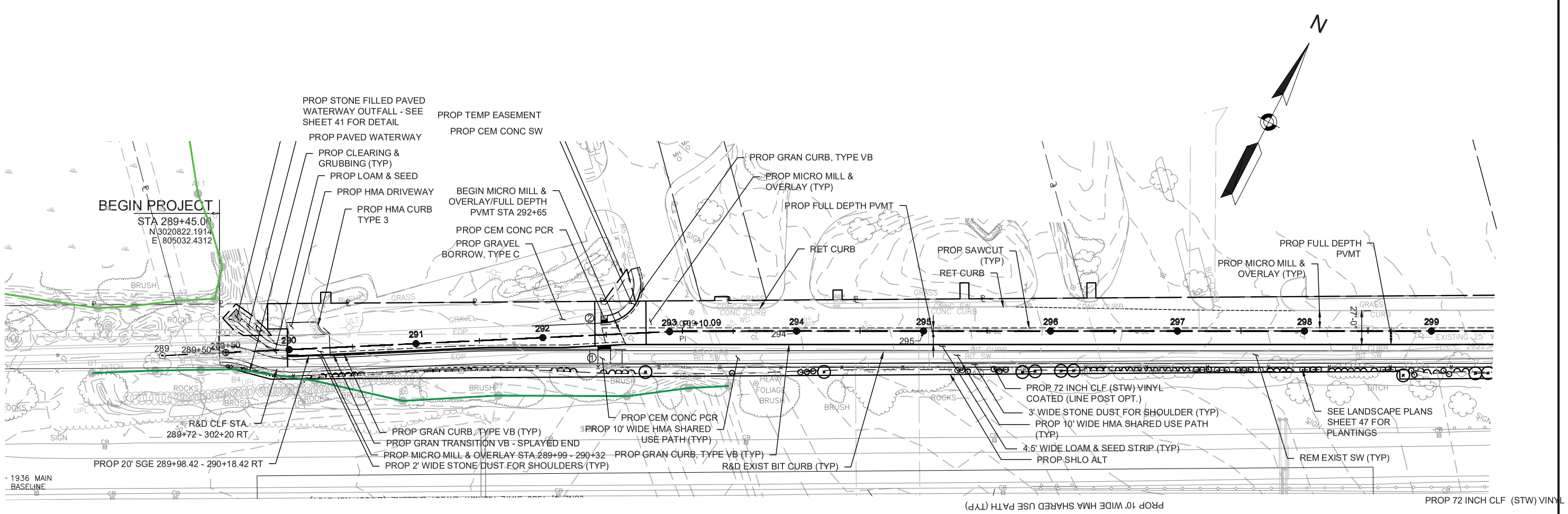
WQC/ACOE PLAN SHEET 16 OF 63

Proposal No. 609211-132091

A00829 - 494

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 1 OF 8



TOTAL PROJECT IMPACTS TO WATERS OF THE UNITED STATES:

PERMANENT VW IMPACT AREA = 2,225 SF ±

PERMANENT LUW/WOTUS IMPACT AREA = 10,343 SF ±

TOTAL PERMANENT IMPACT AREA = 12,568 SF ±

DREDGE VOLUME = 1,491 CY ±

FILL VOLUME = 1,491 CY ±

VEGETATED WETLAND (VW)

DITCH

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

TEMPORARY VW IMPACT AREA = 4,641 SF ±

TEMPORARY LUW/WOTUS IMPACT AREA = 2,082 SF ±

TOTAL TEMPORARY IMPACT AREA = 6,723 SF ±

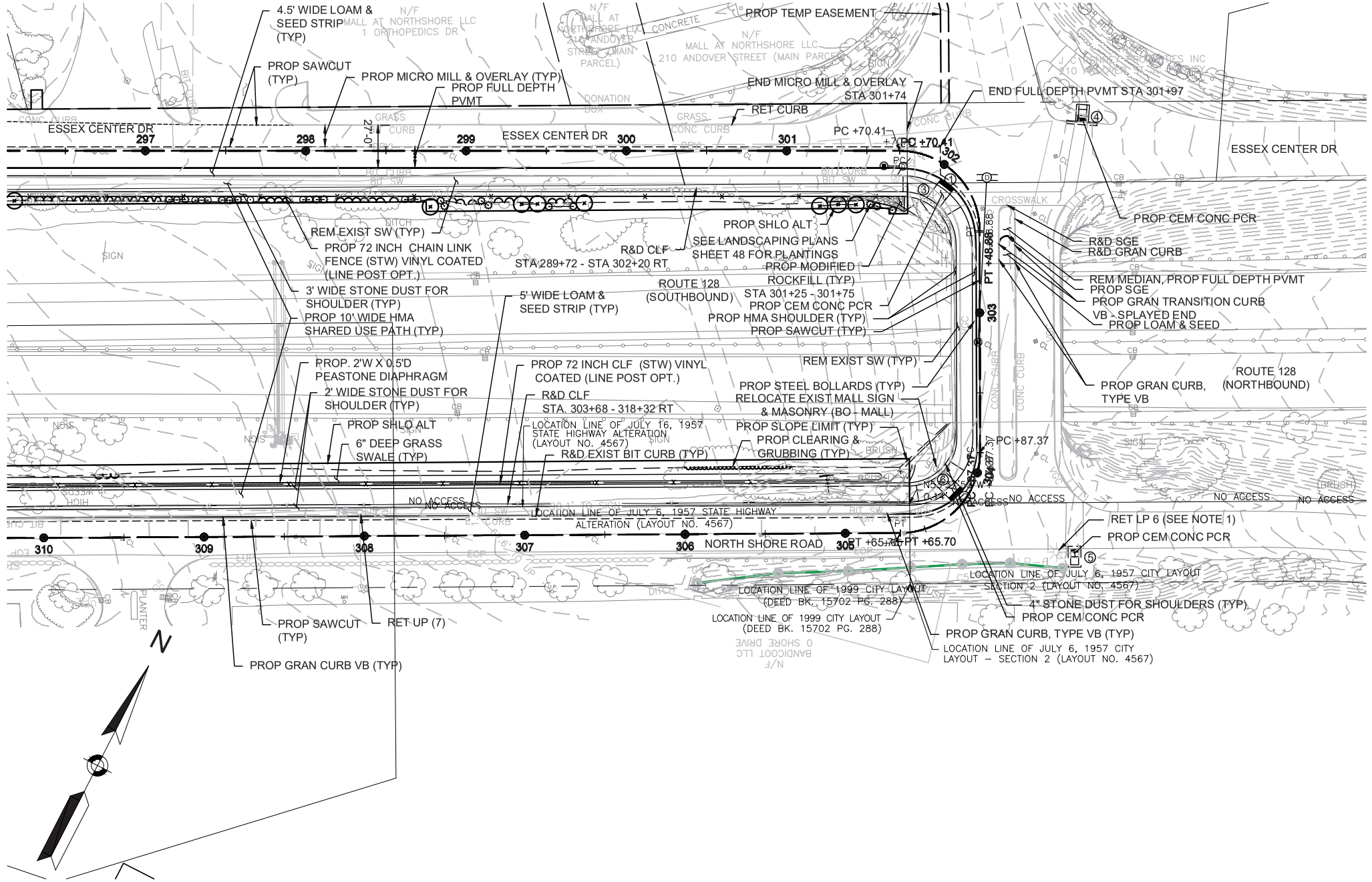
PERMANENT STREAM/BANK IMPACT = 618 LF ±

TEMPORARY STREAM/BANK IMPACT = 201 LF ±

40 0 40 80
SCALE IN FEET
1" = 80"

WQC/ACOE PLAN SHEET 17 OF 63

Proposal No. 609211-132091
A00829 - 495



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

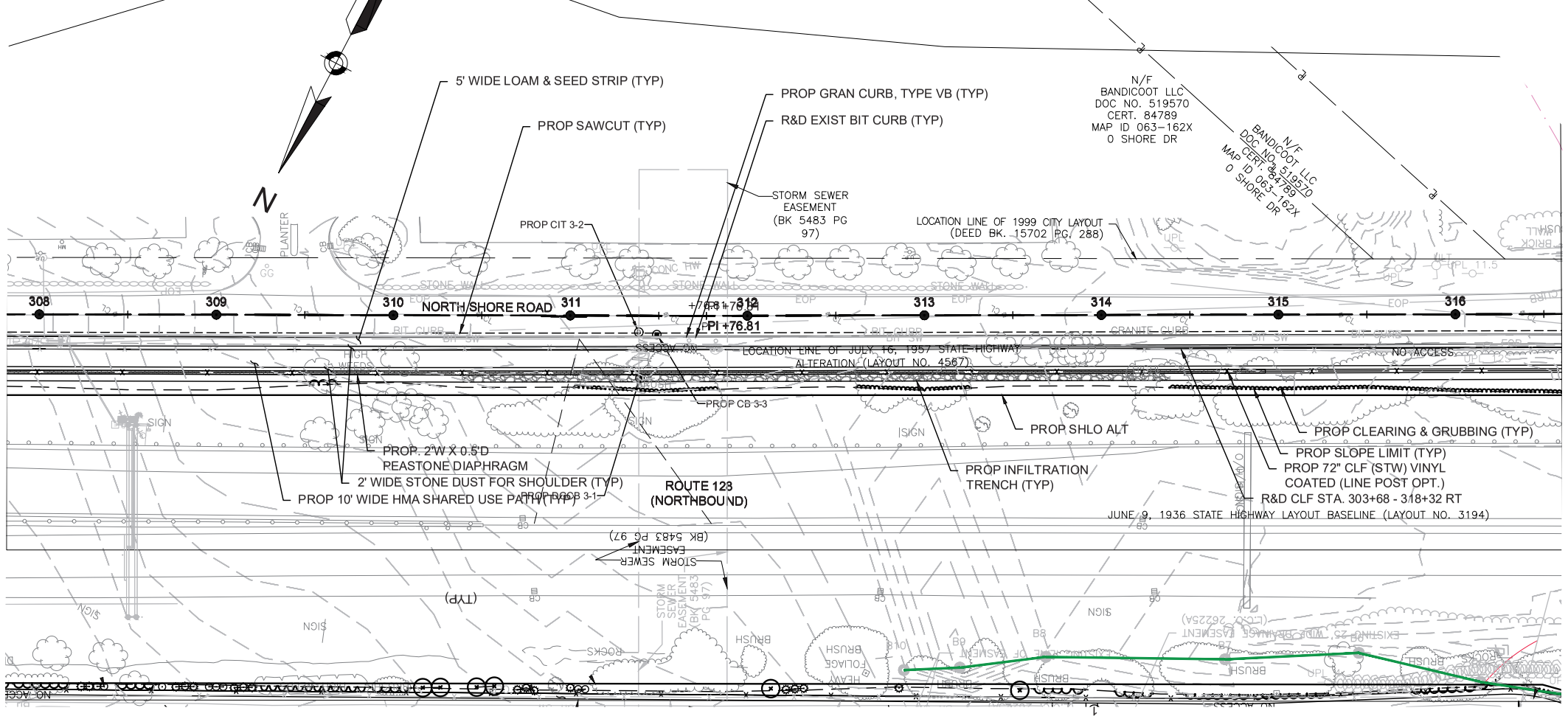
40 0 40 80
SCALE IN FEET
1" = 80'

Proposal No. 609211-132091
A00829 - 496

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 3 OF 8



PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 80"

WQC/ACOE PLAN SHEET 19 OF 63

Proposal No. 609211-132091

A00829 - 497

PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

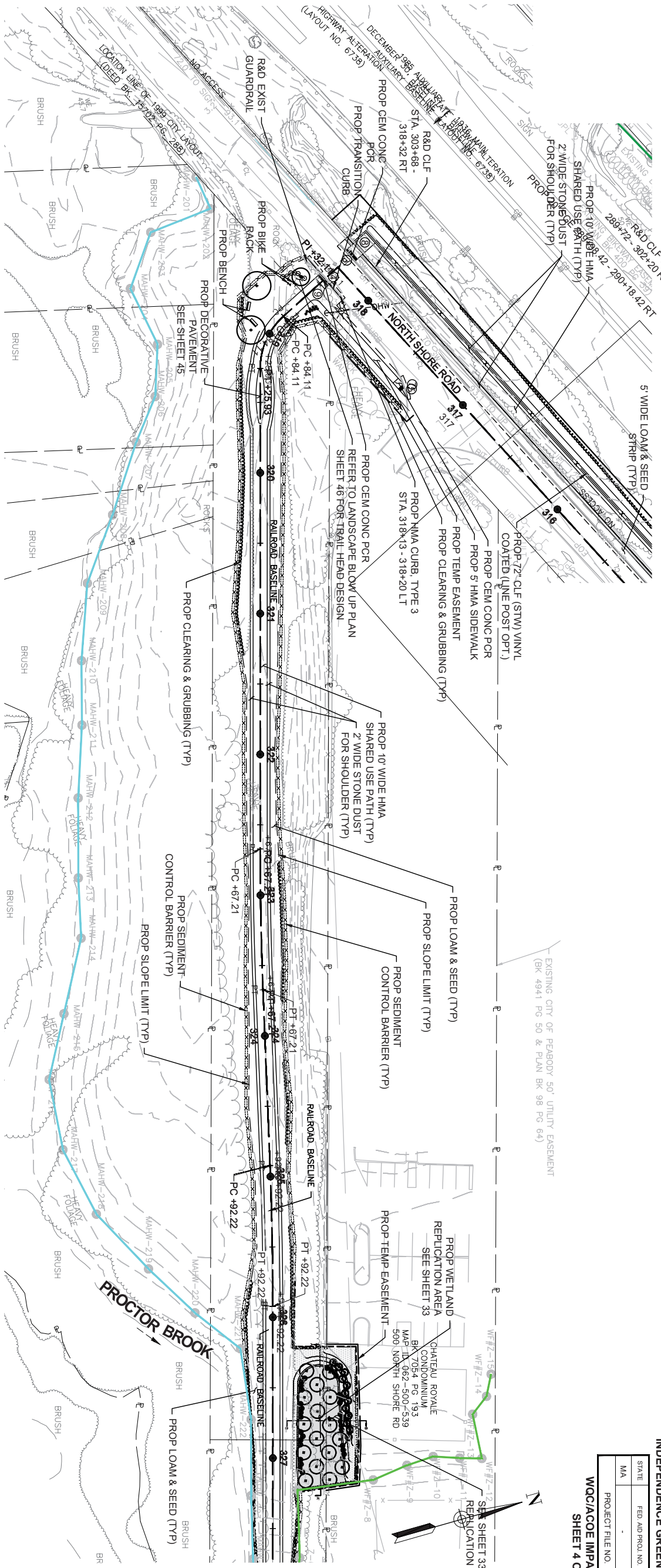
BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

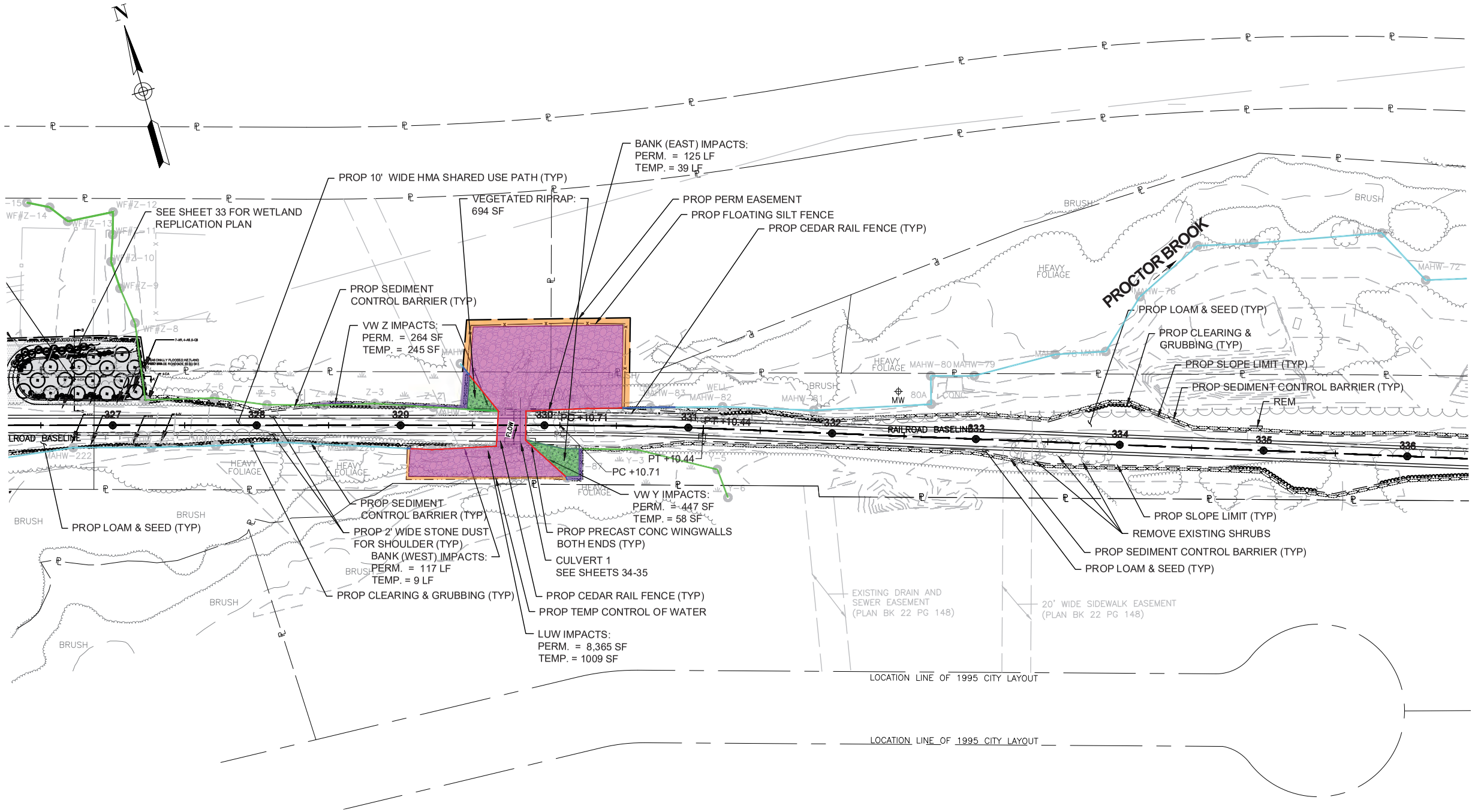
WQC/ACOE PLAN SHEET 20 OF 63



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
	PROJECT FILE NO. 609211		

WQC/ACOE IMPACTS PLAN
SHEET 4 OF 8



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 80"

Proposal No. 609211-132091
A00829 - 499

WQC/ACOE PLAN SHEET 22 OF 63

PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

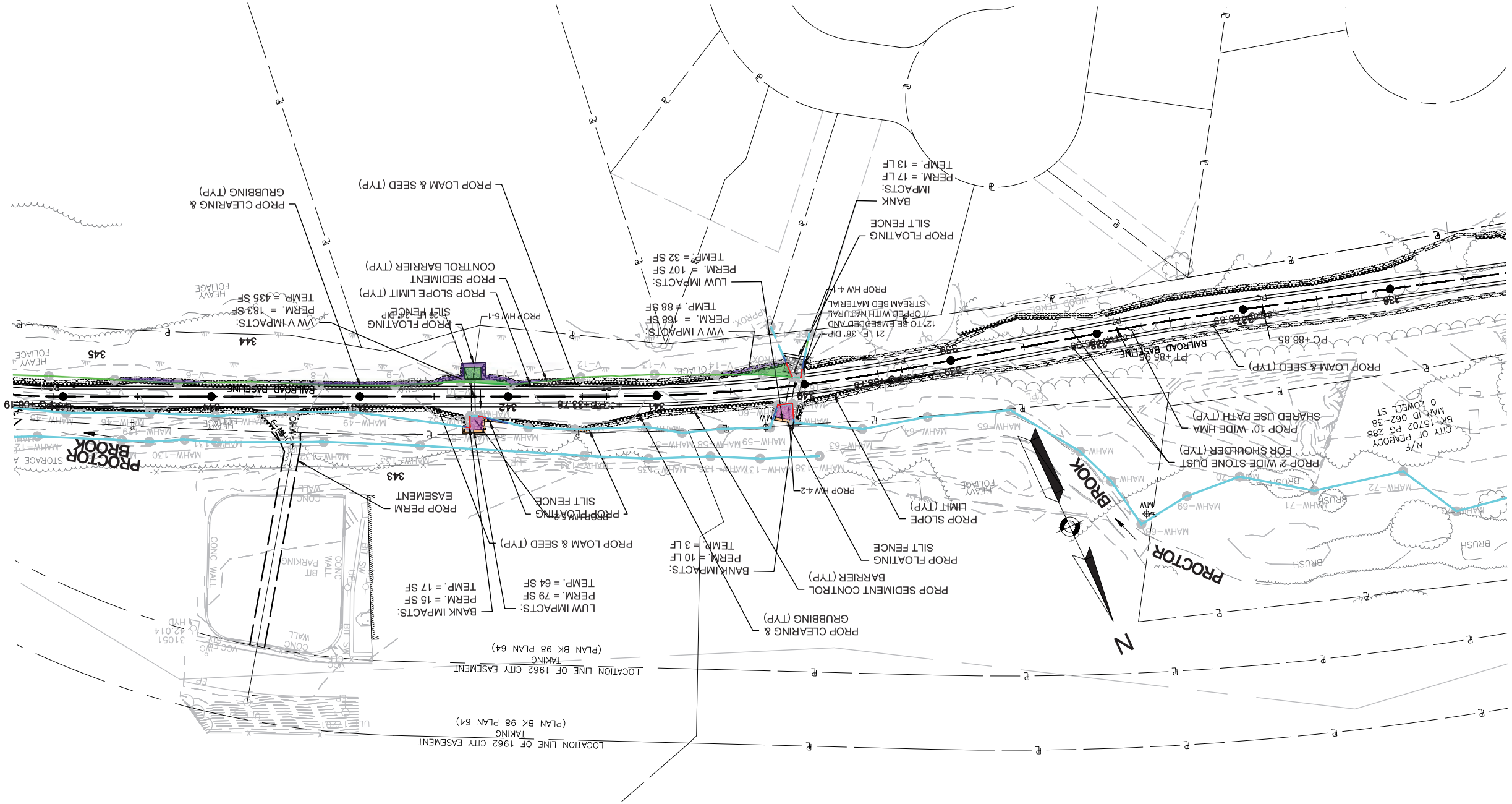
BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

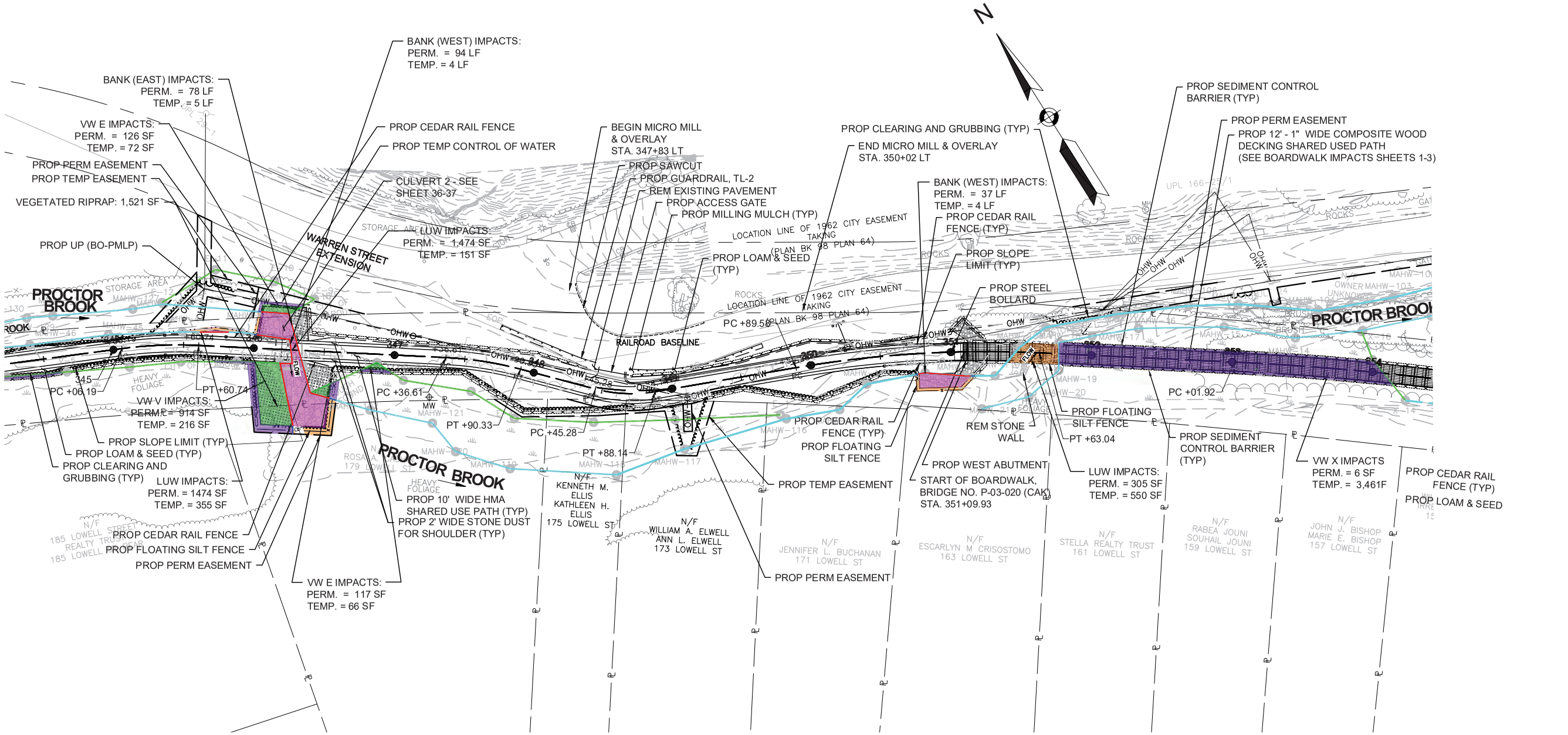
SCALE IN FEET
1" = 80'
40 0 40 80


PROCTOR BROOK
BROOK
PROCTOR
N
RAILROAD BASELINE
PC +86.85
PT +85.05
PROP LOAM & SEED (TYP)
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP 2 WIDE STONE DUST FOR SHOULDER (TYP)
PROP SLOPE LIMIT (TYP)
PROP FLOATING SILT FENCE
PROP SEDIMENT BARRIER (TYP)
PROP CLEARING & GRUBBING (TYP)
BANK IMPACTS: PERM. = 10 LF TEMP. = 3 LF
LUW IMPACTS: PERM. = 79 SF TEMP. = 64 SF
BANK IMPACTS: PERM. = 15 SF TEMP. = 17 SF
PROP LOAM & SEED (TYP)
PROP PERM EASEMENT
PROP FLOATING SILT FENCE
PROP HW 4-2
PROP HW 5-1
VW V IMPACTS: PERM. = 183 SF TEMP. = 435 SF
PROP FLOATING SILT FENCE
PROP SEDIMENT
PROP SLOPE LIMIT (TYP)
CONTROL BARRIER (TYP)
PROP CLEARING & GRUBBING (TYP)
PROP LOAM & SEED (TYP)
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
PROP FLOATING SILT FENCE
BANK IMPACTS: PERM. = 17 LF TEMP. = 13 LF
LUW IMPACTS: PERM. = 107 SF TEMP. = 32 SF
VW V IMPACTS: PERM. = 468 SF TEMP. = 88 SF
12" TO BE EMBEDDED AND TOPPED WITH NATURAL STREAM BED MATERIAL
21 LF, 36" DIP
PROP HW 4-1
PROP 2 WIDE STONE DUST FOR SHOULDER (TYP)
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP LOAM & SEED (TYP)
RAILROAD BASELINE
PC +86.85
PT +85.05
N/F CITY OF PEABODY BK 15702 PG 288 MAP 1D 062-38 0 LOWELL ST
BROOK
PROCTOR
N
PROP CLEARING & GRUBBING (TYP)
PROP SEDIMENT BARRIER (TYP)
BANK IMPACTS: PERM. = 10 LF TEMP. = 3 LF
PROP FLOATING SILT FENCE
PROP SLOPE LIMIT (TYP)
PROP PERM EASEMENT
PROP FLOATING SILT FENCE
PROP LOAM & SEED (TYP)
LUW IMPACTS: PERM. = 79 SF TEMP. = 64 SF
BANK IMPACTS: PERM. = 15 SF TEMP. = 17 SF
PROP LOAM & SEED (TYP)
PROP CLEARING & GRUBBING (TYP)
CONTROL BARRIER (TYP)
PROP SEDIMENT
PROP SLOPE LIMIT (TYP)
PROP HW 5-1
VW V IMPACTS: PERM. = 183 SF TEMP. = 435 SF
PROP FLOATING SILT FENCE
PROP HW 4-2
PROP FLOATING SILT FENCE
BANK IMPACTS: PERM. = 17 LF TEMP. = 13 LF
LUW IMPACTS: PERM. = 107 SF TEMP. = 32 SF
VW V IMPACTS: PERM. = 468 SF TEMP. = 88 SF
12" TO BE EMBEDDED AND TOPPED WITH NATURAL STREAM BED MATERIAL
21 LF, 36" DIP
PROP HW 4-1
PROP LOAM & SEED (TYP)
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP 2 WIDE STONE DUST FOR SHOULDER (TYP)
N/F CITY OF PEABODY BK 15702 PG 288 MAP 1D 062-38 0 LOWELL ST
RAILROAD BASELINE
PC +86.85
PT +85.05
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
PROP CLEARING & GRUBBING (TYP)
PROP SEDIMENT BARRIER (TYP)
PROP FLOATING SILT FENCE
BANK IMPACTS: PERM. = 10 LF TEMP. = 3 LF
LUW IMPACTS: PERM. = 79 SF TEMP. = 64 SF
BANK IMPACTS: PERM. = 15 SF TEMP. = 17 SF
PROP LOAM & SEED (TYP)
PROP PERM EASEMENT
PROP FLOATING SILT FENCE
PROP HW 4-2
PROP HW 5-1
VW V IMPACTS: PERM. = 183 SF TEMP. = 435 SF
PROP FLOATING SILT FENCE
PROP SEDIMENT
PROP SLOPE LIMIT (TYP)
CONTROL BARRIER (TYP)
PROP CLEARING & GRUBBING (TYP)
PROP LOAM & SEED (TYP)
PROP 2 WIDE STONE DUST FOR SHOULDER (TYP)
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP LOAM & SEED (TYP)
RAILROAD BASELINE
PC +86.85
PT +85.05
N/F CITY OF PEABODY BK 15702 PG 288 MAP 1D 062-38 0 LOWELL ST
BROOK
PROCTOR
N
PROP CLEARING & GRUBBING (TYP)
PROP SEDIMENT BARRIER (TYP)
PROP FLOATING SILT FENCE
BANK IMPACTS: PERM. = 10 LF TEMP. = 3 LF

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 7 OF 8



WQC/ACOE PLAN SHEET 23 OF 63

Proposal No. 609211-132091

A00829 - 501

PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

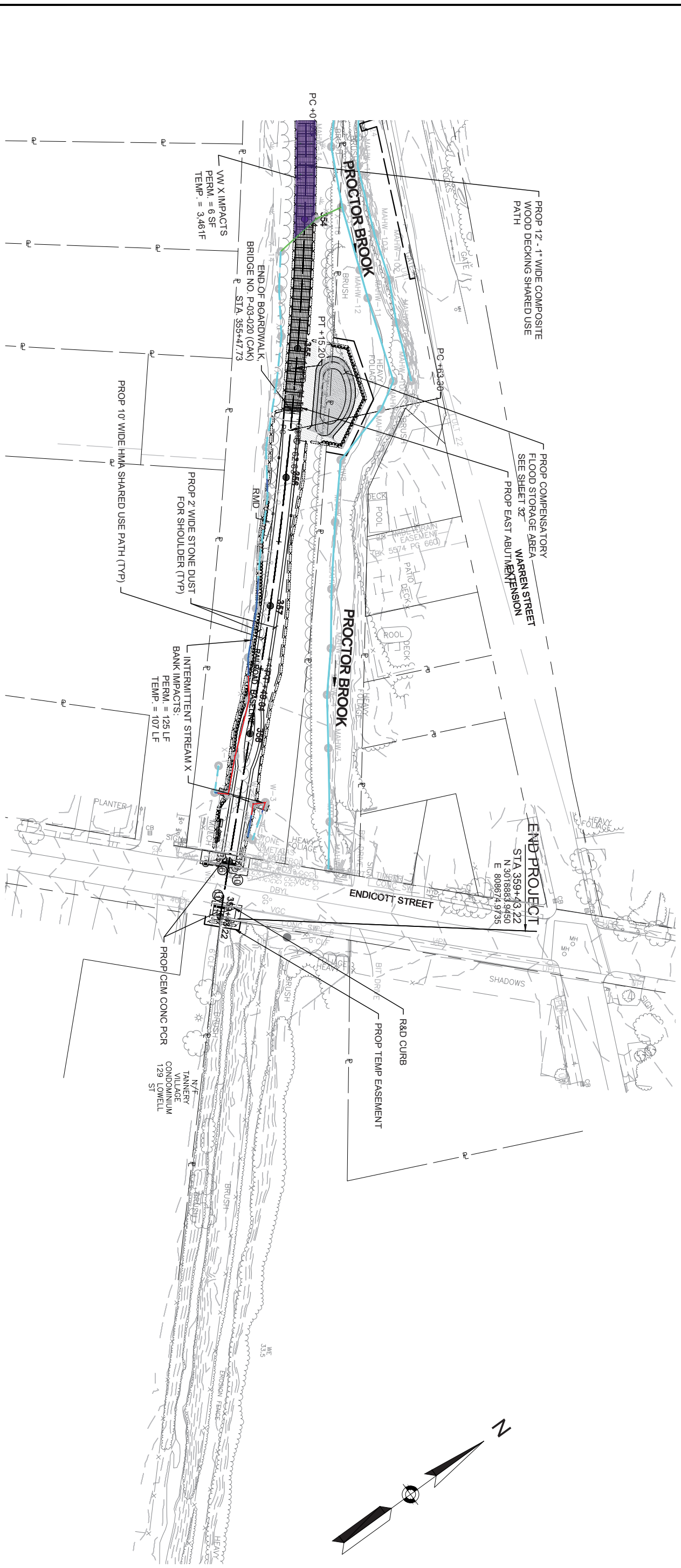
BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

WQC/ACOE PLAN SHEET 24 OF 63



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

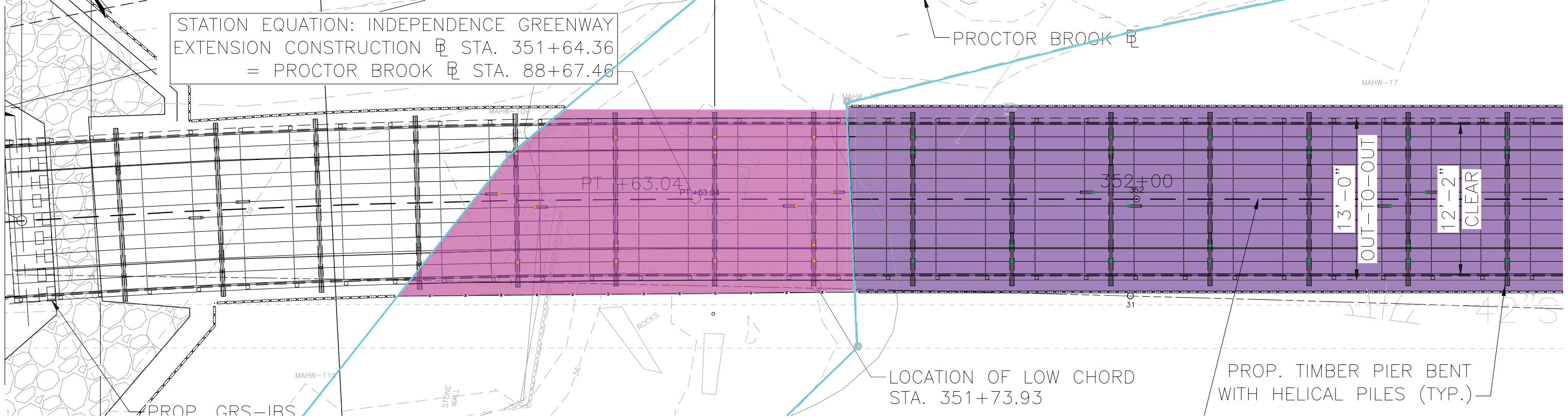
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	8
	PROJECT FILE NO. 609211		

WQC/ACOE IMPACTS PLAN
SHEET 8 OF 8

PEABODY
INDEPENDENCE GREENWAY EXTENSION

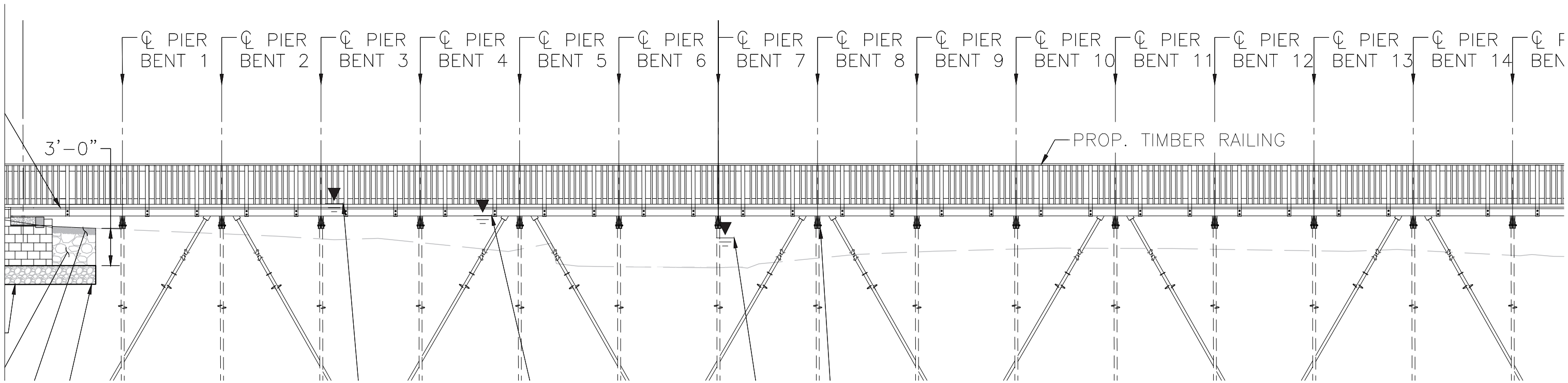
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

BOARDWALK IMPACTS SHEET 1 OF 3



GENERAL PLAN (1 OF 3)

SCALE: 1/8" = 1'-0"



TYPICAL ELEVATION (1 OF 3)

SCALE: 1/8" = 1'-0"

LEGEND:

- PERMANENT BVW IMPACT AREA = 6 SF
- TEMPORARY BVW IMPACT AREA = 3,461 SF
  - FILL VOLUME = 1.5 CY
- PERMANENT LUW IMPACT AREA = 1 SF
- TEMPORARY LUW IMPACT AREA = 432 SF
  - DREDGE VOLUME = 0 CY
  - FILL VOLUME = 0.4 CY
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)

WQC/ACOE PLAN SHEET 25 OF 63

4 0 4 8

SCALE IN FEET

Proposal No. 609211-132091

A00829 - 503

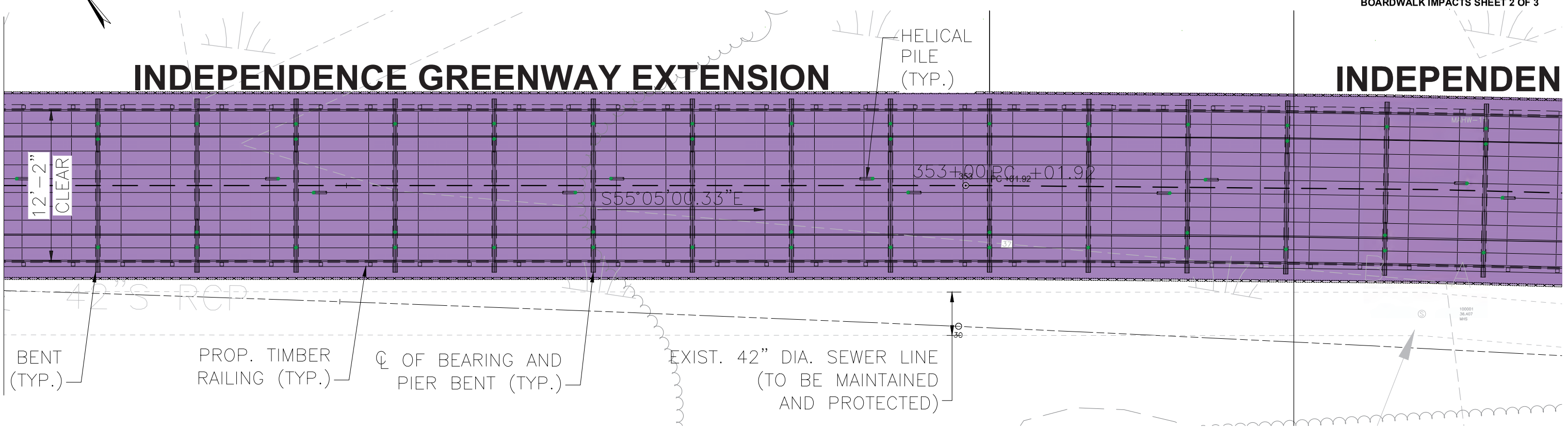
BRIDGE IMPACTS.DWG Plotted on 15-May-2024 2:57 PM

FIFTH STRUCTURAL SUBMISSION (S5) 10-May-2024

PEABODY
INDEPENDENCE GREENWAY EXTENSION

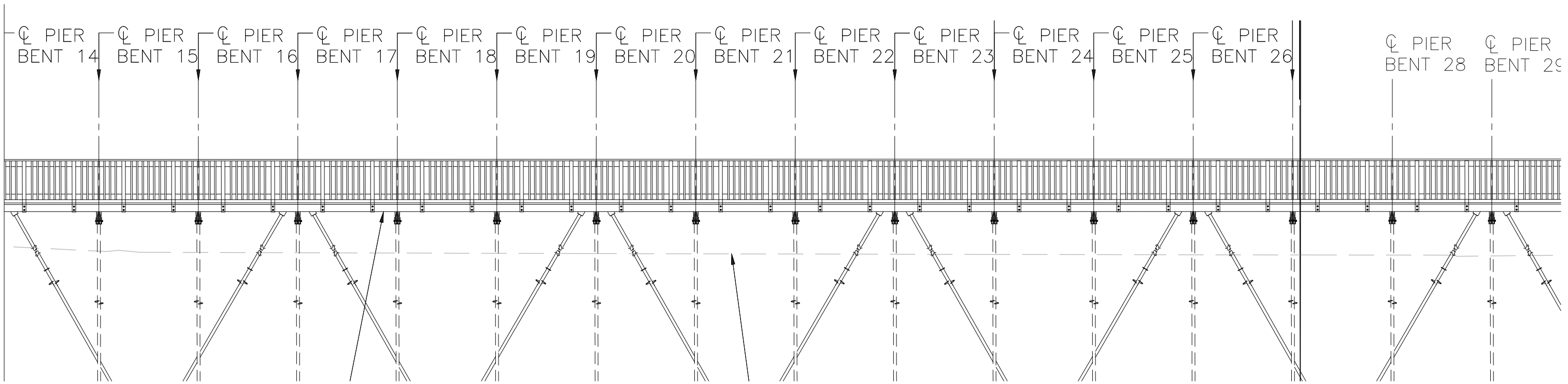
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

BOARDWALK IMPACTS SHEET 2 OF 3



GENERAL PLAN (2 OF 3)

SCALE: $\frac{1}{8}$" = 1'-0"



TYPICAL ELEVATION (2 OF 3)

SCALE: $\frac{1}{8}$" = 1'-0"

LEGEND:

- PERMANENT BVW IMPACT AREA
- TEMPORARY BVW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY LUW IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)

WQC/ACOE PLAN SHEET 26 OF 63

4 0 4 8
SCALE IN FEET

Proposal No. 609211-132091

A00829 - 504

BRIDGE IMPACTS.DWG Plotted on 15-May-2024 2:58 PM

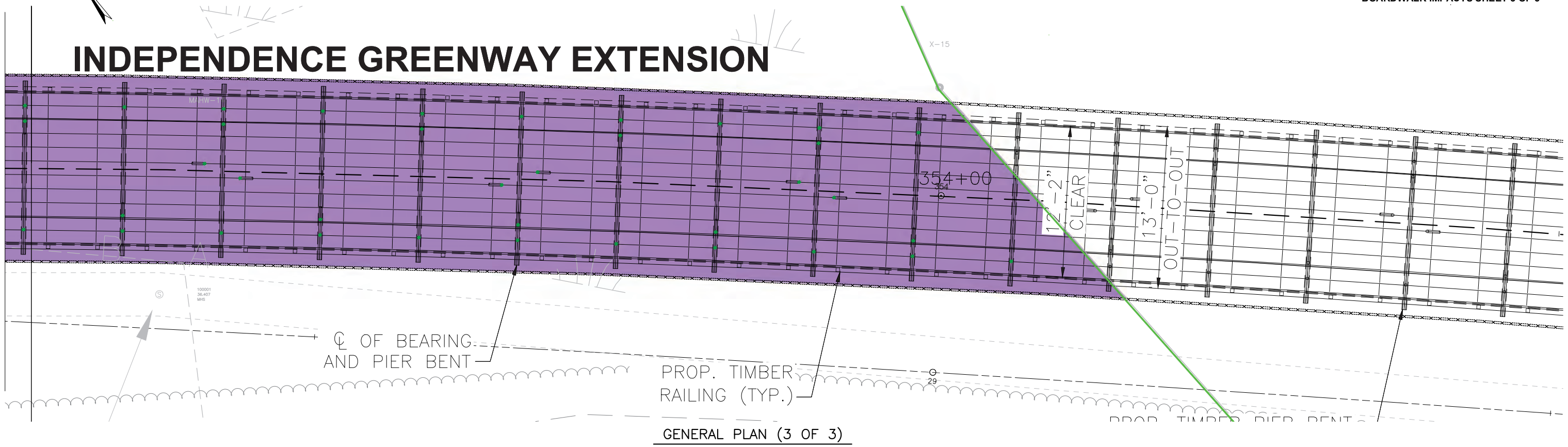
FIFTH STRUCTURAL SUBMISSION (S5) 10-May-2024

Proposal No. 609211-132091

BRIDGE IMPACTS.DWG Plotted on 15-May-2024 2:59 PM

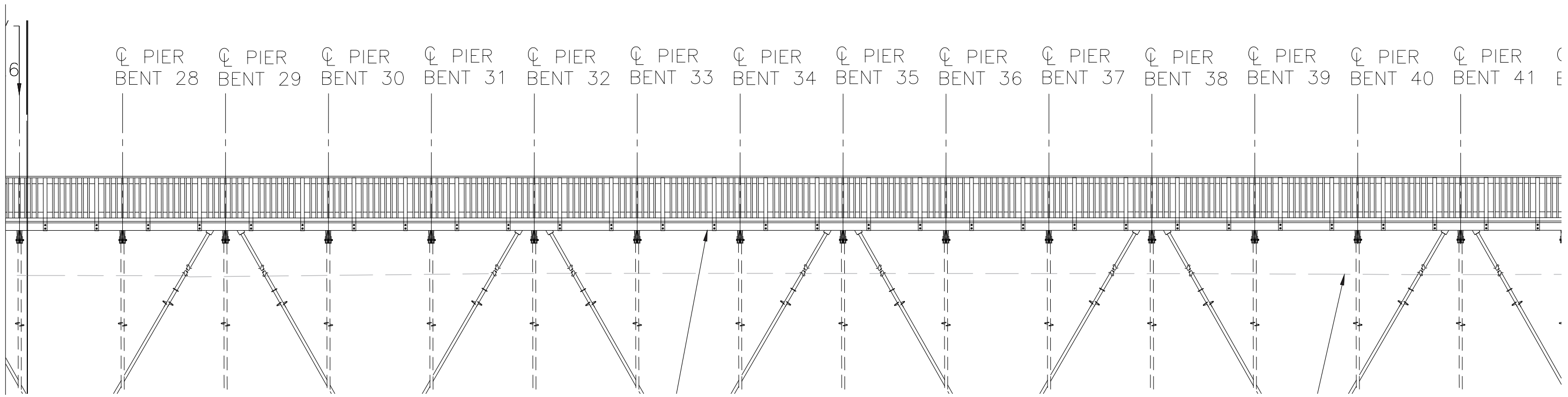
A008290 - 505

INDEPENDENCE GREENWAY EXTENSION



GENERAL PLAN (3 OF 3)

SCALE: $\frac{1}{8}$" = 1'-0"



TYPICAL ELEVATION (3 OF 3)

SCALE: $\frac{1}{8}$" = 1'-0"

LEGEND:

- PERMANENT BVW IMPACT AREA
- TEMPORARY BVW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY LUW IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)

WQC/ACOE PLAN SHEET 27 OF 63

4 0 4 8

SCALE IN FEET

FIFTH STRUCTURAL SUBMISSION (S5) 10-May-2024

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	142
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 1

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

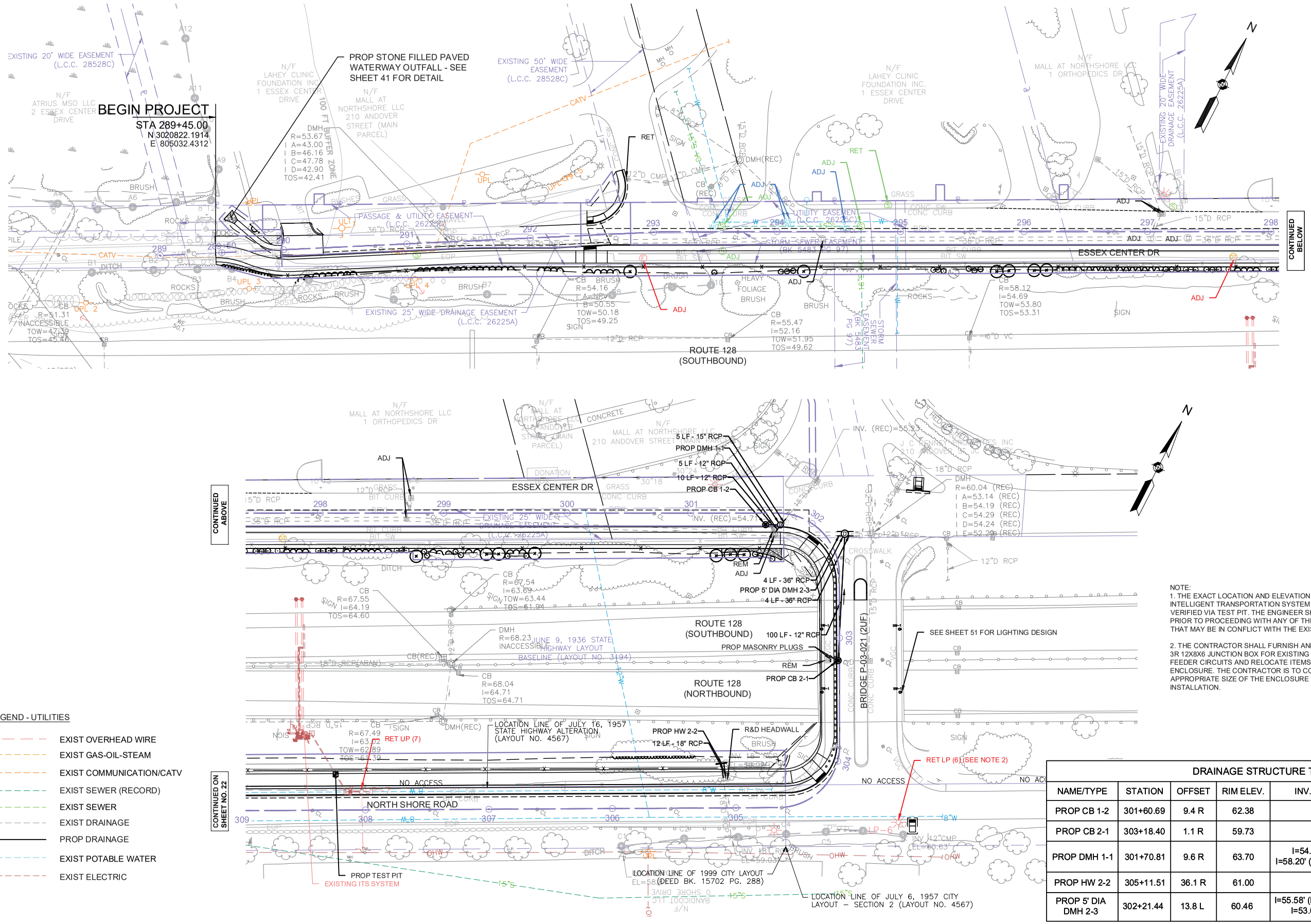
NONE

WATER SUPPLY ALTERATIONS

SEE BELOW

DRAINAGE DETAILS

SEE BELOW



NOTE:
1. THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

2. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA 3R 12X8X6 JUNCTION BOX FOR EXISTING POLE-MOUNTED FEEDER CIRCUITS AND RELOCATE ITEMS WITHIN THE ENCLOSURE. THE CONTRACTOR IS TO CONFIRM THE APPROPRIATE SIZE OF THE ENCLOSURE PRIOR TO INSTALLATION.

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 1-2	301+60.69	9.4 R	62.38		I=58.38' (PROP DMH 1-1)
PROP CB 2-1	303+18.40	1.1 R	59.73		I=55.63' (PROP 5' DIA DMH 2-3)
PROP DMH 1-1	301+70.81	9.6 R	63.70	I=54.79' (V.I.F.) I=58.20' (PROP CB 1-2)	I=53.79' (EX DMH 1-3)
PROP HW 2-2	305+11.51	36.1 R	61.00		I=59.33' ()
PROP 5' DIA DMH 2-3	302+21.44	13.8 L	60.46	I=55.58' (PROP CB 2-1) I=53.08' (V.I.F.)	I=53.07' ()

WQC/ACOE PLAN SHEET 28 OF 63

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	142
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 2

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

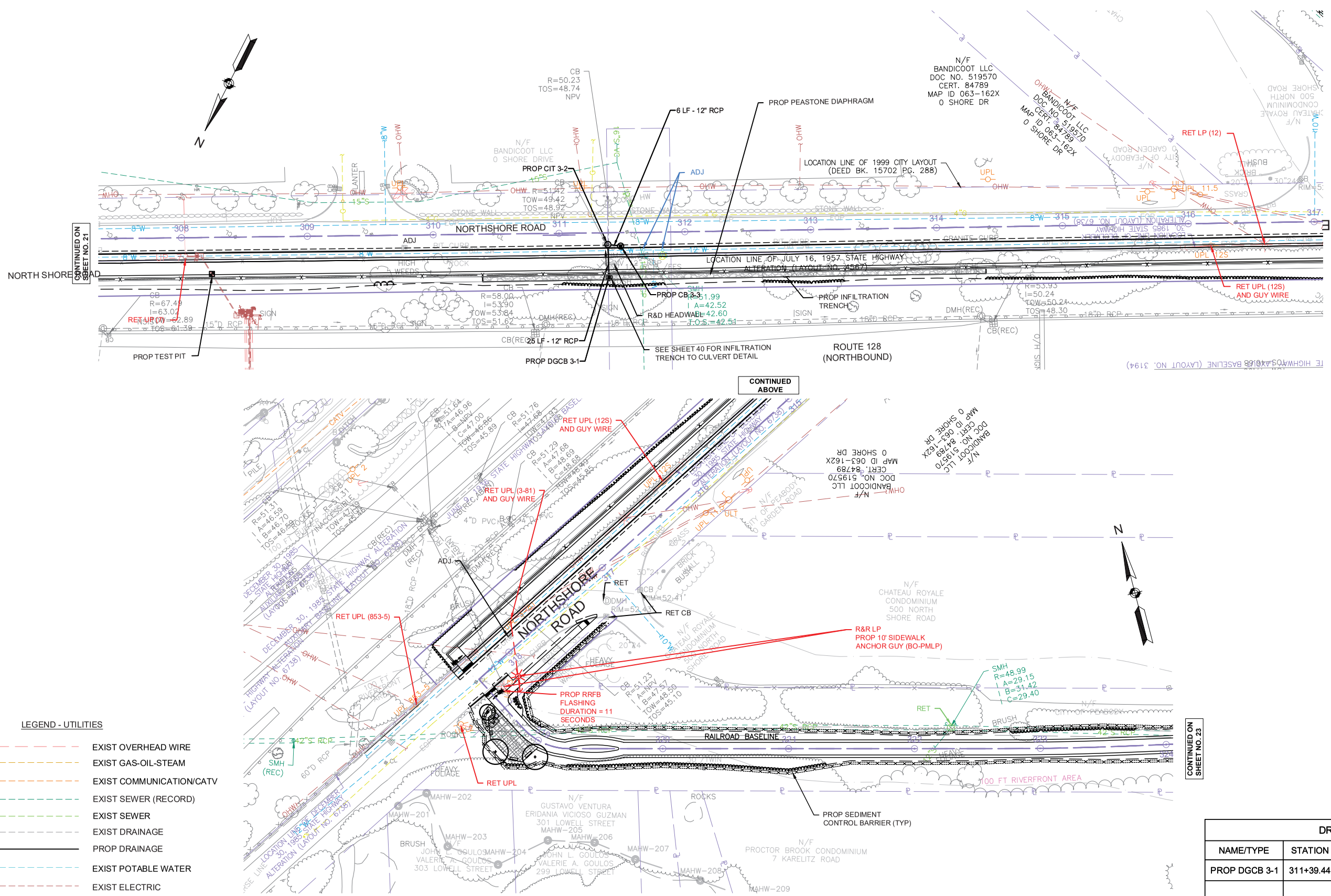
NONE

WATER SUPPLY ALTERATIONS

SEE BELOW

DRAINAGE DETAILS

SEE BELOW



LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP DGCB 3-1	311+39.44	38.4 R	51.26		I=48.61' (PROP CIT 3-2)
PROP CIT 3-2	311+38.53	9.5 R	51.42	I=48.40' (PROP DGCB 3-1) I=48.40' (PROP CB 3-3)	I=48.30' (V.I.F.)
PROP CB 3-3	311+48.84	10.7 R	51.41		I=48.60' (PROP. CIT 3-2)

WQC/ACOE PLAN SHEET 29 OF 63

Proposal No. 609211-132091

A0082829 - 507

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	142
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 3

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

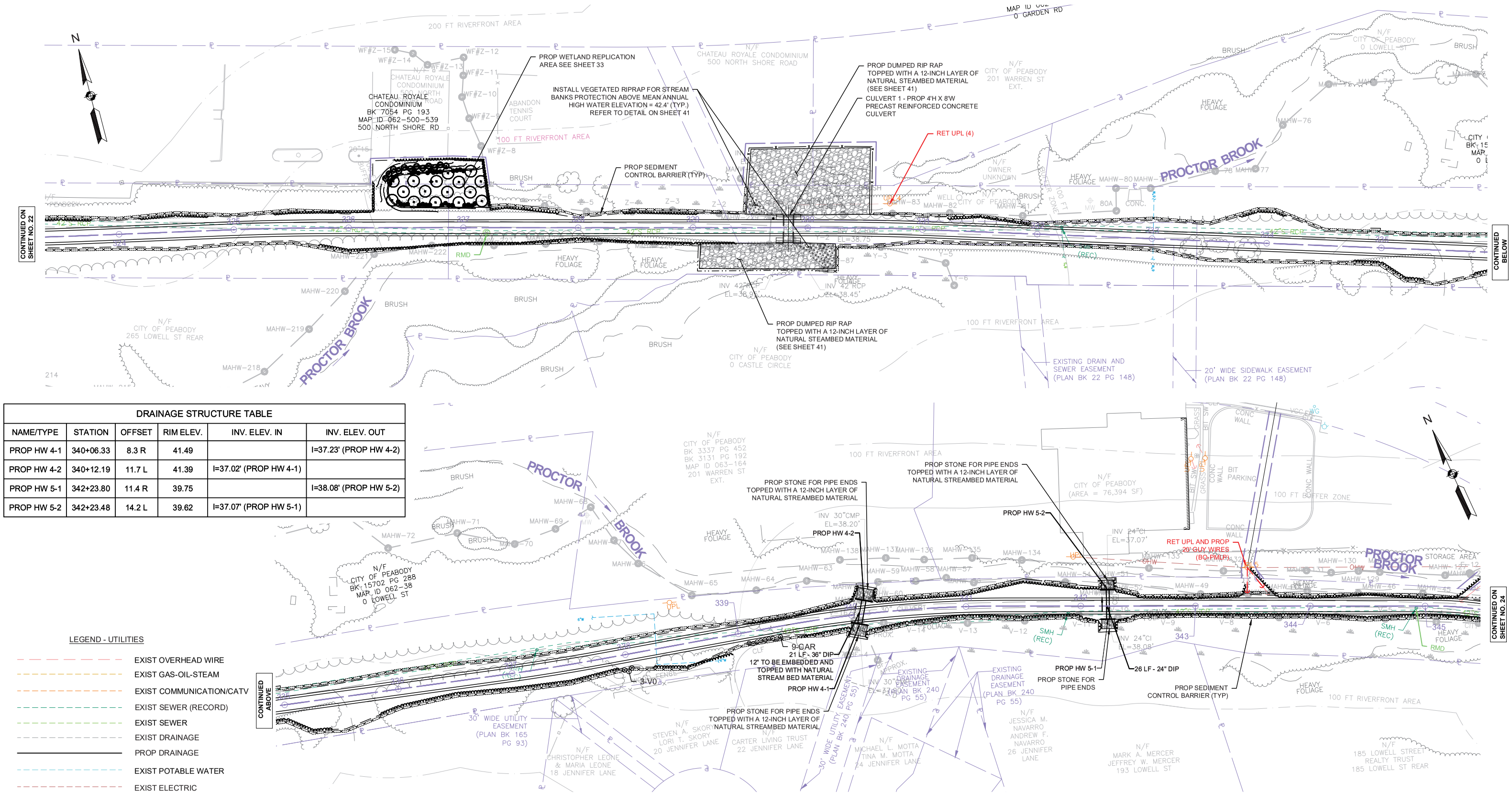
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE BELOW



DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 4-1	340+06.33	8.3 R	41.49		I=37.23' (PROP HW 4-2)
PROP HW 4-2	340+12.19	11.7 L	41.39	I=37.02' (PROP HW 4-1)	
PROP HW 5-1	342+23.80	11.4 R	39.75		I=38.08' (PROP HW 5-2)
PROP HW 5-2	342+23.48	14.2 L	39.62	I=37.07' (PROP HW 5-1)	

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

WQC/ACOE PLAN SHEET 30 OF 63

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	142
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 4

Proposal No. 609211-132091

A00829 - 509

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

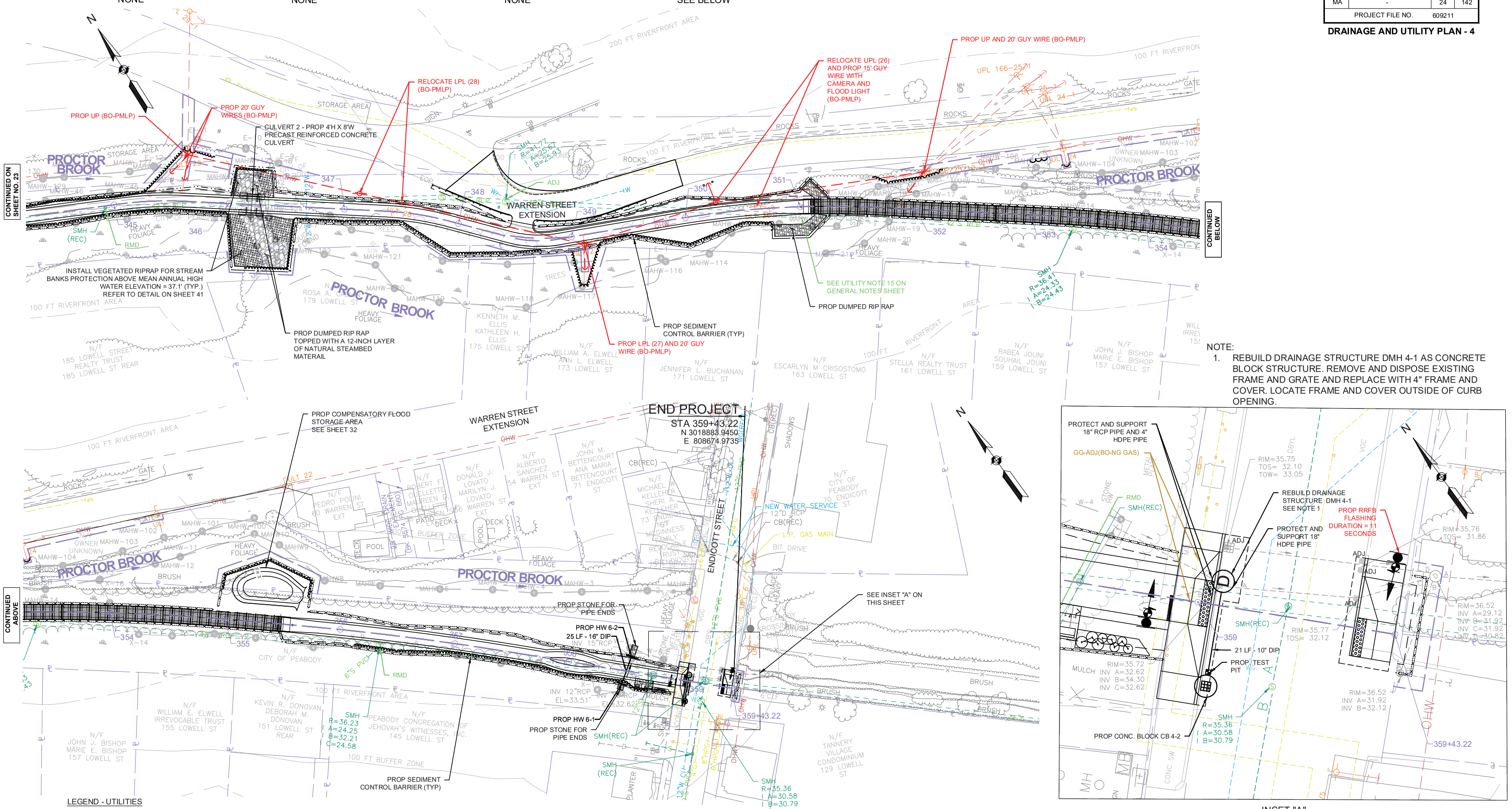
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE BELOW



0 40 100 160

SCALE: 1" = 80'

NOTE:

1. REBUILD DRAINAGE STRUCTURE DMH 4-1 AS CONCRETE BLOCK STRUCTURE. REMOVE AND DISPOSE EXISTING FRAME AND GRATE AND REPLACE WITH 4" FRAME AND COVER. LOCATE FRAME AND COVER OUTSIDE OF CURB OPENING.

INSET "A"

0 10 25 40

SCALE: 1" = 20'

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 6-1	358+48.46	11.6 R	35.47		I=33.51' (PROP HW 6-2)
PROP HW 6-2	358+52.79	12.9 L	34.88	I=32.92' (PROP HW 6-1)	

DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 4-2	359+04.67	17.6 R	35.63		I=33.50' (PROP DMH 4-1)
PROP DMH 4-1 (DRAINAGE STRUCTURE REBUILT)	359+04.67	5.3 L	34.76	I=33.29 (PROP CB 4-2) I=MATCH EXISTING	I=MATCH EXISTING

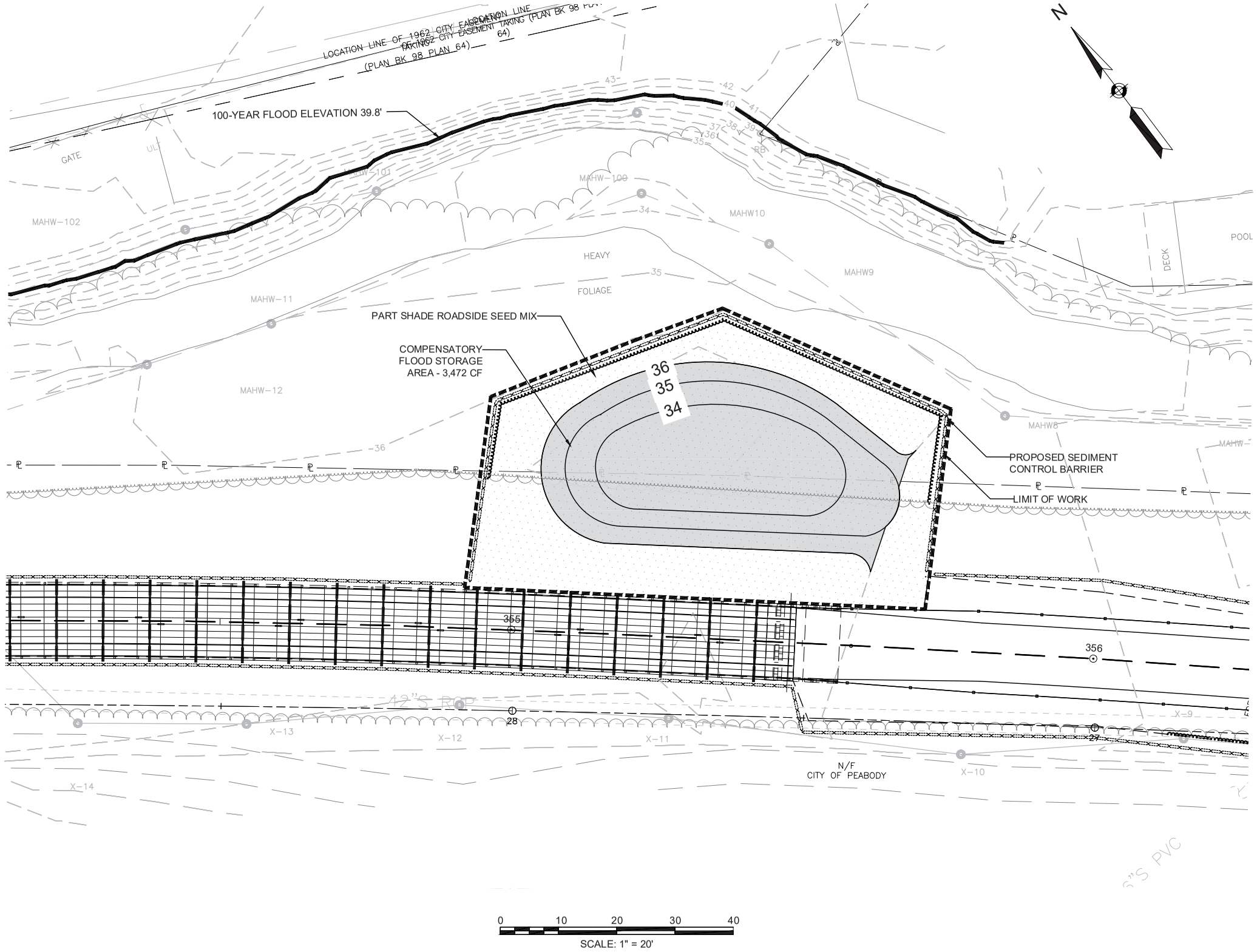
WQC/ACOE PLAN SHEET 31 OF 63

Proposal No. 609211-132091

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	142
PROJECT FILE NO.	609211		

COMPENSATORY FLOOD STORAGE



LEGEND

- LIMIT OF WORK
- SEDIMENT CONTROL BARRIER
- 100 — PROPOSED CONTOUR
- 100 — EXISTING CONTOUR
- LIMIT OF CLEARING
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPENSATORY FLOOD STORAGE

144 FT LENGTH OF SEDIMENT CONTROL BARRIER

3,244 SQ FT AREA OF PART SHADE ROADSIDE SEED MIX

NOTES:

1. PRIOR TO ANY CLEARING AND GRUBBING, THE CONTRACTOR SHALL STAKE THE LIMITS OF THE FLOOD COMPENSATION AREA AS SHOWN ON THIS PLAN.
2. THE CONTRACTOR SHALL ARRANGE WITH THE ENGINEER TO HAVE THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION ON SITE DURING CONSTRUCTION.
3. THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION FOR THIS PROJECT IS MAXWELL MCNULTY - MAXWELL.R.MCNULTY@DOT.STATE.MA.US

COMPENSATORY FLOOD STORAGE NET CUT
100 YEAR FLOOD ELEVATION =39.8'

ELEVATION	ELEVATION	INCREMENTAL NET CUT VOLUME
34-35	34	921
	35	
35-36	35	1,401
	36	
36-37	36	1,151
	37	
Total		3,472

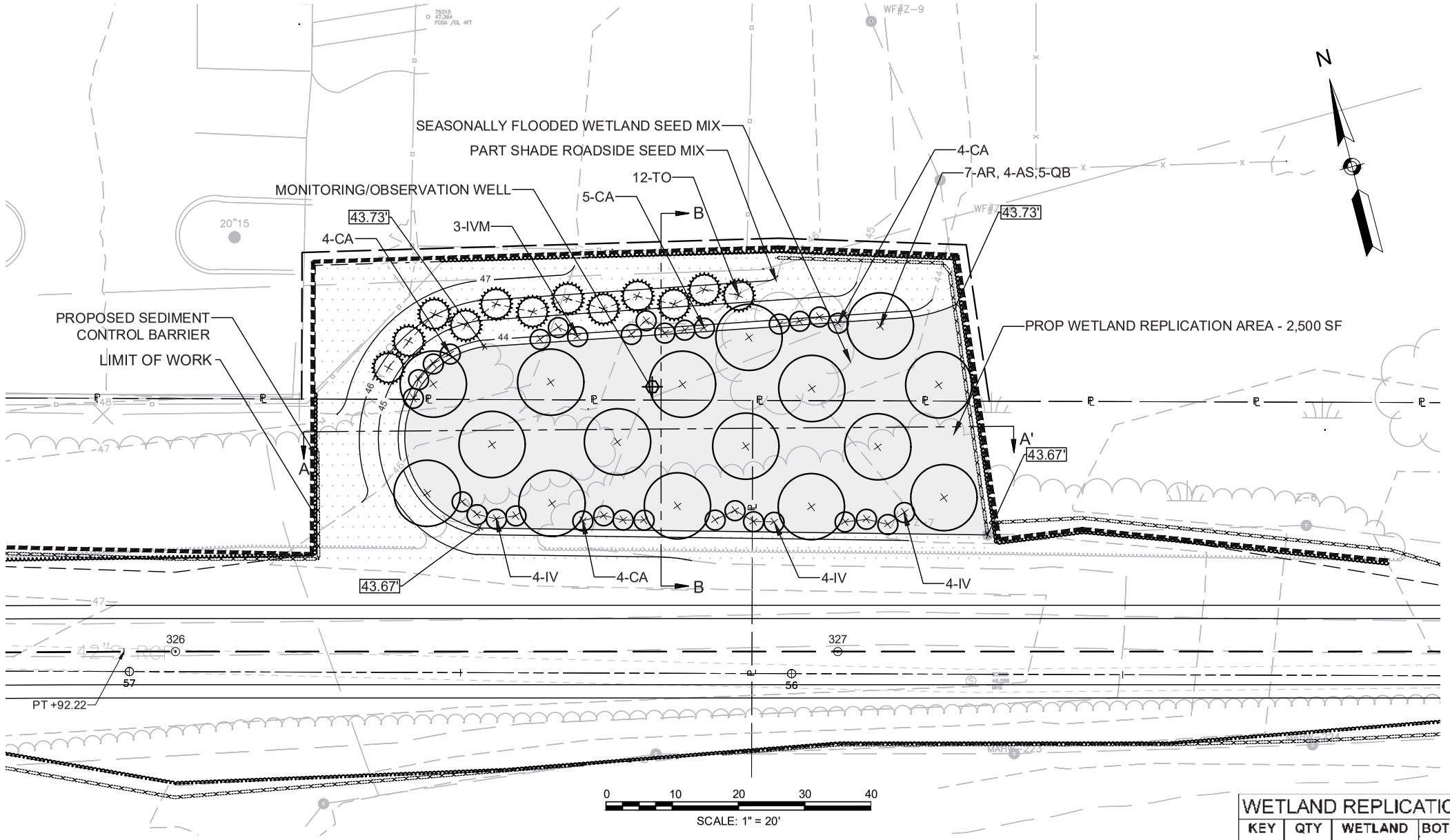
A00829 - 510

Plotted on 18-Apr-2024 8:50 PM
SHT0XX_EV(WETLAND REPLICATION PLAN).DWG

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	142
PROJECT FILE NO.	609211		

WETLAND REPLICATION PLAN



NOTES:

1. IMPACTS TO EXISTING TREES AND SOILS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
2. CONTACT THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION PRIOR TO THE START OF CONSTRUCTION. THE REPRESENTATIVE FOR THIS PROJECT IS MAXWELL R. MCNULTY MAXWELL.R.MCNULTY@DOT.STATE.MA.US.
3. FINAL GRADES TO BE TO MATCH ADJACENT WETLAND. MINOR ADJUSTMENTS IN FINAL GRADES SHALL BE MADE IN THE FIELD BY THE WETLAND SPECIALIST.
4. REPLICATION AREA SHALL BE EXCAVATED BELOW PROPOSED GRADES TO ALLOW FOR THE PLACEMENT OF WETLAND SOILS. THE DEPTH OF WETLAND SOILS SHALL BE 18" MAXIMUM AND SHALL MATCH THE DEPTH OF WETLAND SOIL IN THE ADJACENT WETLAND. DEPTH OF WETLAND SOIL SHALL BE DETERMINED BY THE WETLAND SPECIALIST. THE SALVAGED TOPSOIL MATERIAL AND B-HORIZON SUBSOIL MATERIAL EXCAVATED FROM THE WETLAND IMPACT AREAS SHALL BE PLACED IN SEPARATE STOCKPILES TO BE REUSED IN THE PROPOSED REPLICATION AREA IF SUITABLE.
5. REPLICATION AREA GRADES SHALL MATCH THE ELEVATIONS OF THE ABUTTING WETLAND TO MAINTAIN A HYDROLOGIC CONNECTION. WETLAND SPECIALIST SHALL INSPECT THE SUB-GRADE OF THE REPLICATION AREA TO ENSURE THAT THE PROPER HYDROLOGY HAS BEEN ESTABLISHED. MINOR MODIFICATIONS TO THIS GRADING PLAN MAY BE MADE IN THE FIELD BY THE QUALIFIED WETLAND SPECIALIST IN RESPONSE TO SUBSURFACE HYDROLOGIC CONDITIONS.
6. TREES AND SHRUBS IN THE REPLICATION AREA AND ADJACENT UPLAND AREA SHALL BE FIELD LOCATED BY THE WETLAND SPECIALIST.

PLANTING & SEEDING NOTES:

1. SEED SHALL BE MANUALLY BROADCAST. LIMITS SHOWN ARE APPROXIMATE. ACTUAL LIMITS SHALL BE AS DIRECTED BY THE WETLAND SPECIALIST.

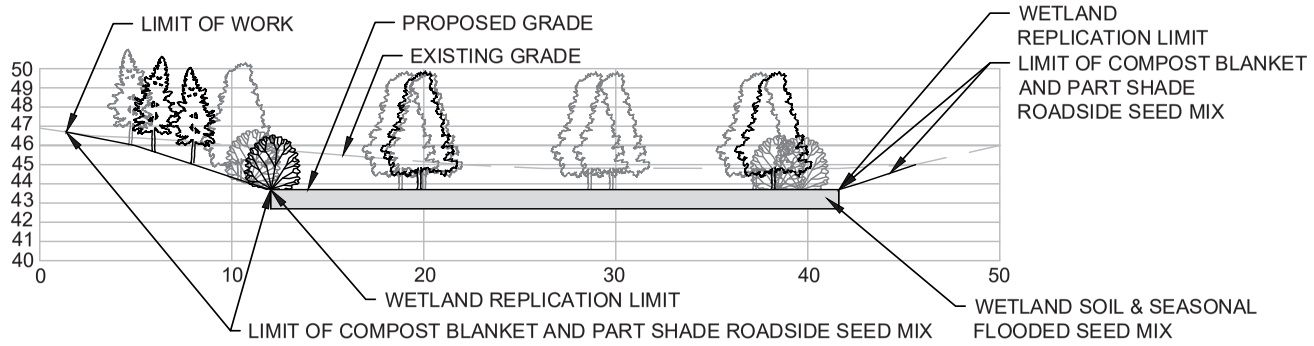
LEGEND

- LIMIT OF WORK
- SEDIMENT BARRIER
- 100 — EXISTING CONTOUR
- 44 — PROPOSED CONTOUR
- LIMIT OF CLEARING
- 124.694 — PROPOSED SPOT GRADE
- MONITORING/OBSERVATION WELL
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

84 FT LENGTH OF SEDIMENT CONTROL BARRIER

2,084 SQ FT OF PART SHADE ROADSIDE SEED MIX

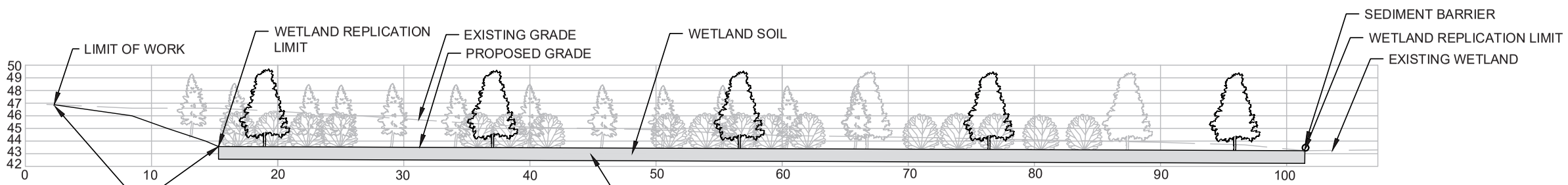
2,500 SQ FT WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX



SECTION (B-B')
(HOR. SCALE 1" = 5' , VERT. SCALE 1" = 5')

WETLAND REPLICATION PLANT LIST

KEY	QTY	WETLAND STAUS	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
			DECIDUOUS TREES			
AR	7	FAC	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	4	FACW	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
QB	5	FACW	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
			EVERGREEN TREES			
TO	12	FACW	THUJA OCCIDENTALIS	AMERICAN ARBORVITAE	4-5 FEET	B&B
			DECIDUOUS SHRUBS			
CA	17	FACW	CORNUS AMOMUM	SILKY DOGWOOD	2-3 FEET	#2 CONT.
IV	12	FACW	ILEX VERTICILATA	WINTERBERRY	2-3 FEET	#2 CONT.
IVM	3	FACW	ILEX VERTICILATA -MALE	MALE WINTERBERRY	2-3 FEET	#2 CONT.

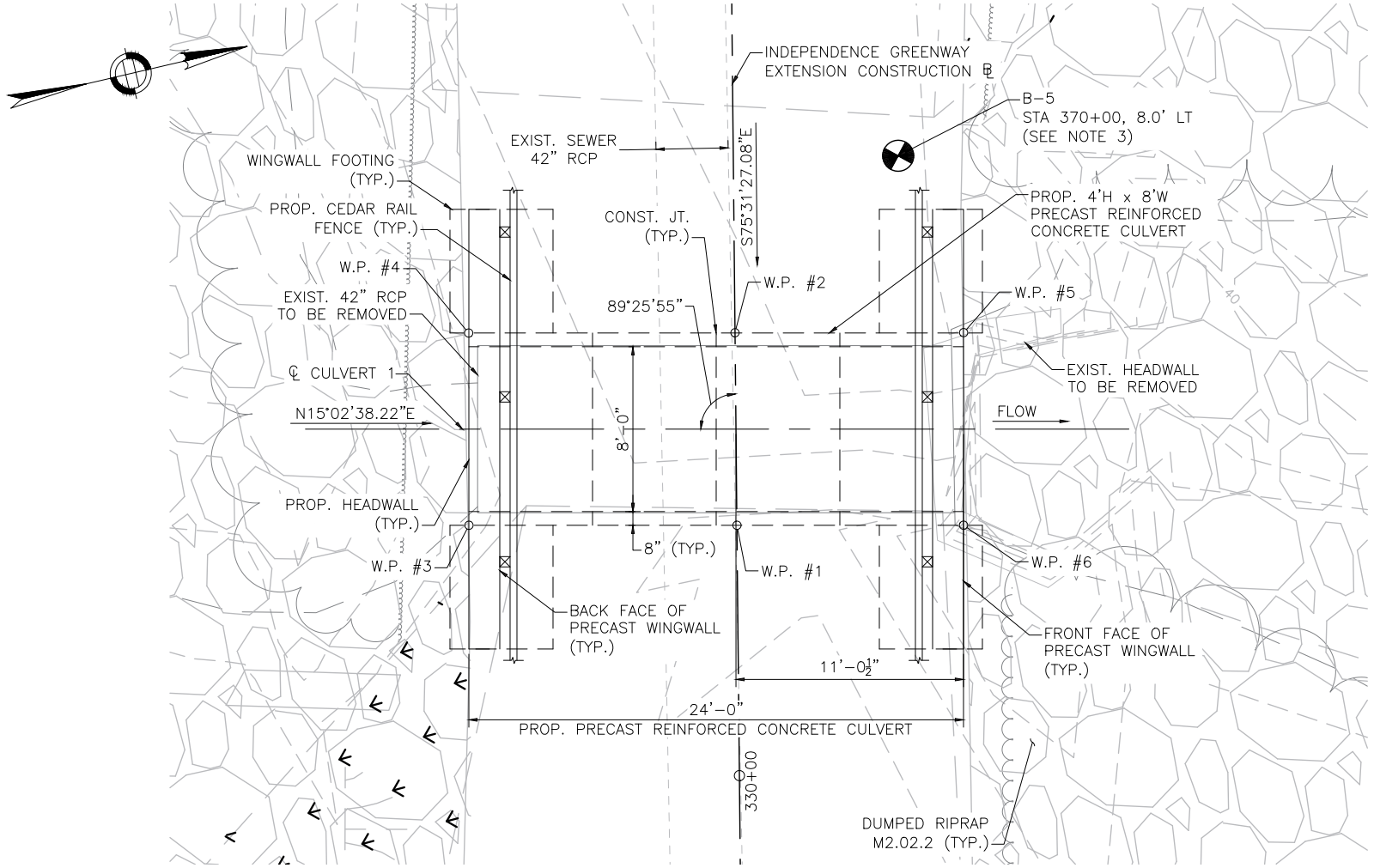


SECTION (A-A')
(HOR. SCALE 1" = 5' , VERT. SCALE 1" = 5')

WQC/ACOE PLAN SHEET 33 OF 63

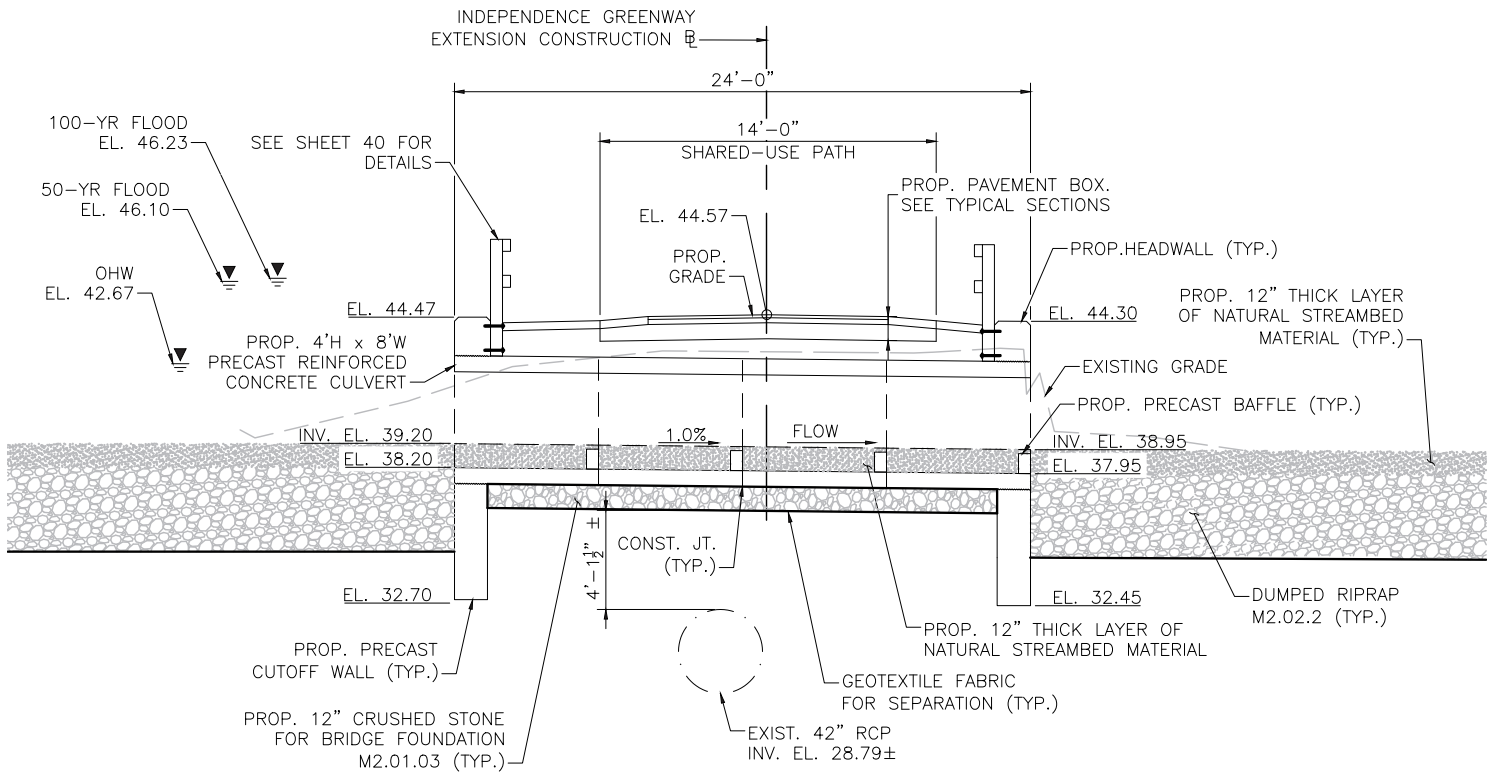
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	140
PROJECT FILE NO.	609211		

CULVERT 1 - PLAN AND LONGITUDINAL SECTION



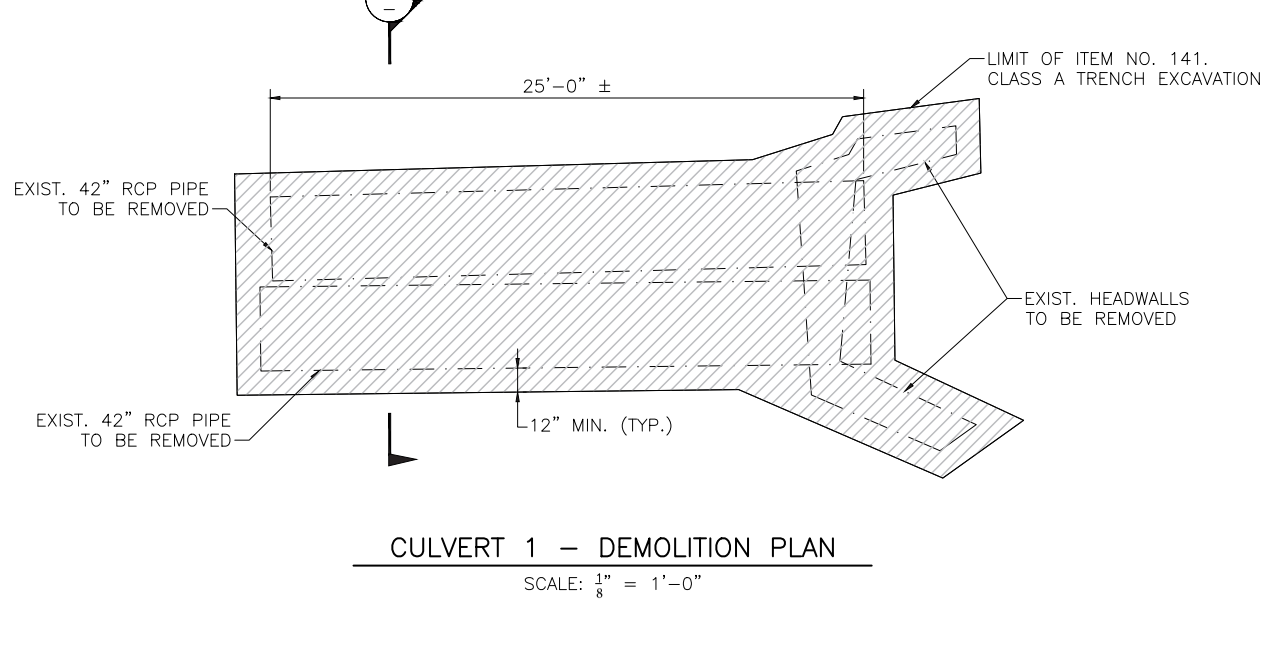
CULVERT 1 – PLAN

SCALE: ⅛" = 1'–0"



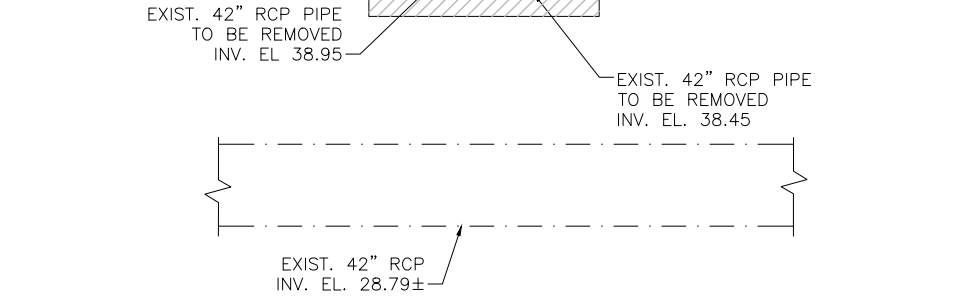
CULVERT 1 – LONGITUDINAL SECTION

SCALE: ⅛" = 1'–0"



CULVERT 1 – DEMOLITION PLAN

SCALE: ⅛" = 1'–0"



SECTION 1 –

SCALE: ⅛" = 1'–0"

CULVERT NO.1 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
1	329+87.85	0.00 LT	3020223.57	806099.03
2	329+78.52	0.00 LT	3020225.91	806089.99
3	329+87.72	45.41 RT	3020211.01	806095.66
4	329+78.39	45.37 RT	3020213.43	806086.64
5	329+78.63	44.89 LT	3020236.61	806092.87
6	329+87.96	44.87 LT	3020234.18	806101.88

NOTES:

1. SEE SHEET 40 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'–0" MAXIMUM.
3. CONTRACTOR TO PERFORM DRIVE SAMPLE BORING (ITEM NO. 191.) FOR B–5 AS EARLY ACTION ITEM TO VERIFY SOIL CONDITIONS ASSUMED IN THE GEOTECHNICAL REPORT FOR CULVERT 1.

4 0 4 8

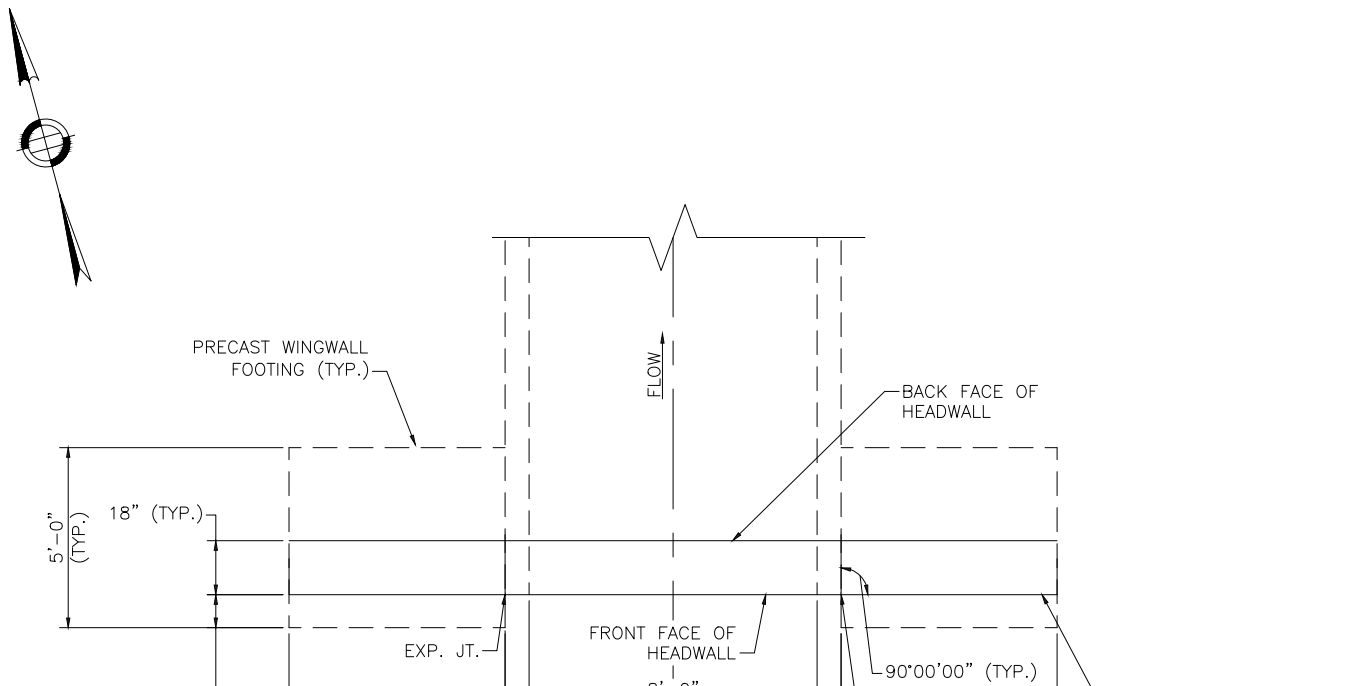
SCALE IN FEET

Proposal No. 609211-132091

A00829 - 512

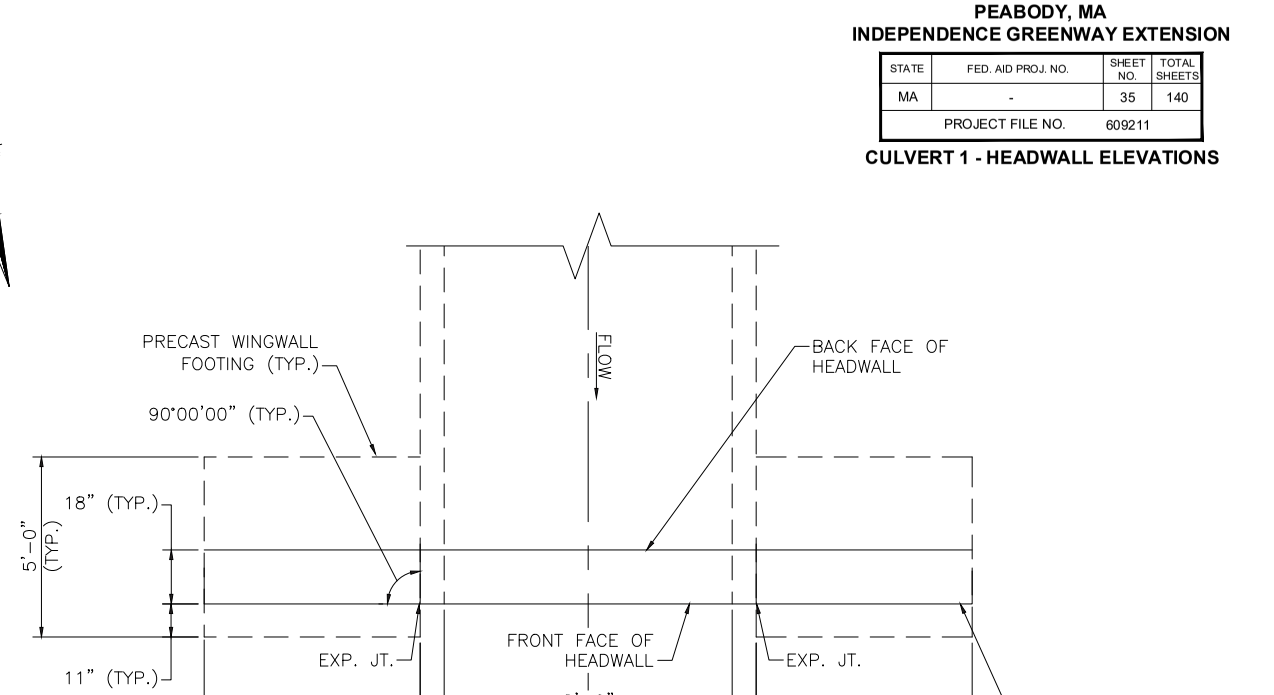
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	35	140
PROJECT FILE NO.	609211		

CULVERT 1 - HEADWALL ELEVATIONS



CULVERT 1 – UPSTREAM PLAN

SCALE: $\frac{3}{16}$" = 1'–0"

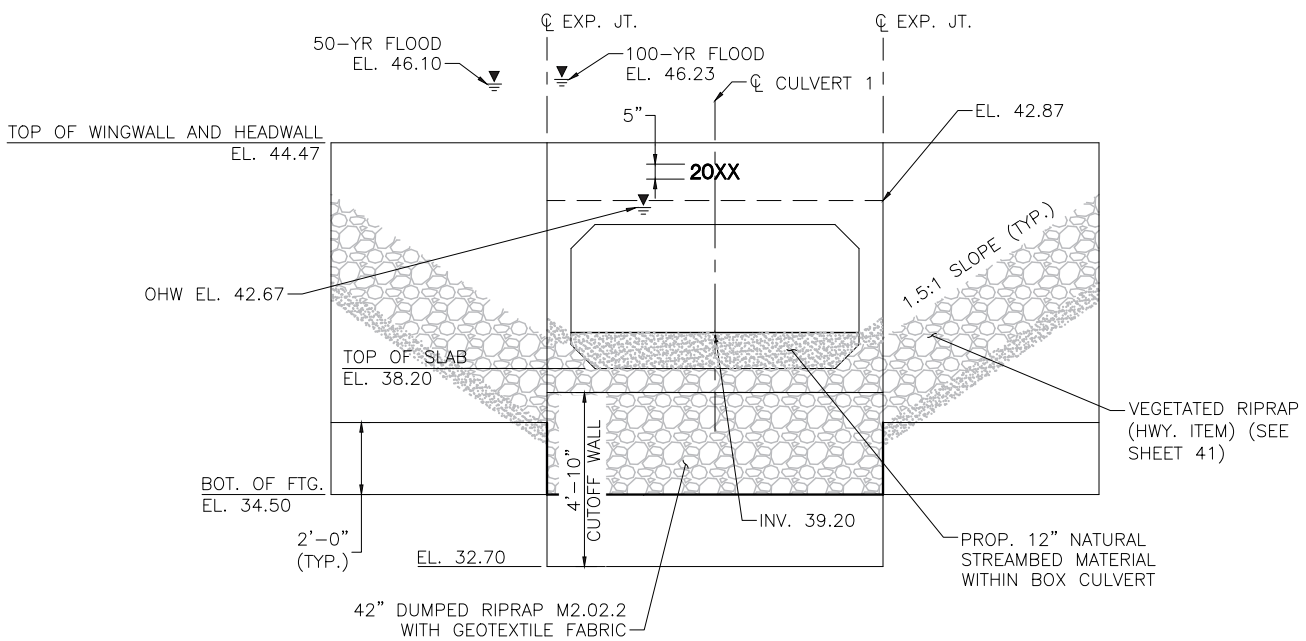


CULVERT 1 – DOWNSTREAM PLAN

SCALE: $\frac{3}{16}$" = 1'–0"

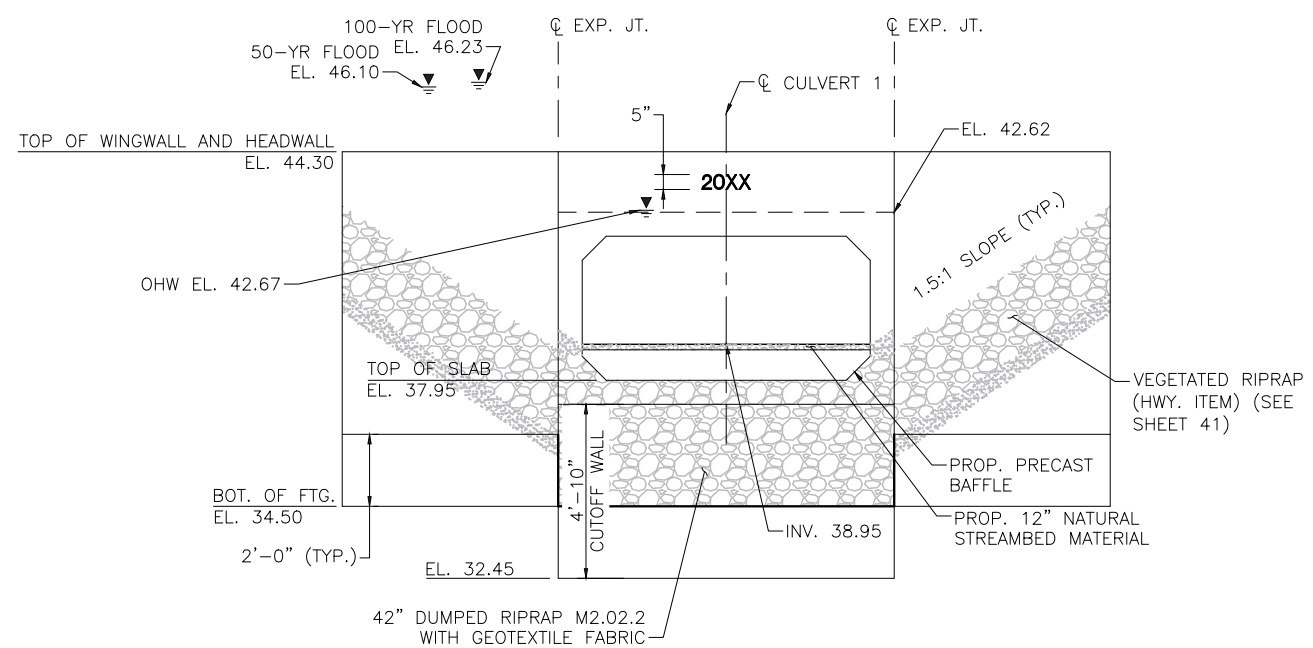
0 5'-4" 13'-4"

SCALE: 1" = 5'-4"



CULVERT 1 – UPSTREAM ELEVATION

SCALE: $\frac{3}{16}$" = 1'–0"



CULVERT 1 – DOWNSTREAM ELEVATION

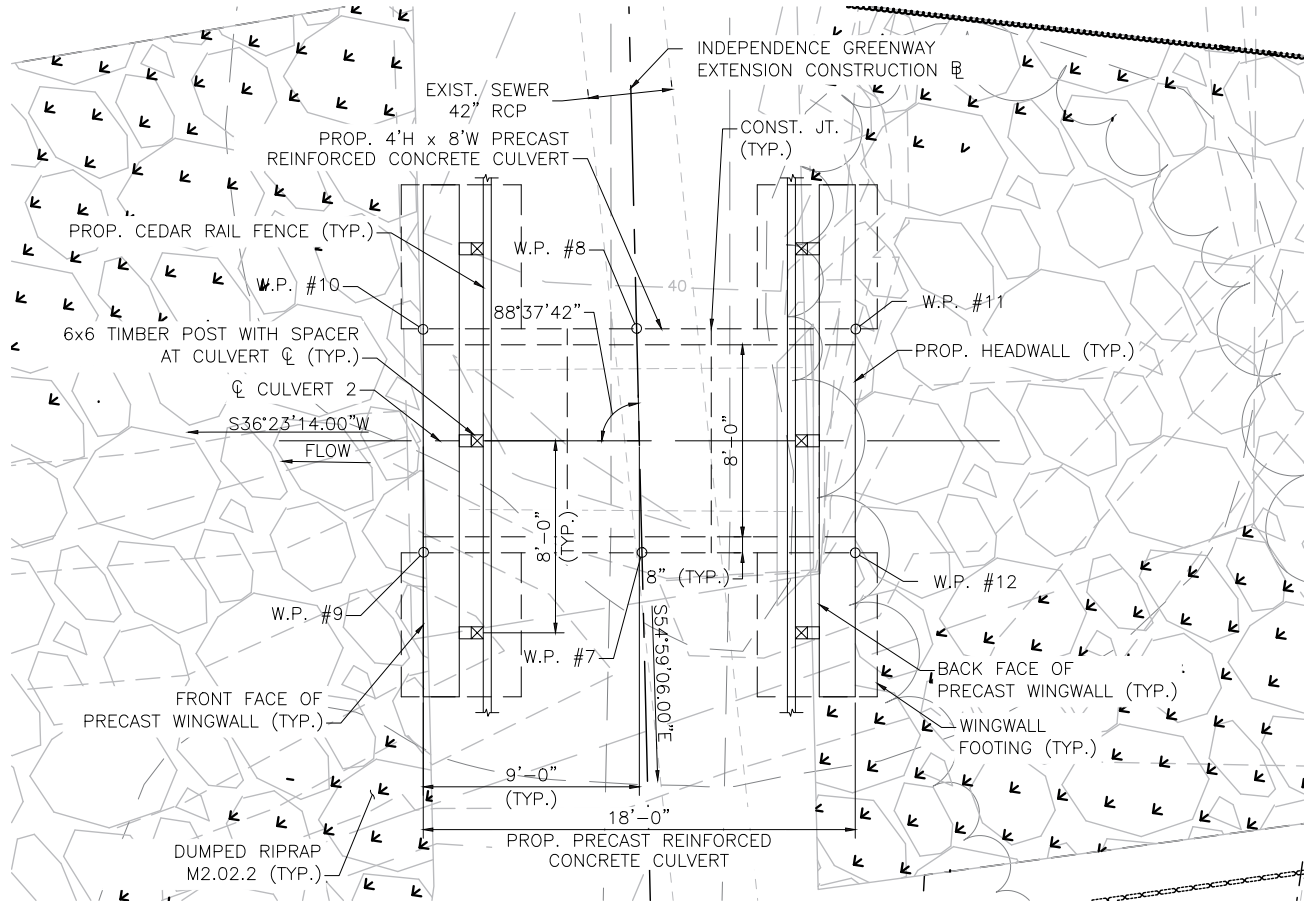
SCALE: $\frac{3}{16}$" = 1'–0"

NOTES:

1. SEE SHEET 34 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

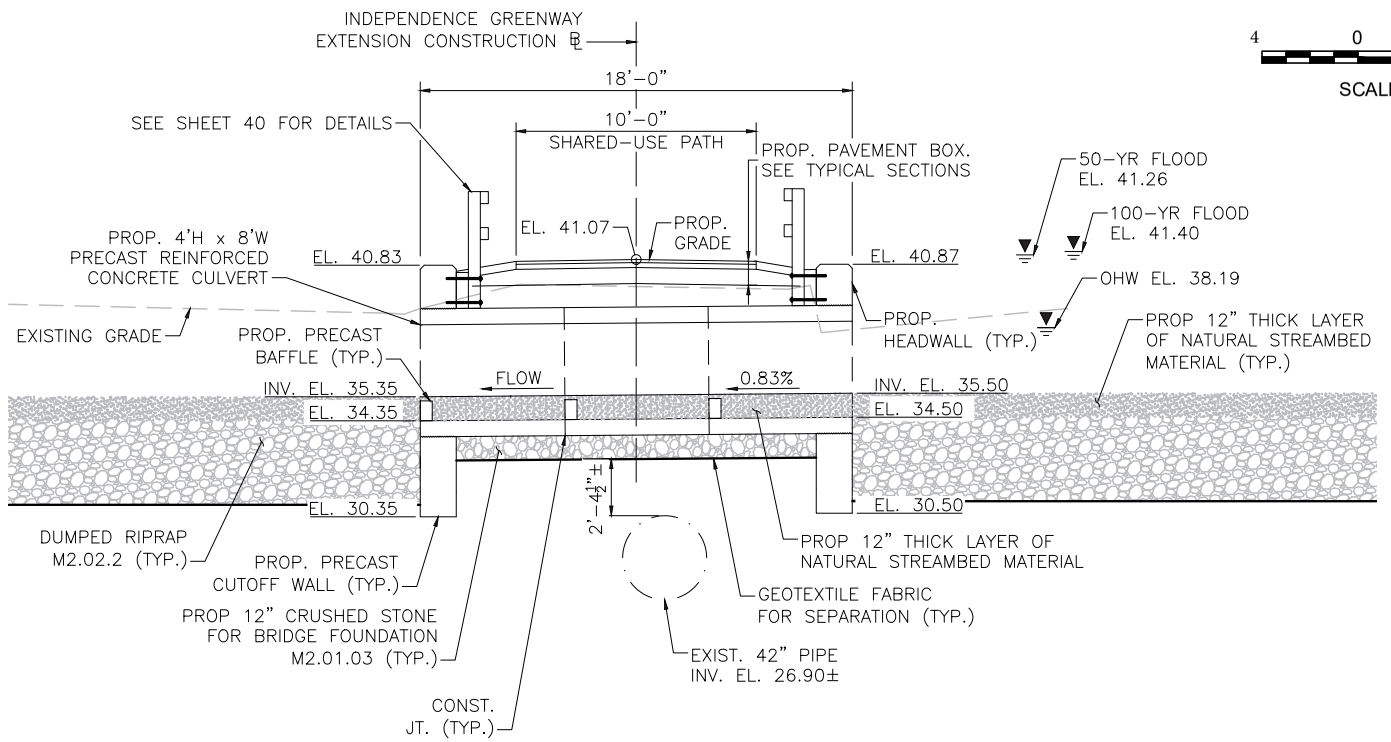
Proposal No. 609211-132091
A00820 - 513

CULVERT 2 - PLAN AND LONGITUDINAL SECTION



CULVERT 2 – PLAN

SCALE: 1/8" = 1'-0"

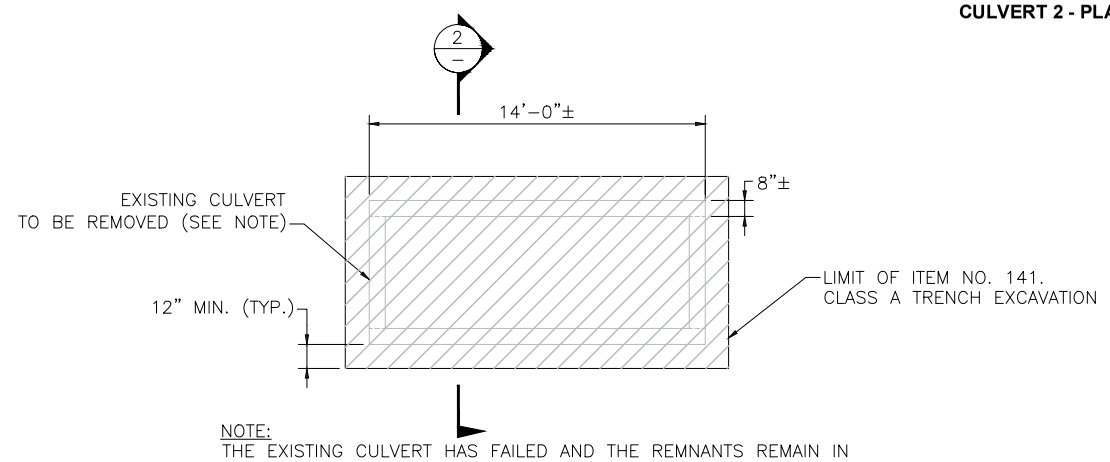


CULVERT 2 – LONGITUDINAL SECTION

SCALE: 1/8" = 1'-0"

4 0 4 8

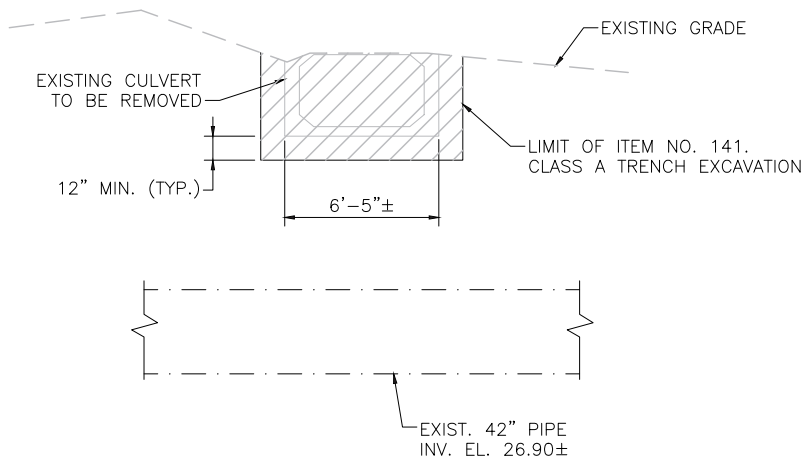
SCALE IN FEET



NOTE:
THE EXISTING CULVERT HAS FAILED AND THE REMNANTS REMAIN IN THE CHANNEL. ALL THE EXISTING REMNANTS OF THE EXISTING CULVERT TO BE REMOVED FROM THE CHANNEL. REMOVAL SHALL BE MEASURED AND PAID UNDER ITEM NO. 141. CLASS A TRENCH EXCAVATION.

CULVERT 2 – DEMOLITION PLAN

SCALE: 1/8" = 1'-0"



SECTION 2 –

SCALE: 1/8" = 1'-0"

CULVERT NO.2 WORKING POINTS:

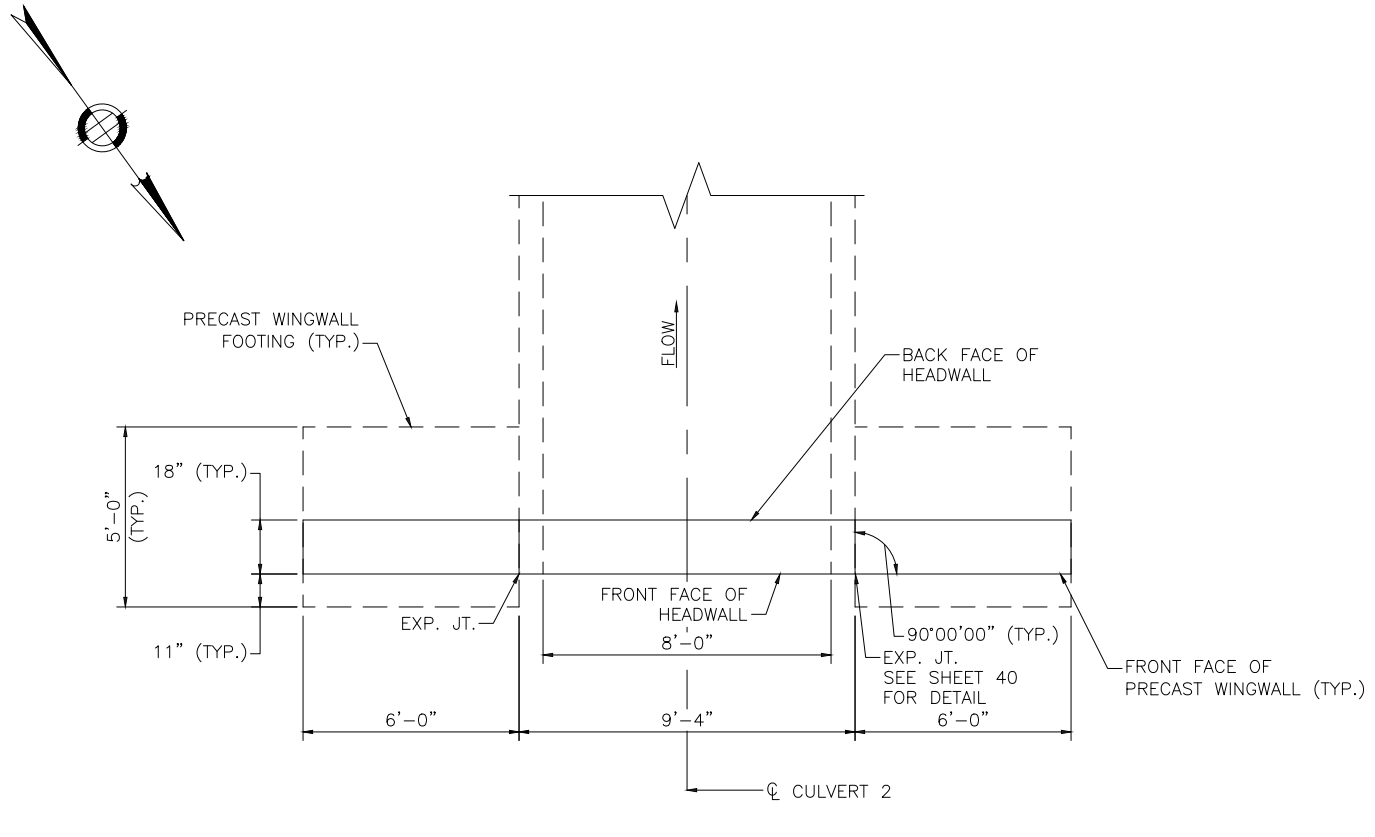
W.P.	STATION	OFFSET	NORTHING	EASTING
7	346+24.36	0.00 LT	3019677.22	807634.33
8	346+15.02	0.00 LT	3019682.58	807626.68
9	346+9.11	9.11 RT	3019677.35	807634.15
10	346+14.81	8.89 RT	3019682.70	807626.51
11	346+15.24	9.11 LT	3019689.92	807632.09
12	346+24.57	8.89 LT	3019677.10	807634.50

NOTES:
1. SEE SHEET 40 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'-0" MAXIMUM.

Proposal No. 609211-132091
A00829 - 514

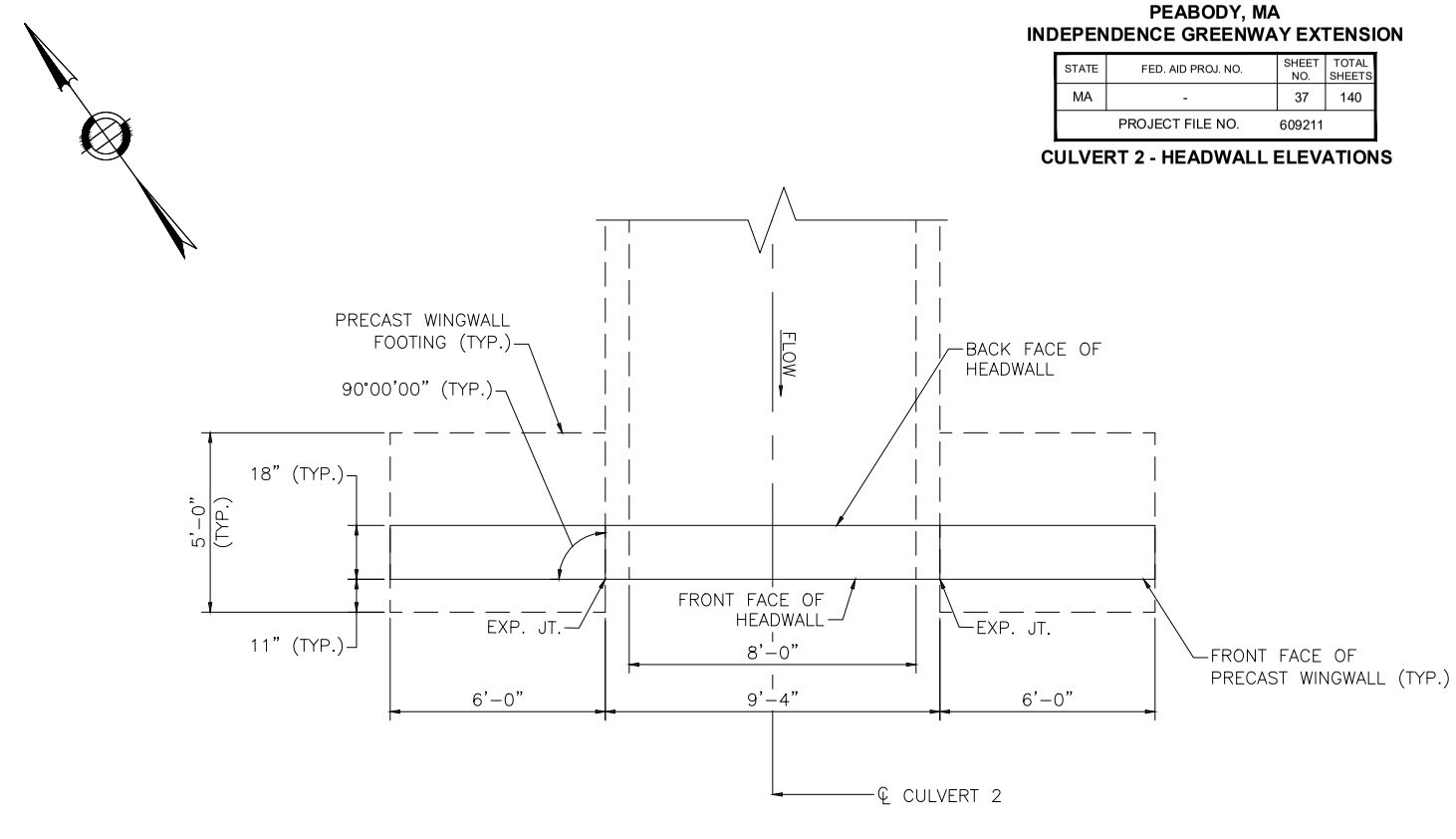
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	37	140
PROJECT FILE NO.	609211		

CULVERT 2 - HEADWALL ELEVATIONS



CULVERT 2 – UPSTREAM PLAN

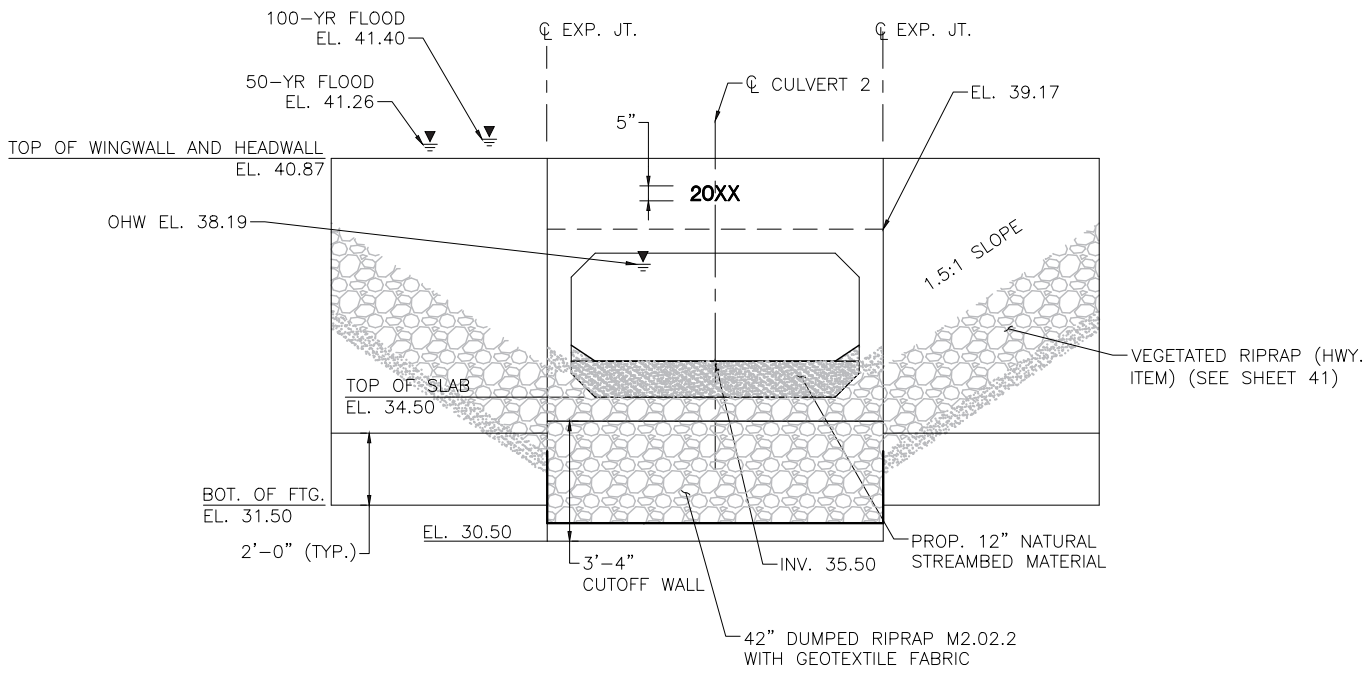
SCALE: $\frac{3}{16}$" = 1'–0"



CULVERT 2 – DOWNSTREAM PLAN

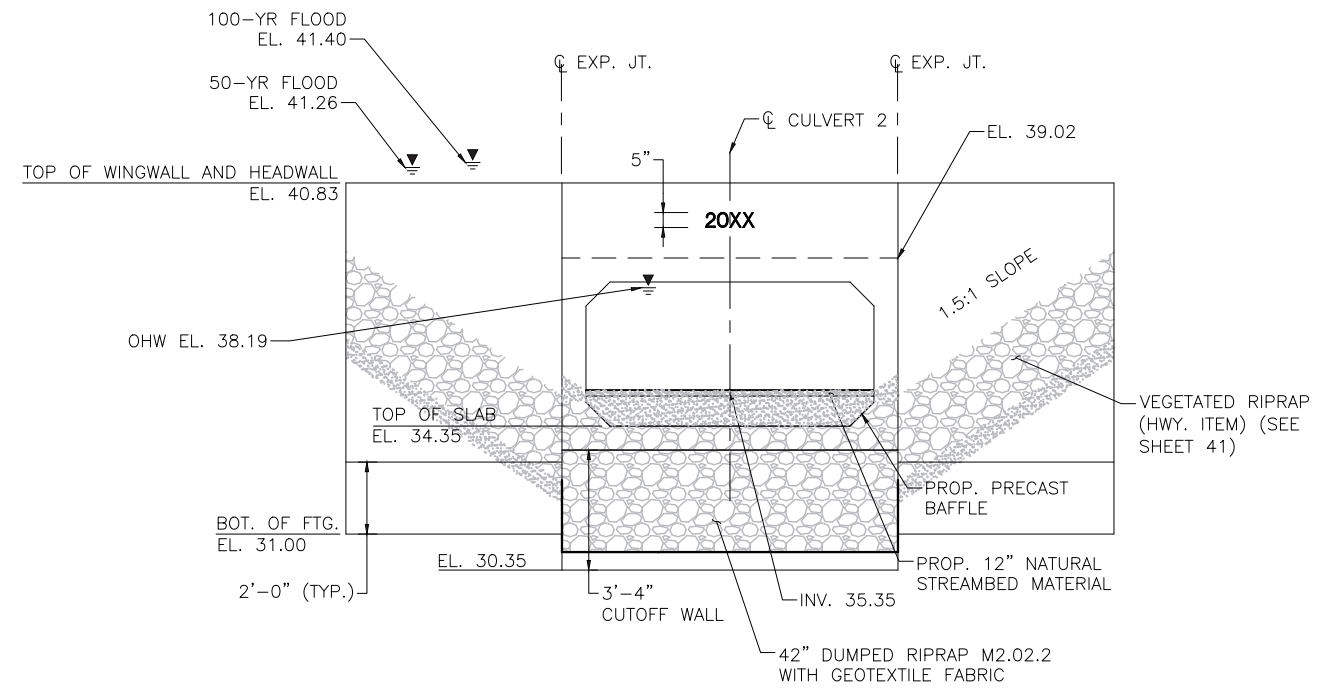
SCALE: $\frac{3}{16}$" = 1'–0"

SCALE: 1" = 5'-4"



CULVERT 2 – UPSTREAM ELEVATION

SCALE: $\frac{3}{16}$" = 1'–0"



CULVERT 2 – DOWNSTREAM ELEVATION

SCALE: $\frac{3}{16}$" = 1'–0"

NOTES:

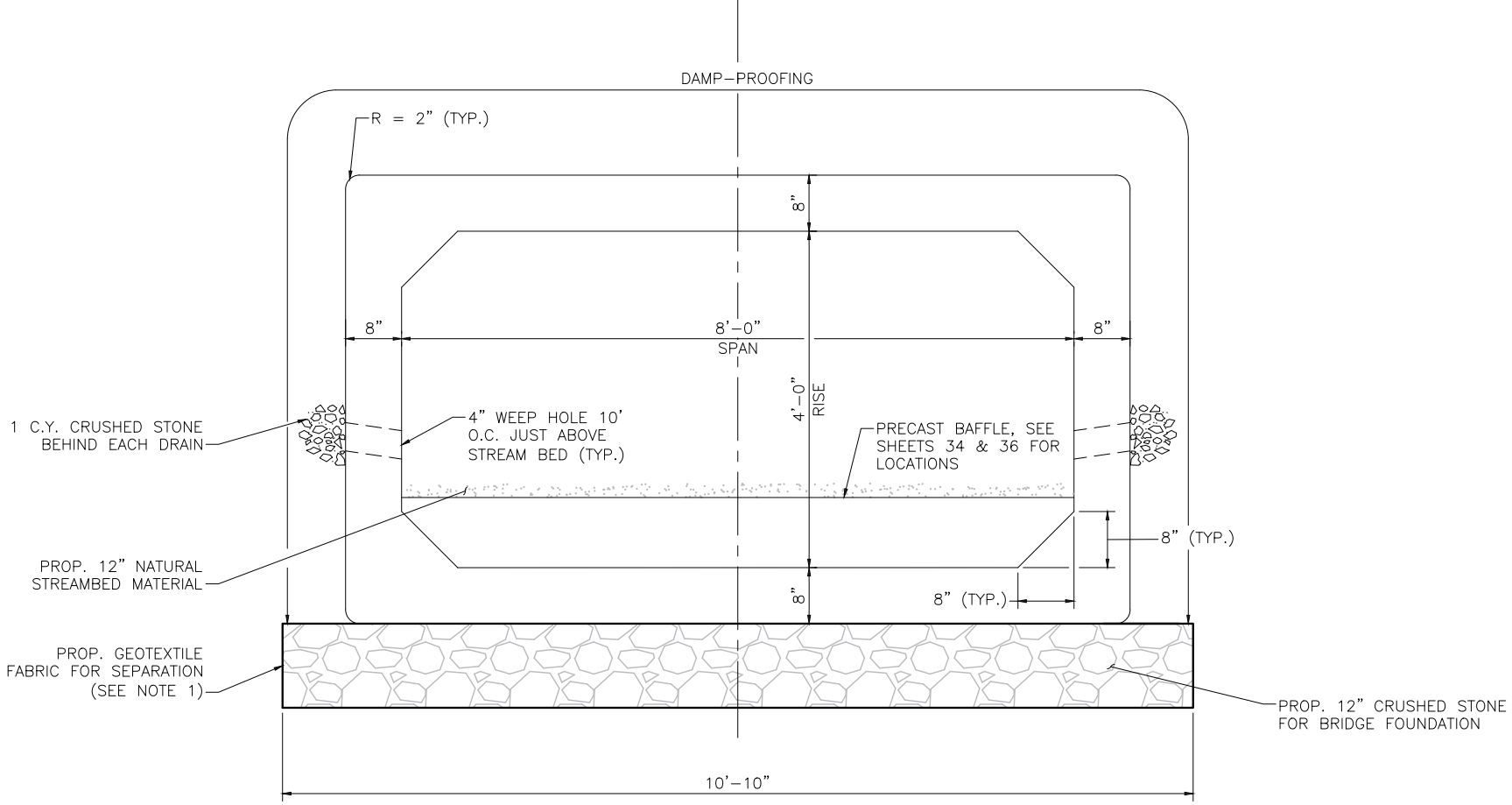
1. SEE SHEET 36 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

WQC/ACOE PLAN SHEET 37 OF 63

Proposal No. 609211-132091
A00829 - 515

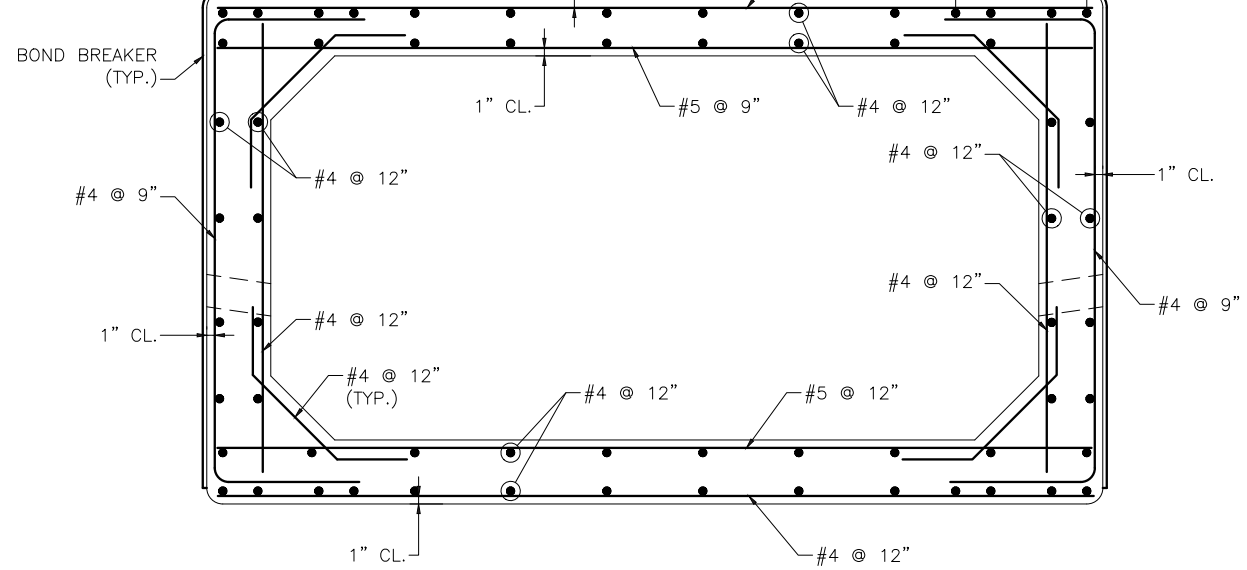
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	38	140
PROJECT FILE NO.	609211		

BOX CULVERT SECTIONS



BOX CULVERT TYPICAL SECTION

SCALE: 1" = 2'–0"



NOTE:

REINFORCING SHOWN IS CONCEPTUAL MINIMUM REQUIRED REINFORCEMENT FOR A DESIGN LIVE LOADING OF AASHTO HL–93 WITHOUT THE LANE LOAD. FINAL REINFORCEMENT SHALL BE DESIGNED AND DETAILED BY THE CONTRACTOR.

BOX CULVERT REINFORCING DETAILS

SCALE: 1" = 2'–0"

NOTES:

1. PROPOSED GEOTEXTILE FABRIC TO ENVELOP LIMITS OF 12" CRUSHED STONE FOR BRIDGE FOUNDATION WITH MINIMUM 2'–0" OVERLAP AT SEAM.
2. ALL CONCRETE TO BE 5000 PSI, ¾ IN, 685 HP CEMENT CONCRETE.
3. THE MAXIMUM FACTORED BEARING PRESSURE = 2.33 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. FACTORED BEARING RESISTANCE = 5.00 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.
4. TRANSVERSE REINFORCING SHALL BE PLACED NORMAL TO THE ℄ OF THE CULVERT.
5. ALL REINFORCING SHALL BE GRADE 60 EPOXY COATED.

1 0 1 2

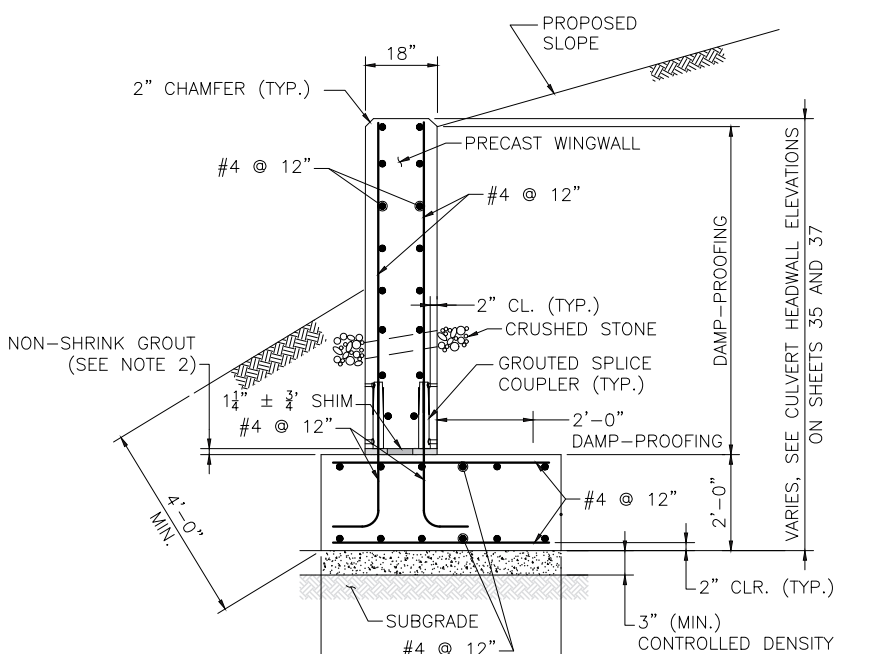
SCALE IN FEET

Proposal No. 609211-132091

A00829 - 516

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	39	140
PROJECT FILE NO.	609211		

HEADWALL AND MISCELLANEOUS DETAILS



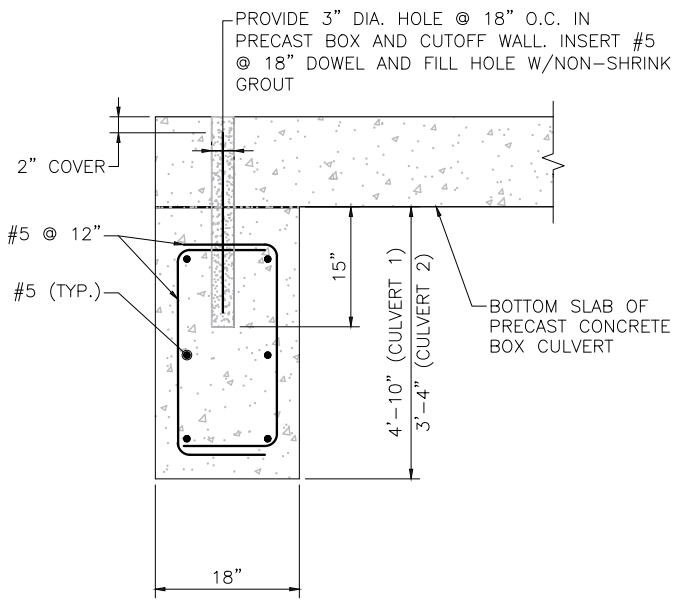
NOTES:

1. THE CONTRACTOR MAY ELECT TO USE PRECAST FOOTINGS, OR MODULAR WINGWALLS IN LIEU OF PRECAST WINGWALL STEMS DEPICTED HERE. DESIGN OF WINGWALLS AND FOOTINGS WHETHER PRECAST OR MODULAR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. PRE-BED PRECAST ELEMENT WITH NON-SHRINK GROUT WITH THICKNESS MORE THAN SHIM STACK.
3. TIMBER RAILING POST ATTACHMENT NOT SHOWN FOR CLARITY, SEE DETAIL ON THIS SHEET.

TYPICAL PRECAST WINGWALL SECTION

SCALE: $\frac{1}{4}$" = 1'-0"

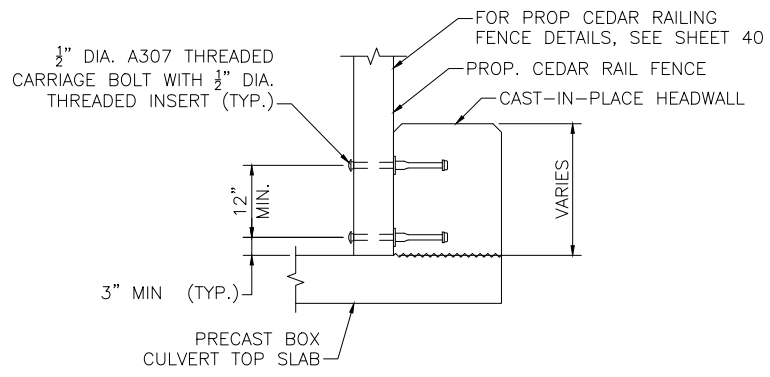
SCALE IN FEET



CUTOFF WALL DETAIL

SCALE: 1" = 2'-0"

SCALE IN FEET

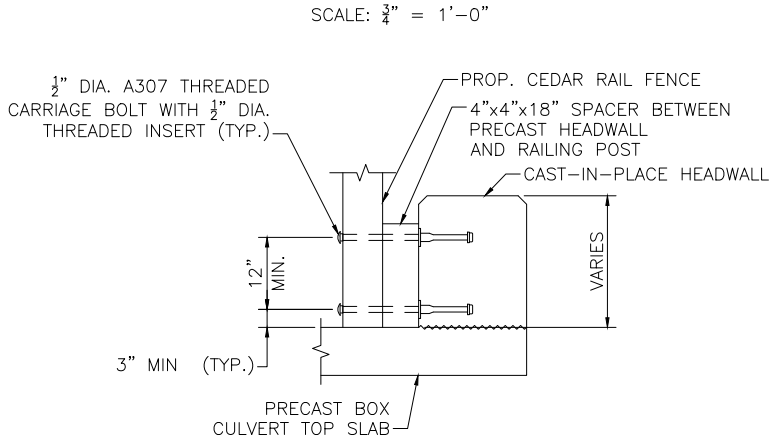


NOTES:

1. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR

CULVERT 1 HEADWALL – POST ATTACHMENT DETAIL

SCALE: $\frac{3}{4}$" = 1'-0"

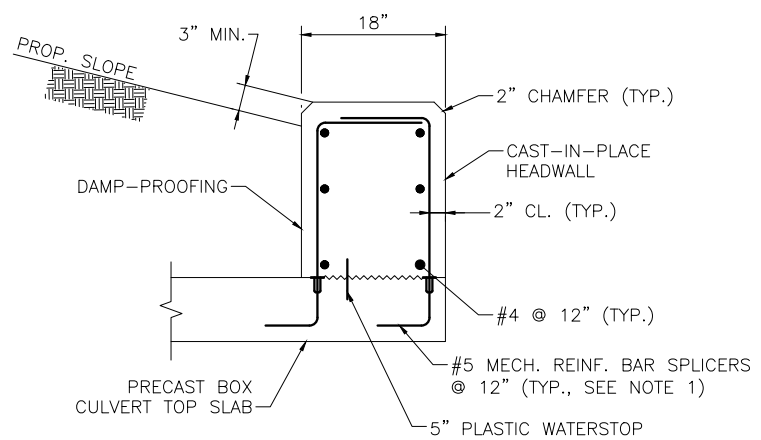


NOTES:

1. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR
3. PROPOSED TIMBER SPACER TO BE PROVIDED AND CUT ALONG SKEW AS NEEDED TO PROVIDE FLUSH ATTACHMENT OF POST.

CULVERT 2 HEADWALL – POST ATTACHMENT DETAIL

SCALE: $\frac{3}{8}$" = 1'-0"

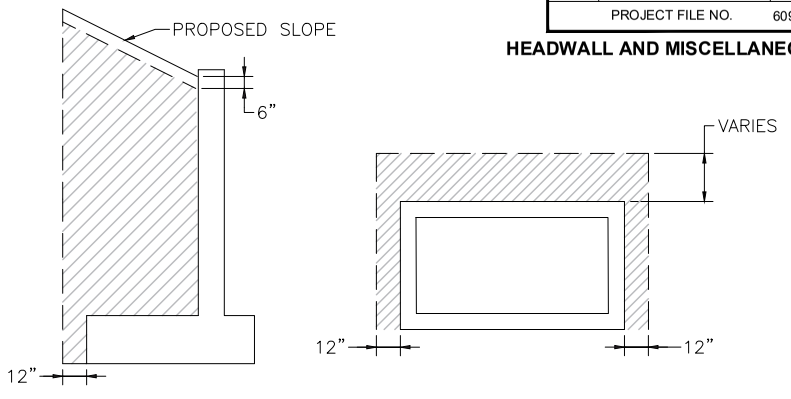


NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 ∫ DOWELS, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

TYPICAL CULVERT HEADWALL REINFORCEMENT DETAIL

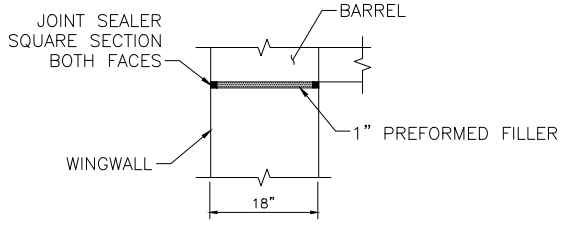
SCALE: 1" = 2'-0"



NOTE:
HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

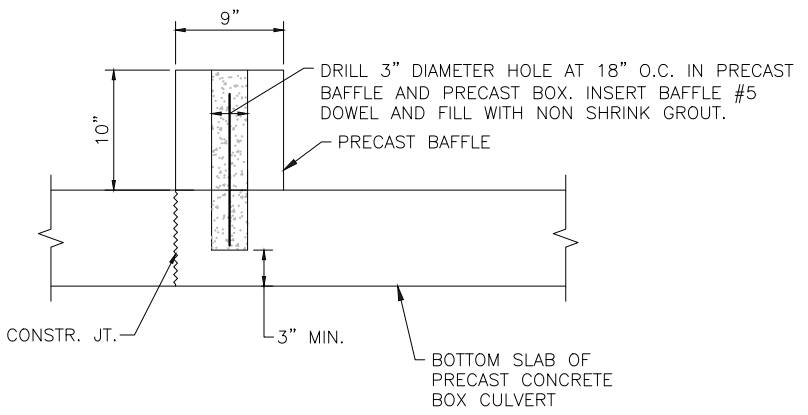
SCALE: $\frac{1}{4}$" = 1'-0"



TYPICAL CULVERT EXPANSION JOINT DETAIL

SCALE: $\frac{3}{8}$" = 1'-0"

SCALE IN FEET

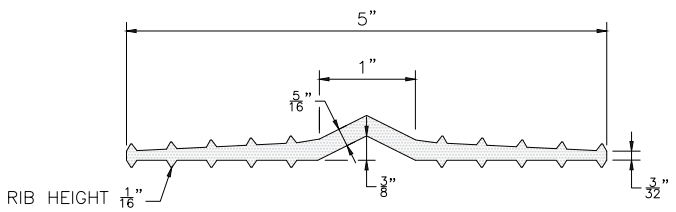


NOTE:
PRECAST BAFFLE AND ATTACHMENT MATERIALS ARE CONSIDERED INCIDENTAL TO THE CULVERT ITEMS.

TYPICAL PRECAST BAFFLE DETAIL

SCALE: $\frac{3}{4}$" = 1'-0"

SCALE IN FEET



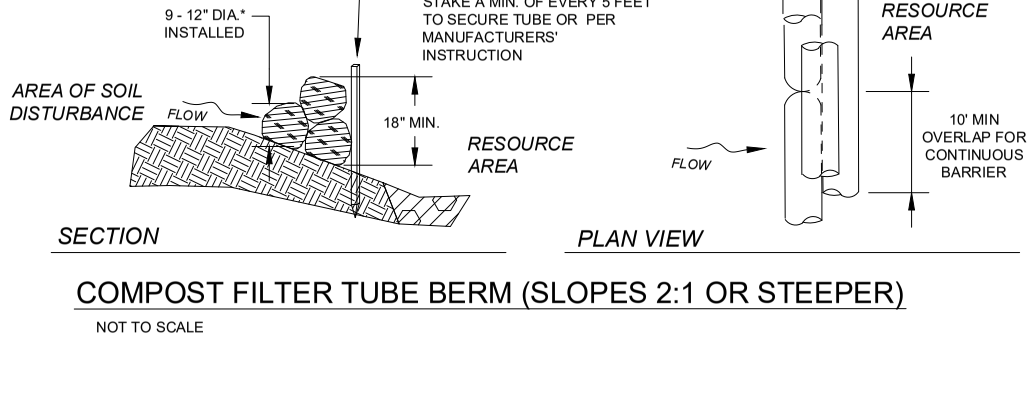
5" WATERSTOP

NOT TO SCALE

Proposal No. 609211-132091
A00820 - 517

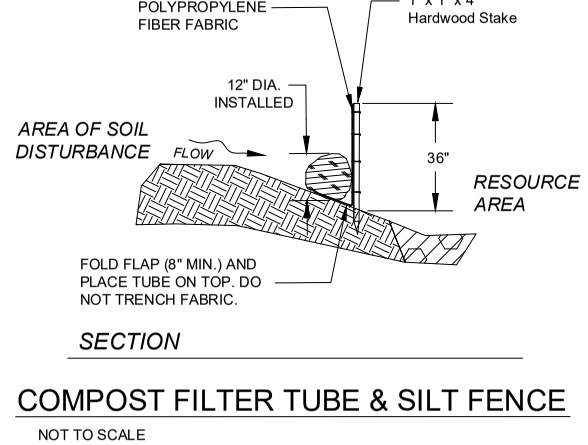
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	40	142
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 1



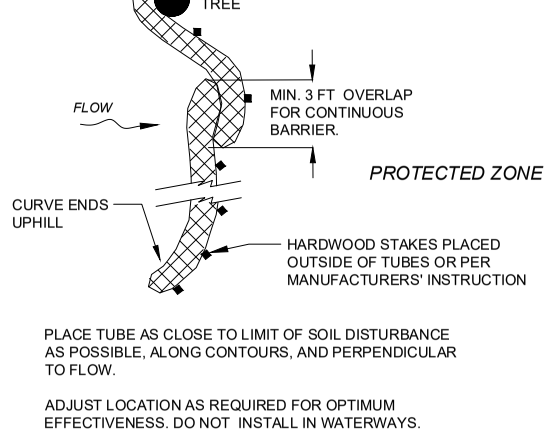
COMPOST FILTER TUBE BERM (SLOPES 2:1 OR STEEPER)

NOT TO SCALE



COMPOST FILTER TUBE & SILT FENCE

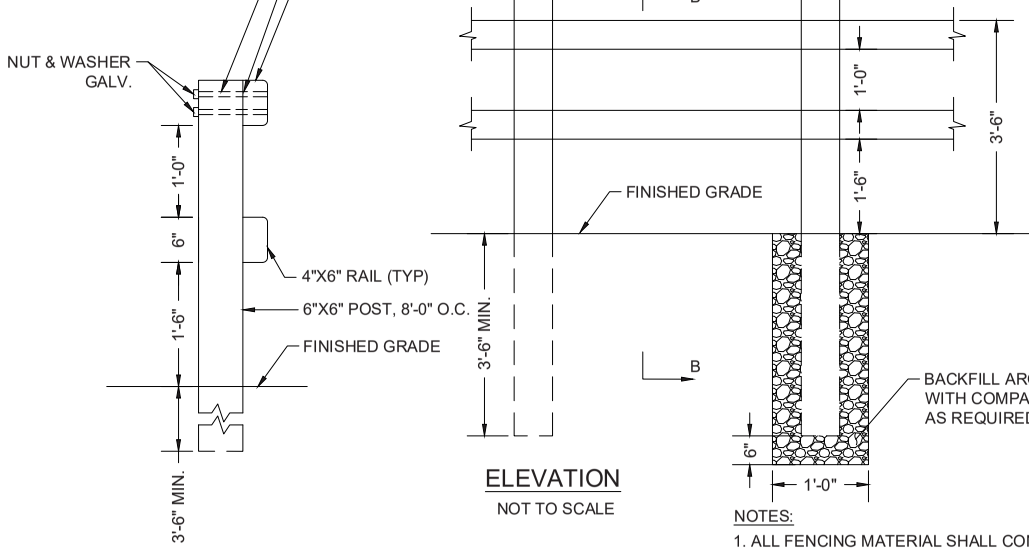
NOT TO SCALE



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

PLAN VIEW



SECTION B-B
NOT TO SCALE

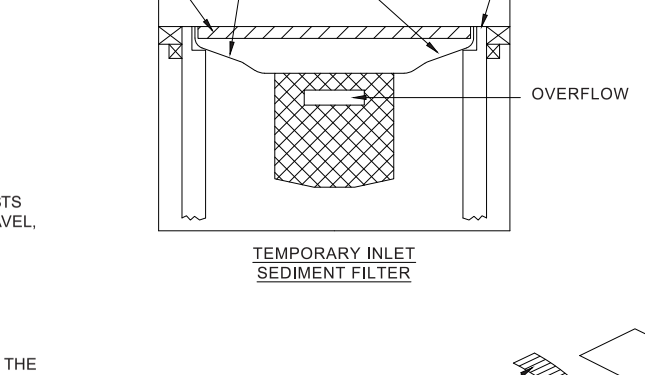
ELEVATION
NOT TO SCALE

WOOD RAIL FENCE

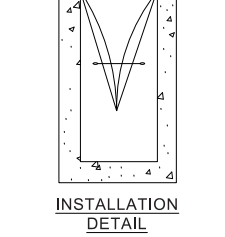
NOT TO SCALE

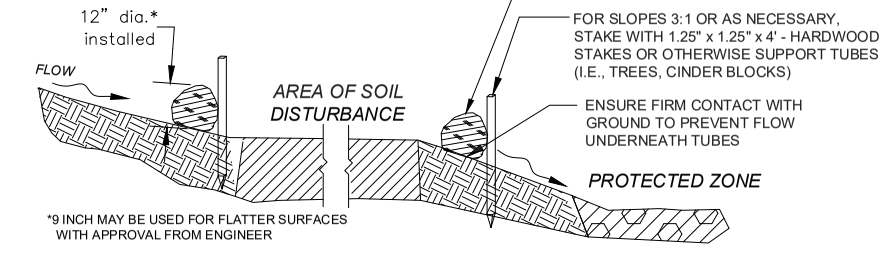
NOTES:
1. ALL FENCING MATERIAL SHALL CONFORM TO THE STANDARD SPECIFICATIONS & SPECIAL PROVISIONS INCLUDED IN THE CONTRACT DOCUMENTS.

2. MOUNTING OF UPPER RAIL IS SHOWN ON SECTION B-B. MOUNT LOWER RAIL SIMILARLY.



TEMPORARY INLET SEDIMENT FILTER

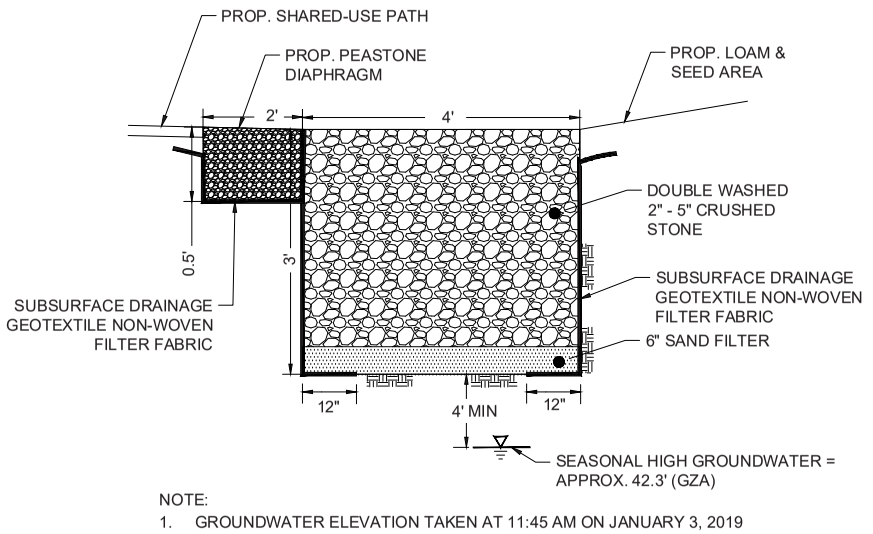




SECTION

SEDIMENT BARRIER - COMPOST FILTER TUBE

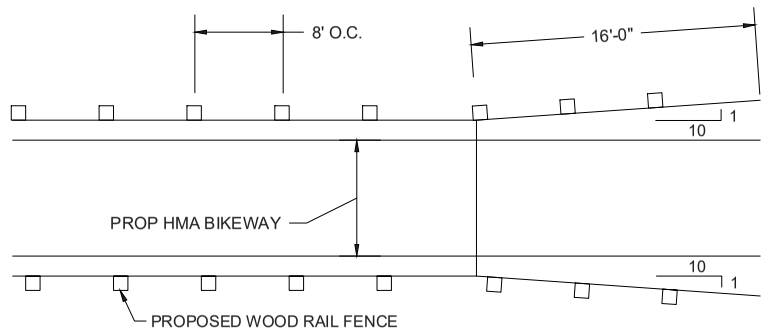
NOT TO SCALE



NOTE:
1. GROUNDWATER ELEVATION TAKEN AT 11:45 AM ON JANUARY 3, 2019

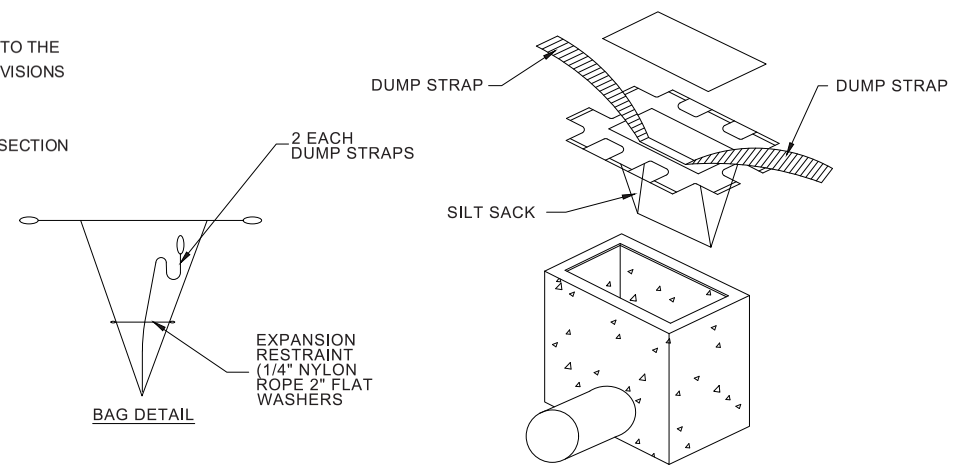
INFILTRATION TRENCH SECTION

NOT TO SCALE



WOOD RAIL FENCE FLARED-END TREATMENT

NOT TO SCALE

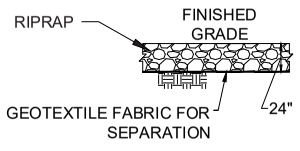


NOTE 1:
TEMPORARY INLET SEDIMENT FILTER TO BE INSTALLED ON ALL PAVED CATCH BASINS OR STORM INLETS.

INLET PROTECTION SILT SACK

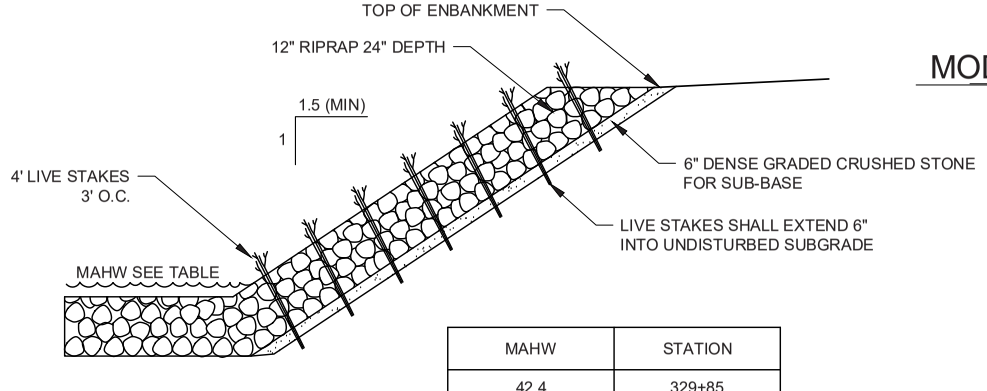
NOT TO SCALE

Proposal No. 609211-132091
A00829 - 518



ABUTMENT ARMORING RIPRAP DETAIL

NOT TO SCALE



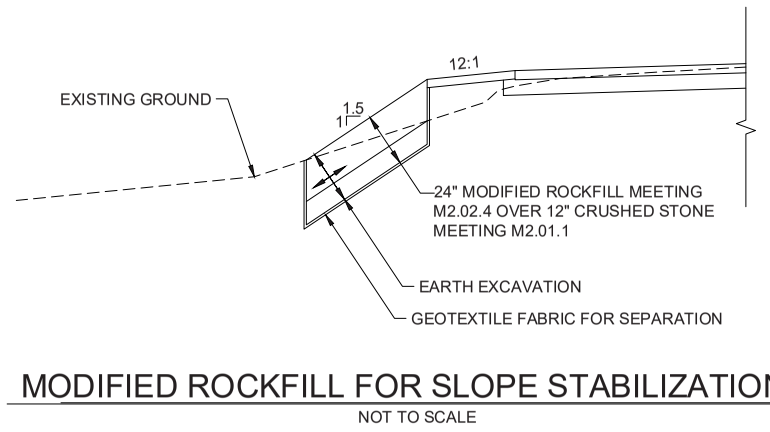
MAHW	STATION
42.4	329+85
37.1	346+20

TABLE 1

NOTES:

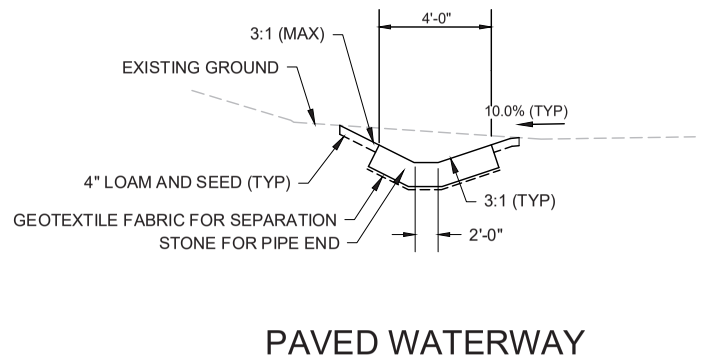
1. DRIVE REBAR INTO VOIDS BETWEEN RIP RAP.
2. HOLES SHALL EXTEND 12" BELOW RIP RAP INTO SUBGRADE OR GRANULAR FILL LAYER.
3. LIVE STAKES SHALL BE PLACED IN HOLES SO THAT THEY EXTEND 6" INTO SUBGRADE.
4. LIVE STAKES SHALL BE LOCATED APPROXIMATELY 3 FEET ON CENTER STARTING 6" ABOVE MEAN HIGH WATER.

LIVE STAKES PLANT LIST				
QTY	BOTANICAL NAME	COMMON NAME	PLANT SIZE	SPACING
100	CORNUS RACEMOSA	GREY DOGWOOD	4 FEET LENGTH	3' O.C
100	SALIX DISCOLOR	PUSSY WILLOW	4 FEET LENGTH	3' O.C
100	CORNUS SERICEA	REDOSIER DOGWOOD	4 FEET LENGTH	3' O.C



MODIFIED ROCKFILL FOR SLOPE STABILIZATION

NOT TO SCALE



PAVED WATERWAY

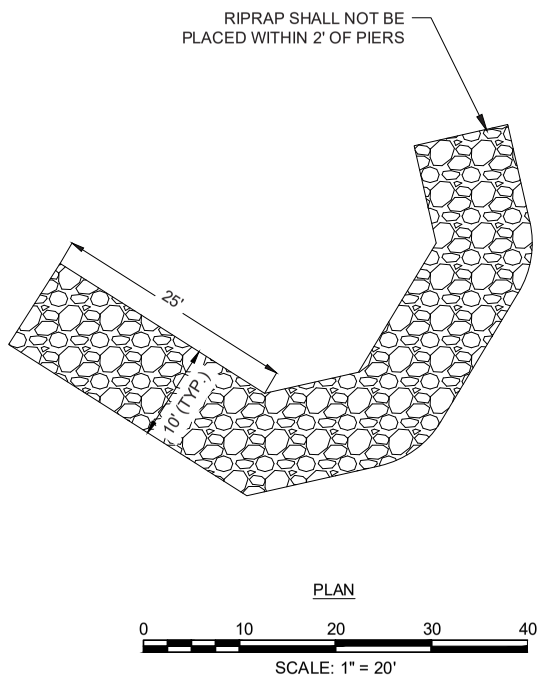
NOT TO SCALE

FHWA CLASS	LENGTH OF APRON L (FEET)	DEPTH OF APRON H (FEET)	WIDTH OF APRON (FEET)	MASSDOT RIPRAP SIZE	CULVERTS AT STATION
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	329+85
II	10.0	2.0	13.5	M2.02.3	340+10
II	8.0	2.0	11.0	M2.02.3	342+25
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	346+20
II	10.0	2.0	5.0	M2.02.3	358+51

SOURCE:
FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 23
MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES

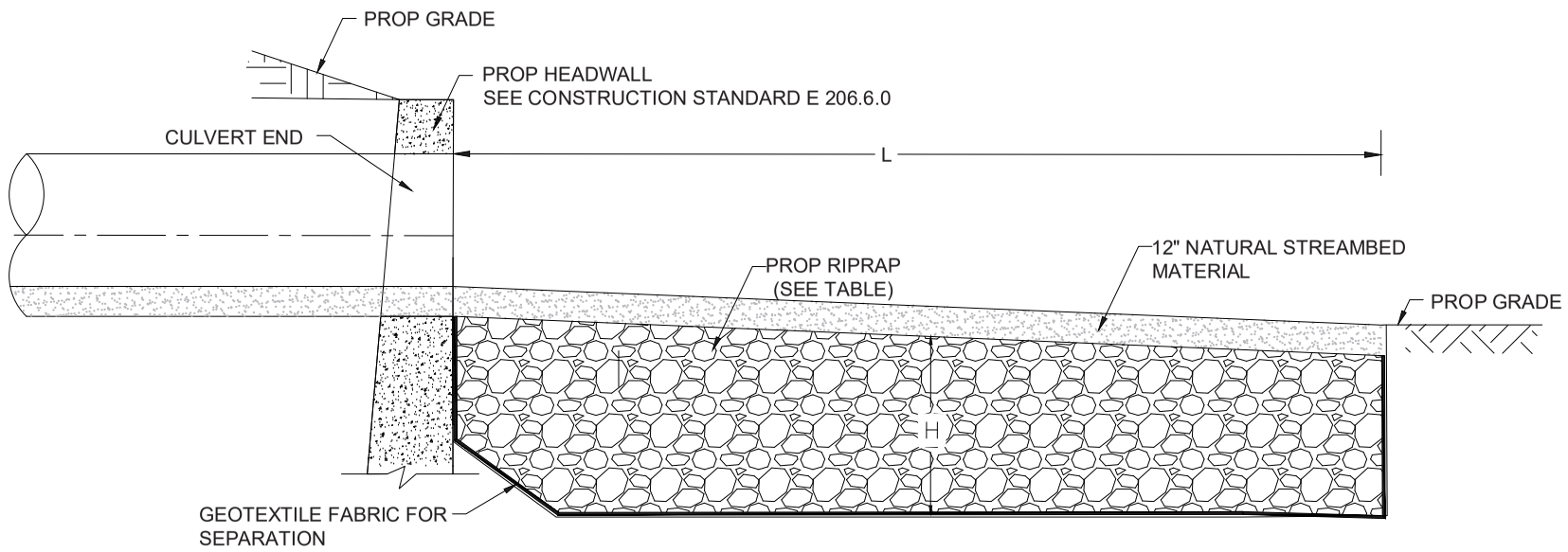
VEGETATED RIPRAP

NOT TO SCALE



ABUTMENT ARMORING RIPRAP PLAN

RIPRAP CLASSES AND APRON DIMENSIONS



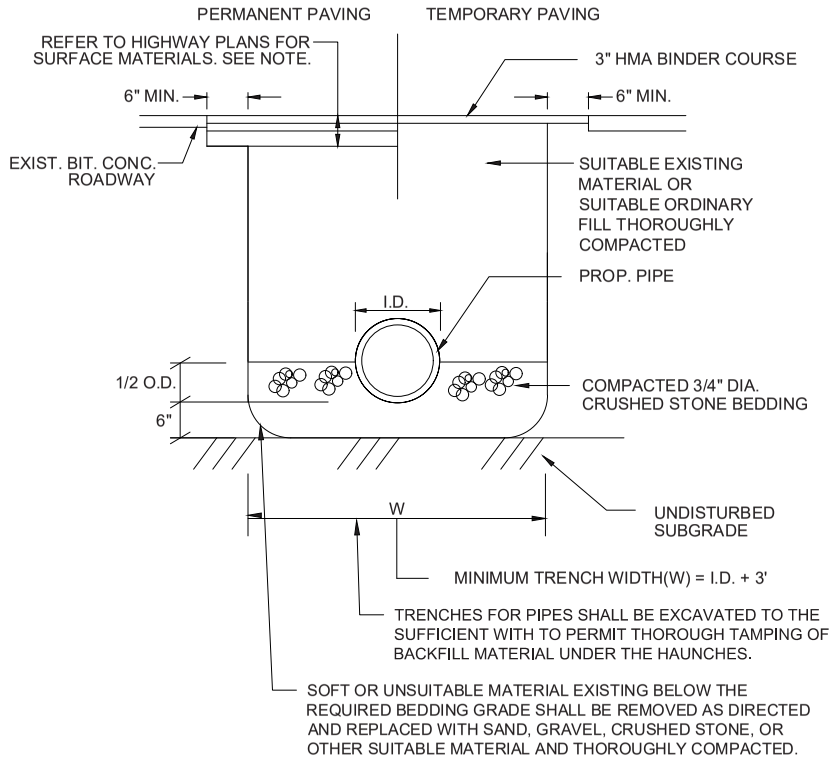
RIPRAP APRON AT INLETS AND OUTLETS OF CULVERTS

NOT TO SCALE

Proposal No. 609211-132091
A00829 - 519

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	42	142
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 3

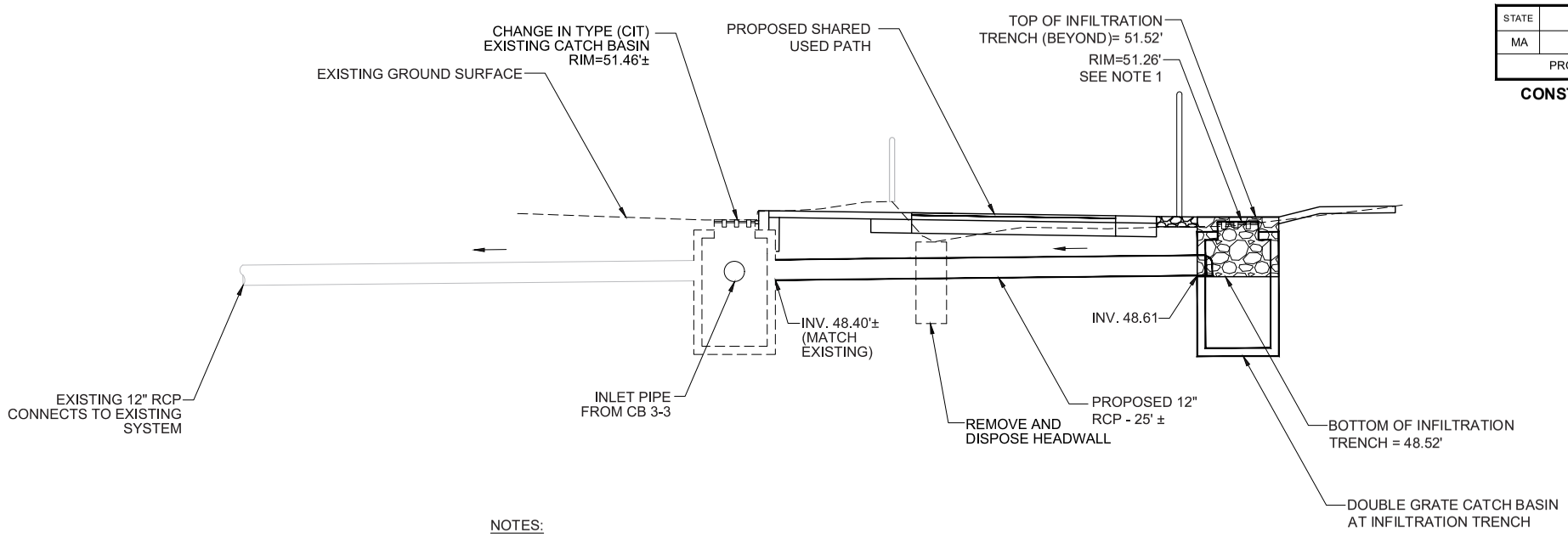


TYPICAL PIPE TRENCH

NOT TO SCALE

NOTE:

1. PERMANENT PAVING TO BE USED IN ALL AREAS OF MILL AND OVERLAY. MATERIALS SHALL MATCH CORRESPONDING FULL DEPTH SECTION. REFER TO TYPICAL ROADWAY SECTIONS.
2. HMA FOR PATCHING TO BE USED IN AREAS OF FUTURE FULL DEPTH CONSTRUCTION.
3. EXISTING MATERIAL OBTAINED FROM EXCAVATION THAT IS DETERMINED TO BE SUITABLE, AND APPROVED BY THE ENGINEER, OR SATISFACTORY BORROW SHALL BE USED. BACKFILL SHALL BE PLACED IN LAYERS NO MORE THAN 6 INCHES IN DEPTH AND THOROUGHLY COMPACTED. BACKFILLING TO A POINT 2 FEET OVER THE PIPE SHALL CONTAIN NO STONES LARGER THAN 3 INCHES.



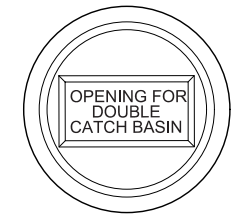
NOTES:

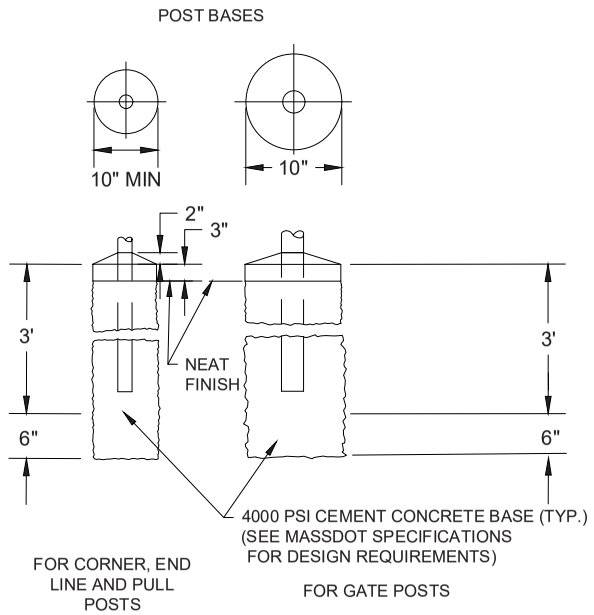
1. THE CRUSHED STONE SHALL BE PLACED AT A 3:1 SLOPE FROM THE GRATE TO THE TOP OF THE INFILTRATION TRENCH TO PREVENT DEBRIS FROM ENTERING THE GRATE

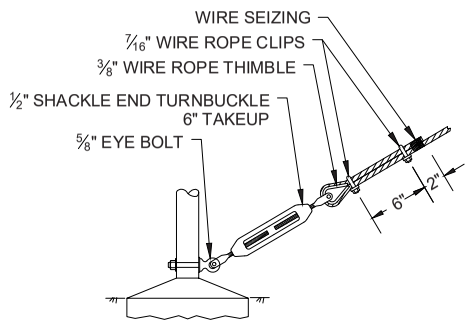
INFILTRATION TRENCH TO CULVERT DETAIL

SCALE: 1" = 8'

0 4 8 12 16





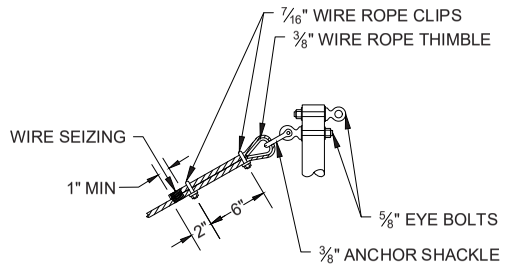


FOR FASTENING TO BASE OF POST

NOTE:

1. FOR EYE BOLT INSTALLATION THROUGH PIPE SECTIONS, USE 2 WASHERS ON "SHOULDER SIDE" AND 1 WASHER WITH LOCK WASHER ON "NUT SIDE" OF POSTS.

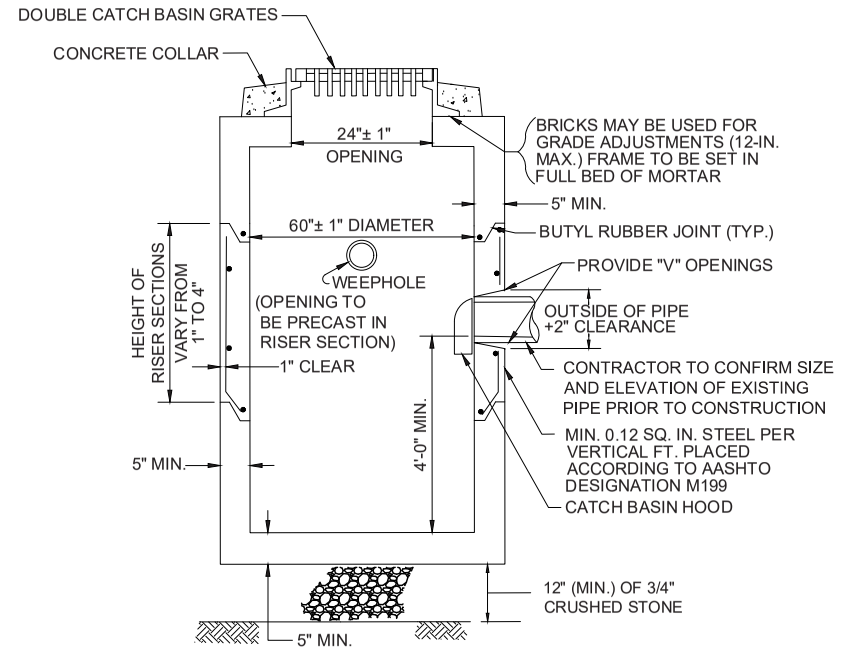
DETAILS OF CABLE ATTACHMENTS



FOR END PULL POST

CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS AND POST BASES

NOT TO SCALE



DOUBLE GRATE CATCH BASIN

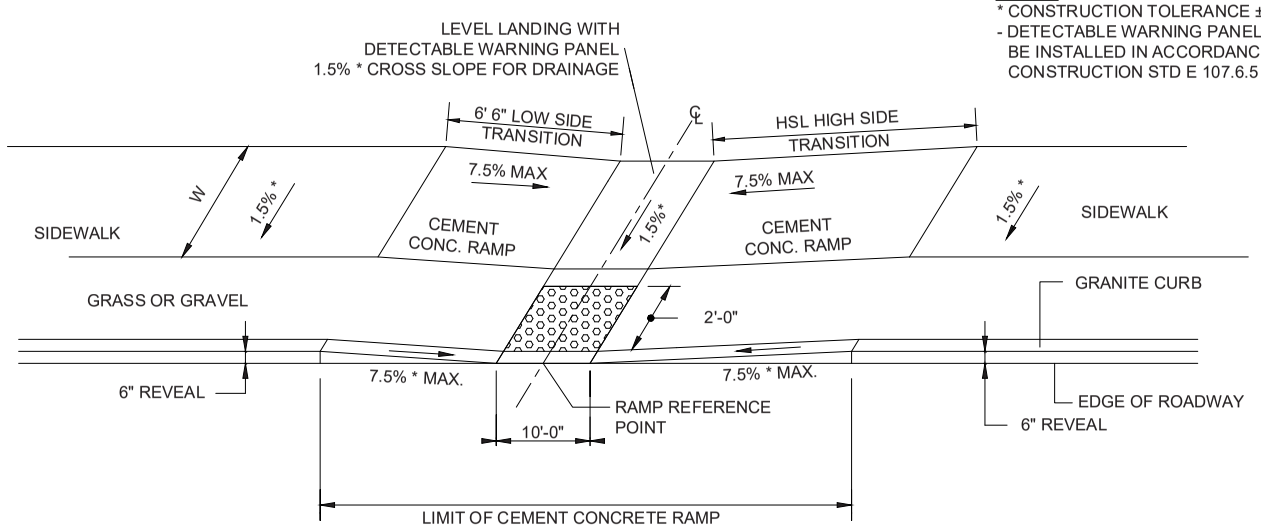
NOT TO SCALE

Proposal No. 609211-132091
A00829 - 520

Proposal No. 609211-132091

A00829 - 521

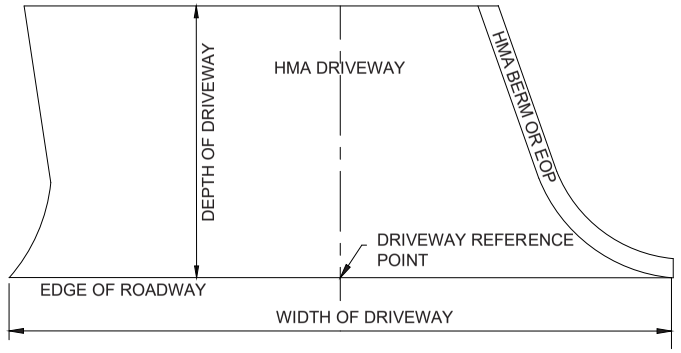
NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5



CURB CUT RAMP (NARROW SIDEWALK WITH GRASS STRIP)

NOT TO SCALE

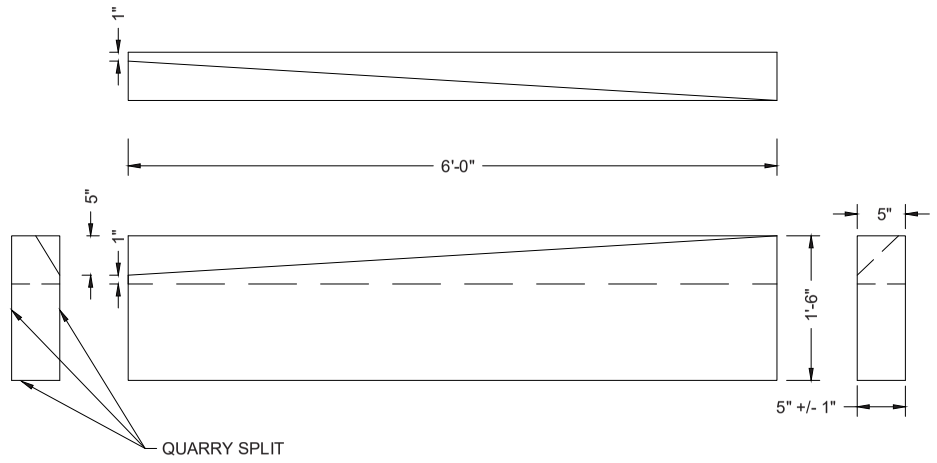
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		WIDTH OF RAMP (FT.)	WIDTH OF SIDEWALK (W) (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
5	NORTHSHORE RD	304+13	74.30 LT	5'-0"	5'-0"	+4.60	-	-
3	ESSEX CENTER DR	302+10	7.67 RT	10'-0"	10'-0"	-3.42	6'-6"	14'-0"
1	ESSEX CENTER DR	292+48.08	8.72 RT	10'-0"	10'-0"	-1.71	9'-0"	6'-6"

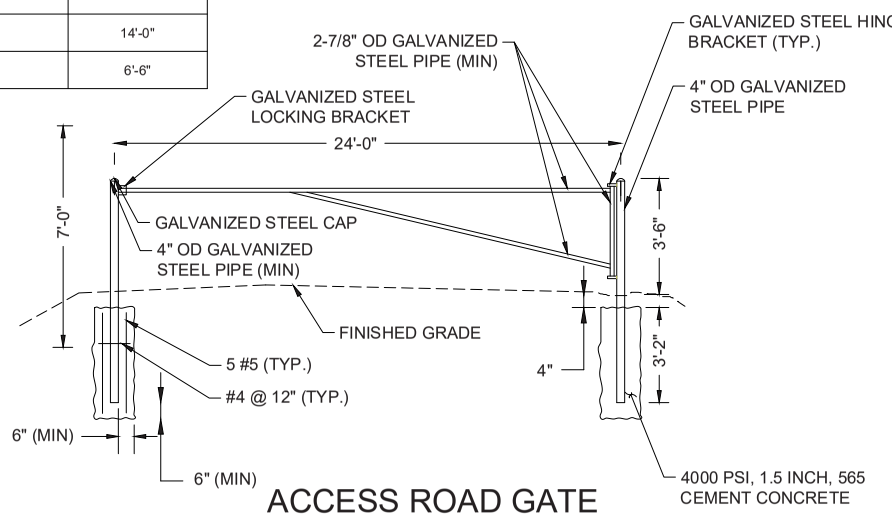


HMA DRIVEWAY WITHOUT SIDEWALK

NOT TO SCALE

CURB CUT DRIVEWAY DETAIL TABLE			
STATION	OFFSET	WIDTH OF DRIVEWAY	DEPTH OF DRIVEWAY
290+16.30	10.90 LT	31'-7"	10'-0"

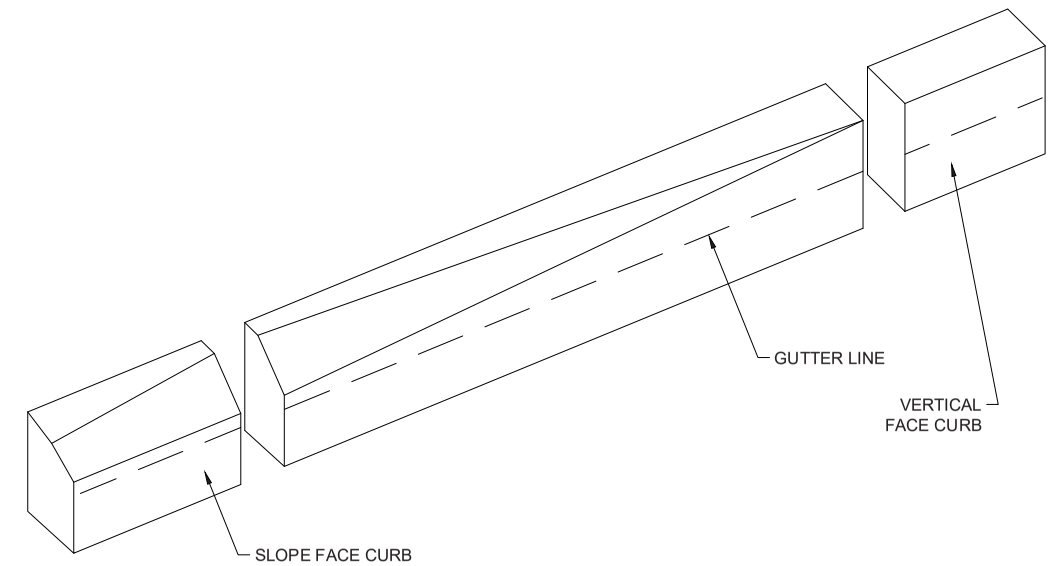




ACCESS ROAD GATE

NOT TO SCALE

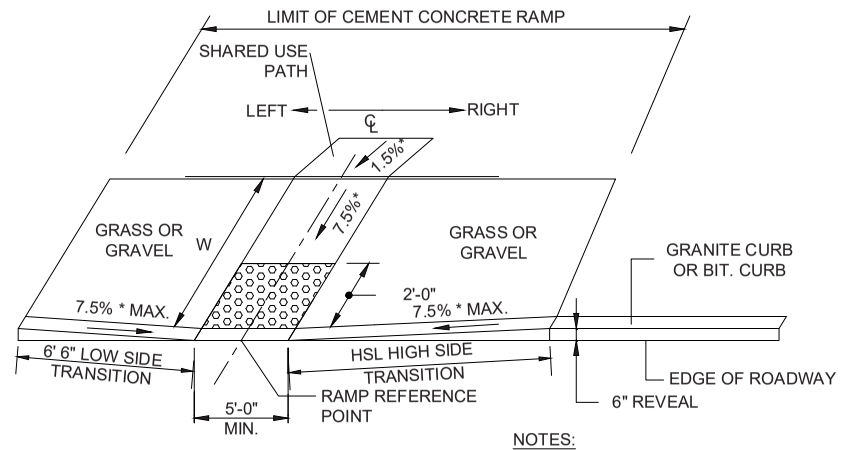
NOTE:
1. ALL GALVANIZED STEEL SHALL MEET GRADE B, Fy = 33,000 KSI AND SHALL BE IN ACCORDANCE WITH SUBSECTION 960.
2. THE GALVANIZED STEEL HINGE BRACKET AND GALVANIZED STEEL LOCKING BRACKET SHALL BE ¼" (MIN) COLD ROLLED GALVANIZED STEEL.
3. VENT HOLES SHALL BE INSTALLED IN GALVANIZED TUBES, PER MANUFACTURER'S RECOMMENDATIONS.
4. CONCRETE SHALL MEET THE REQUIREMENTS OF SUBSECTION 901 OF THE STANDARD SPECIFICATIONS.
5. STEEL REINFORCEMENT SHALL BE GRADE 60 REINFORCING LEVEL I.



GRANITE TRANSITION TYPE VB - SPLAYED END

NOT TO SCALE

NOTE:
1. TOP SURFACE AND SLOPED SURFACE TO BE DRESSED BY SAW. REMAINDER TO BE QUARRY SPLIT.
2. DETAIL SHOWS TRANSITION CURB FOR ONE DIRECTION. FOR OTHER DIRECTION USE OPPOSITE HAND.

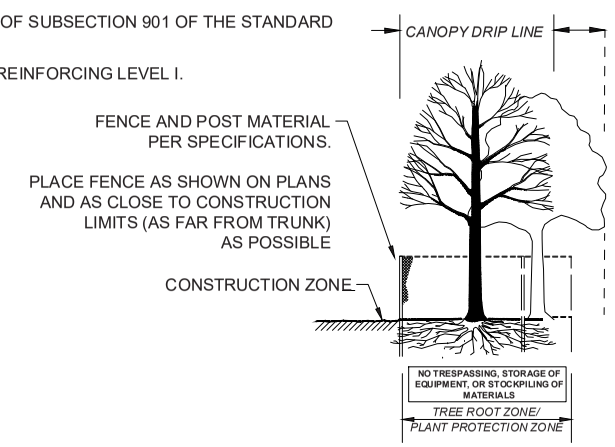


NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5
- PCR 9 LANDING TO BE CONSTRUCTED WITH HMA TO MATCH SHARED USE PATH
** TRANSITION LENGTHS FOR CURBS ONLY

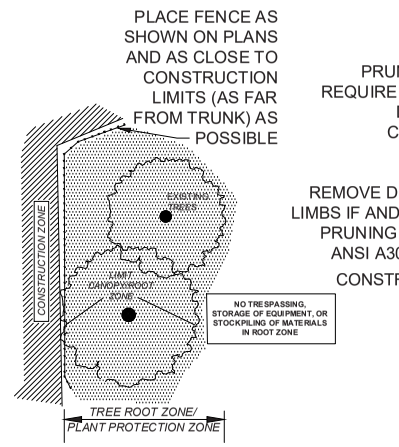
CORNER CURB CUT RAMP (ADJACENT TO SHARED USE PATH)

NOT TO SCALE

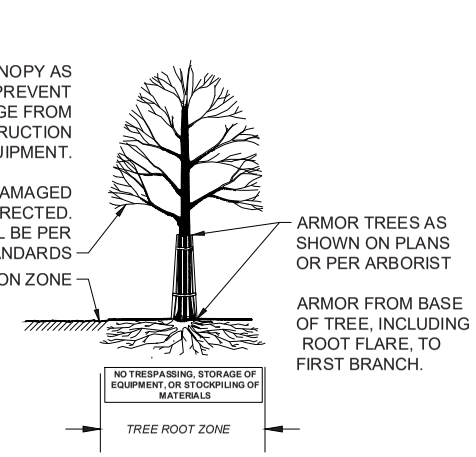
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		LENGTH OF RAMP (W) (FT.)	WIDTH OF RAMP (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
6	NORTHSHORE RD	304+19	5.00 RT	8'-0"	10'-0"	-0.86	7'-8"	6'-6"
8	NORTHSHORE RD	318+32	12.00 RT	9'-0"	10'-0"	+0.04	7'-8"	6'-6"
9	NORTHSHORE RD	318+45	0.00	4'-6"	10'-0"	-0.64	6'-6"***	7'-8"***



SECTION - FENCE PROTECTION OF ROOT ZONE



PLAN VIEW - FENCE PROTECTION OF ROOT ZONE



SECTION - TRUNK ARMORING & PRUNING

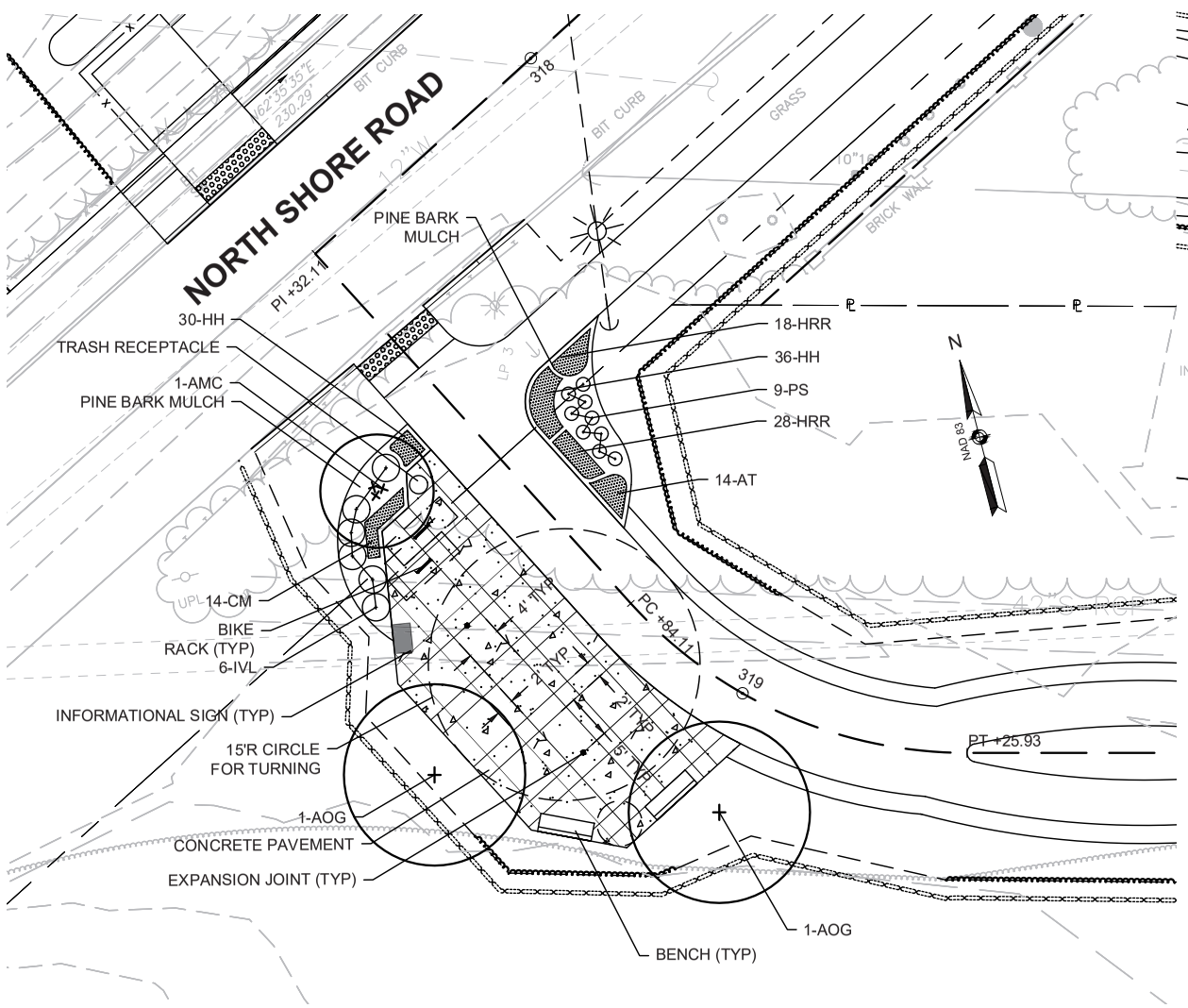
TREE PROTECTION DETAILS

NOT TO SCALE

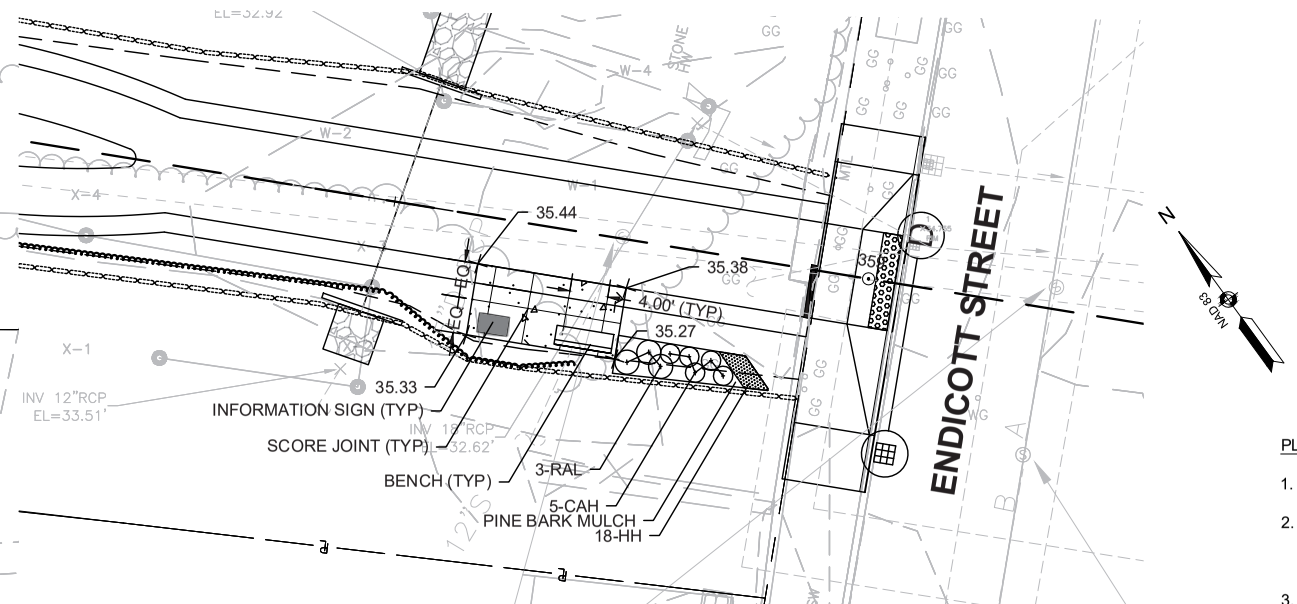
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	46	142
PROJECT FILE NO.	609211		

LANDSCAPE PLAN - 1



1 BLOW UP PLAN TRAILHEAD AT NORTHSHORE ROAD
SCALE 1" = 20'-0"



2 BLOW UP PLAN TRAILHEAD AT ENDICOTT STREET
SCALE 1" = 20'-0"

PLANTING NOTES

1. CONTRACTOR SHALL HAVE ALL SUBSURFACE UTILITIES MARKED PRIOR TO THE START OF WORK.
2. PLANT LOCATIONS ARE APPROXIMATE. PRIOR TO PLANTING, LOCATION OF ALL PLANT MATERIAL WILL BE APPROVED BY THE RESIDENT ENGINEER AND THE LANDSCAPE ARCHITECT.
3. ALL PLANT MATERIAL WILL HAVE TAGS INDICATING COMMON NAME, BOTANICAL NAME, CULTIVAR, & SIZE.
4. IMMEDIATELY AFTER ACCEPTANCE OF PLANTING, TAGS AND RIBBONS SHALL BE REMOVED.
5. ALL PLANTS WILL BE MULCHED PER PLANS AND SPECIFICATIONS.
6. ALL SHRUB AND PERENNIAL BEDS WILL BE WEEDED AND OTHERWISE NEATLY MAINTAINED FOR THE DURATION OF THE CONTRACT.
7. PLANTS AND PLANTING BEDS SHALL BE THOROUGHLY WATERED AS NECESSARY AND PER SPECIFICATIONS.

WATERING NOTES

1. IRRIGATION BAGS MAY BE USED FOR STREETSCAPE AND PARK PLANTINGS ONLY.
2. A SCHEDULE FOR FILLING AND REMOVAL SHALL BE SUBMITTED TO THE ENGINEER.
3. USE AND SCHEDULE MUST BE APPROVED BY THE MASSDOT LANDSCAPE ARCHITECT.
4. A MINIMUM OF 2 BAGS PER TREE SHALL BE USED. BAGS SHALL BE ATTACHED TO STAKES.
5. NO BAGS SHALL BE PLACED AROUND THE TREE TRUNK.
6. BAGS SHALL BE MAINTAINED FULL JUNE 1 - OCTOBER 1 OR AS APPROVED.
7. BAGS SHALL BE REMOVED AT THE END OF THE SEASON.

PLANT LIST - LANDSCAPE PLAN 1

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIER X GRANDIFLORA	'AUTUMN BRILLIANCE' SERVICEBERRY	4-5 FEET CLUMP	B&B	
ACO	2	ACER RUBRUM 'OCTOBER GLORY'	'OCTOBER GLORY' RED MAPLE	2-2 1/2" CAL	B&B	
		DECIDUOUS SHRUBS				
ML	6	ITEA VIRGINIANA 'SPRICHT' LITTLE HENRY	'LITTLE HENRY' SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAH	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	'HUMMINGBIRD' SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	'GRO-LOW' SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	14	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	ICE DANCE SEDGE	#1 CONT		12" O.C.
HH	84	HEMEROCALLIS 'HAPPY RETURNS'	'HAPPY RETURNS' DAYLILY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS 'ROSY RETURNS'	'ROSY RETURNS' DAYLILY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANDOAH'	'SHENANDOAH' SWITCH GRASS	#2 CONT		18" O.C.

0 10 20 30 40
SCALE: 1" = 20'

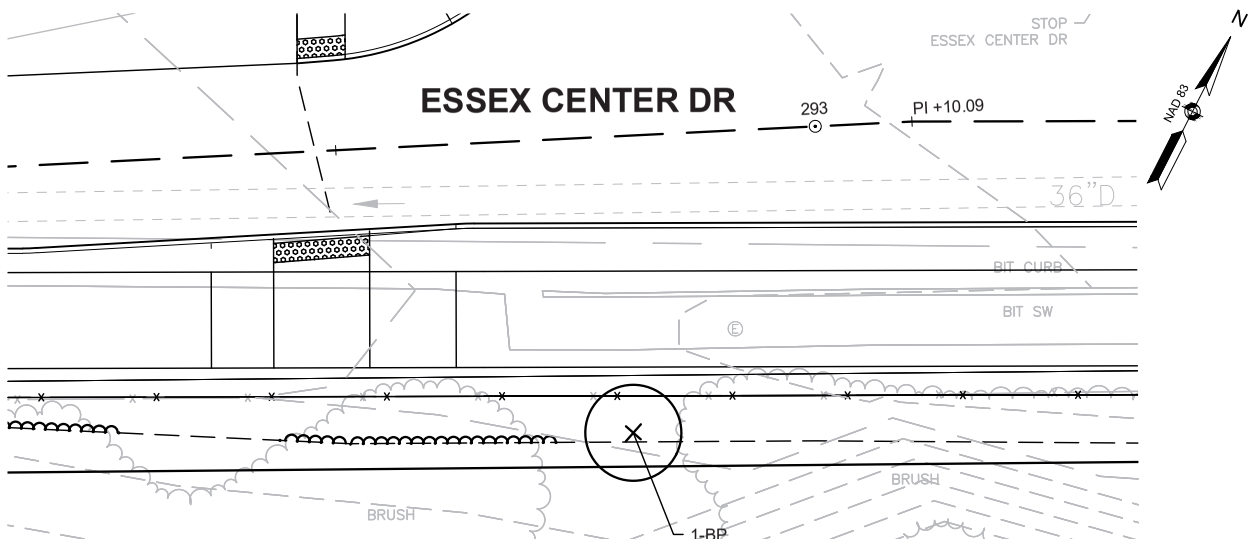
WQC/ACOE PLAN SHEET 44 OF 63

Proposal No. 609211-132091

A00820829 - 522

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	47	142
PROJECT FILE NO.	609211		

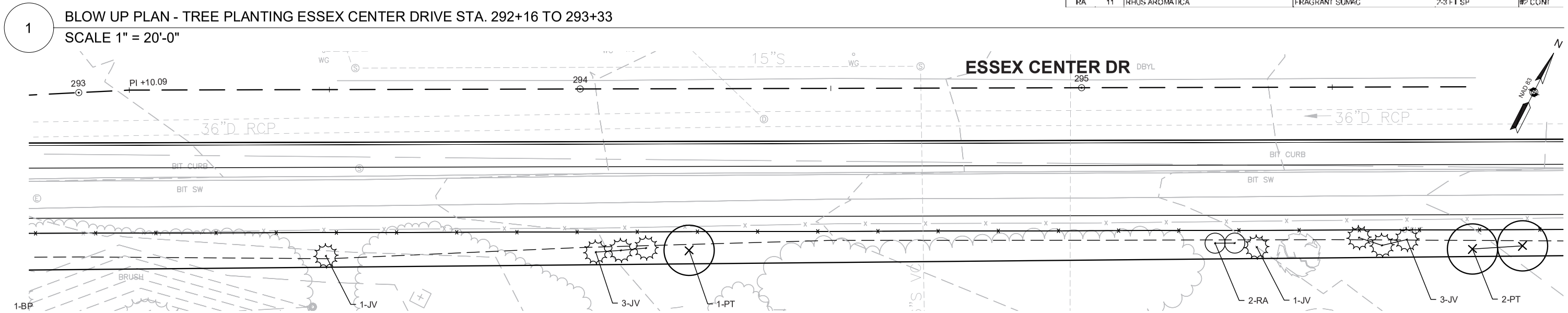
LANDSCAPE PLAN - 2



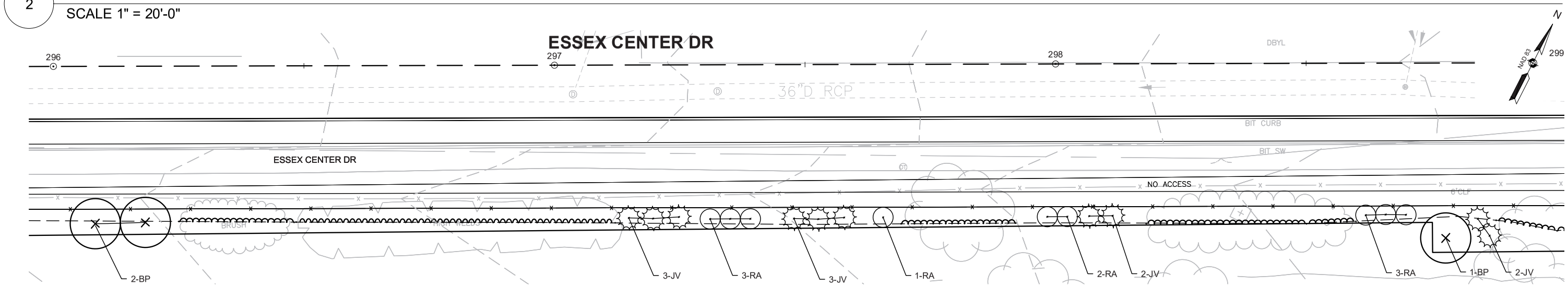
1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 292+16 TO 293+33
SCALE 1" = 20'-0"

PLANT LIST - LANDSCAPE PLAN 2

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	4	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#5 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	18	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT
		DECIDUOUS SHRUBS			
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 292+80 TO 296+00
SCALE 1" = 20'-0"



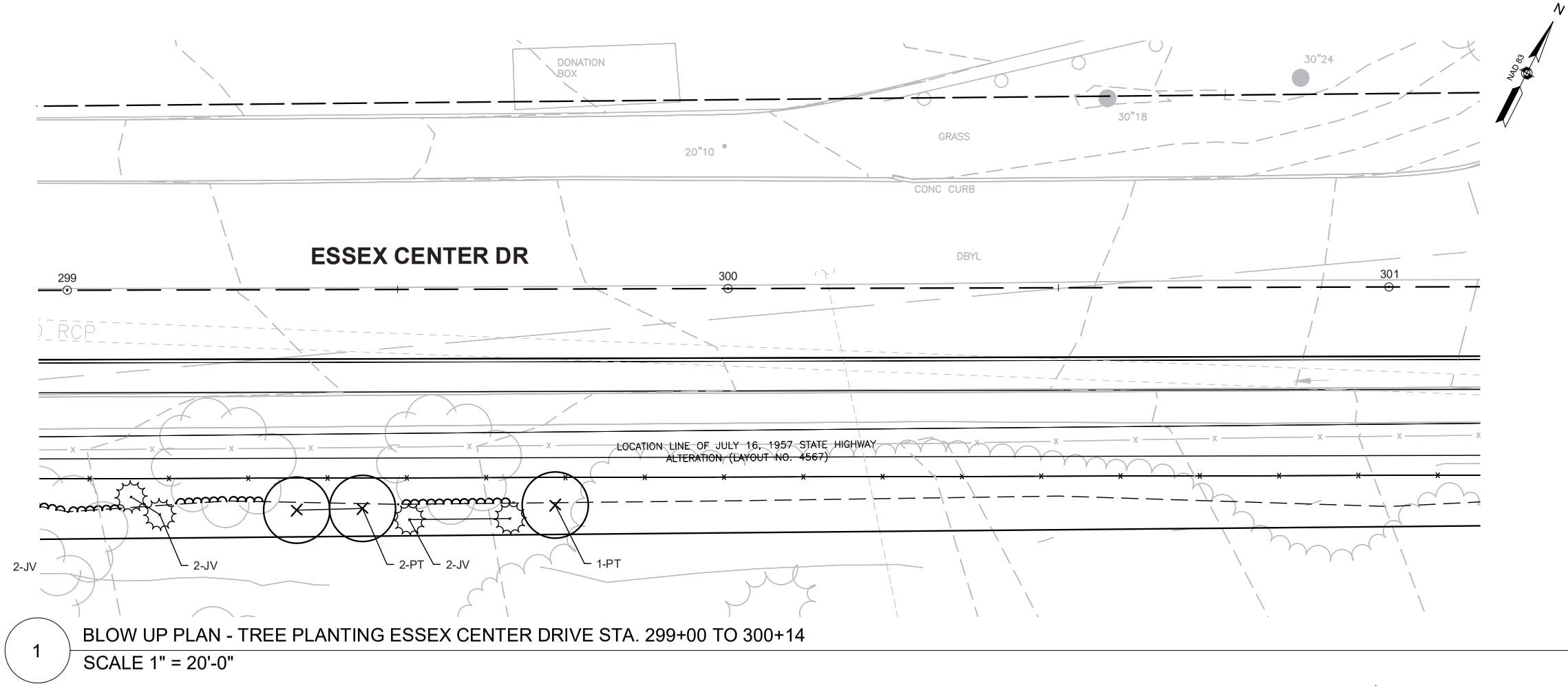
3 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 296+00 TO 299+00
SCALE 1" = 20'-0"

0 10 20 30 40
SCALE: 1" = 20'

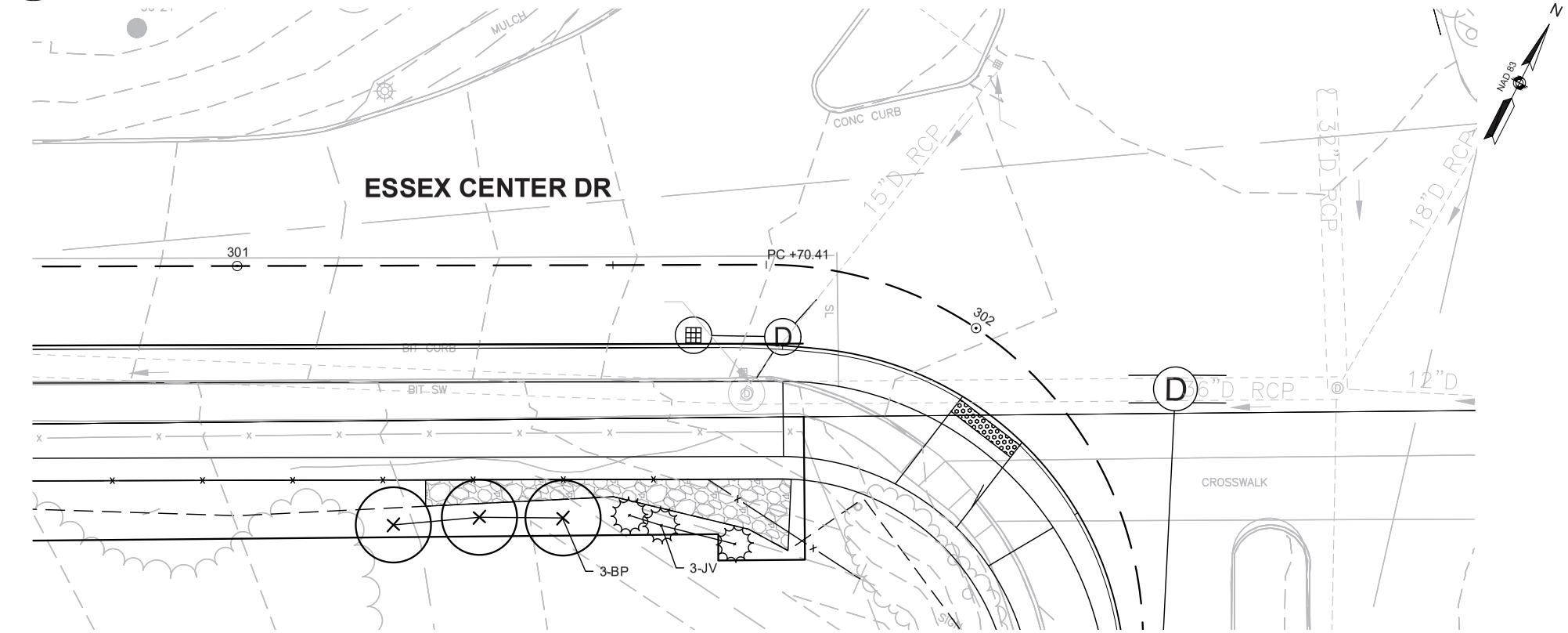
WQC/ACOE PLAN SHEET 45 OF 63

NOTE: SEE LANDSCAPE PLAN SHEET 1 FOR PLANT LIST

Proposal No. 609211-132091
A00820 - 523



1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 299+00 TO 300+14
SCALE 1" = 20'-0"



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 300+78 TO 301+97
SCALE 1" = 20'-0"

PLANT LIST - LANDSCAPE PLAN 3

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	3	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	7	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT

PLANT LIST - UPLAND PROJECT TOTAL

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIER X GRANDIFLORA	AUTUMN BRILLIANCE SERVICEBERRY	4-5 FEET CLUMP	B&B	
AOG	2	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	2-2 1/2" CAL	B&B	
BP	7	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT	
PT	6	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT	
		EVERGEEN TREES				
JV	25	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT	
		DECIDUOUS SHRUBS				
ML	6	ITEA VIRGINIANA 'SPRICH' LITTLE HENRY	'LITTLE HENRY' SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAI	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	'HUMMINGBIRD' SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	'GRO-LOW' SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT	3' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	11	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	ICE DANCE SEDGE	#1 CONT		12" O.C.
HH	94	HEMEROCALLIS 'HAPPY RETURNS'	'HAPPY RETURNS' DAY LILLY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS 'ROSY RETURNS'	'ROSY RETURNS' DAY LILLY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANDOAH'	'SHENANDOAH' SWITCH GRASS	#2 CONT		18" O.C.

0 10 20 30 40
SCALE: 1" = 20'

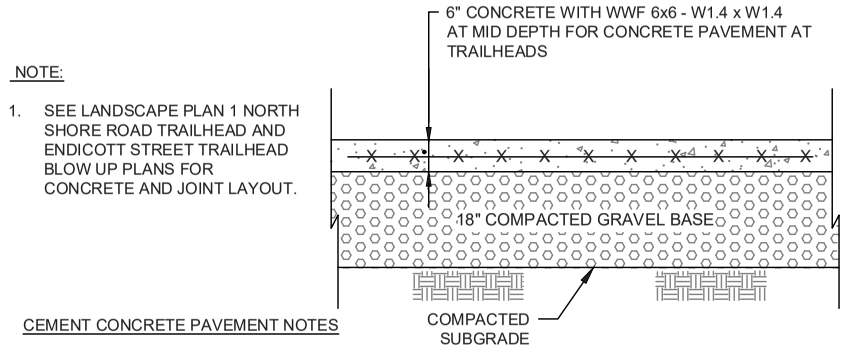
Proposal No. 609211-132091
A00829 - 524

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	49	142
PROJECT FILE NO.	609211		

LANDSCAPE DETAILS - 1

Proposal No. 609211-132091

A00829 - 525



NOTE:

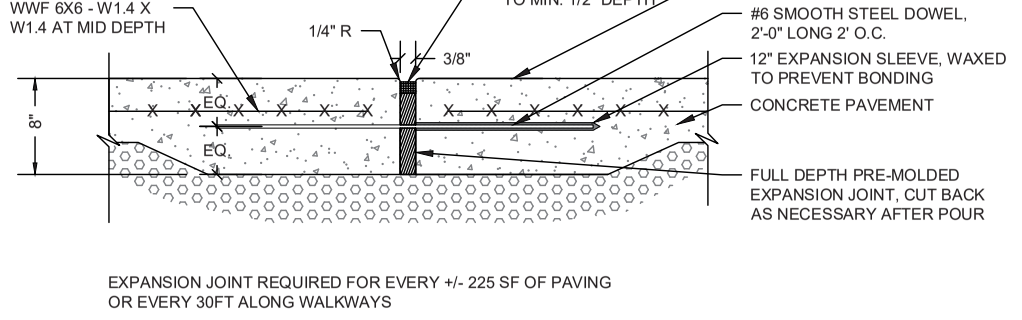
1. SEE LANDSCAPE PLAN 1 NORTH SHORE ROAD TRAILHEAD AND ENDICOTT STREET TRAILHEAD BLOW UP PLANS FOR CONCRETE AND JOINT LAYOUT.

CEMENT CONCRETE PAVEMENT NOTES

1. CEMENT CONCRETE PAVEMENT SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI WITH 6% AIR-ENTRAINMENT AND MINIMUM CEMENT CONTENT OF 610 LBS/C.Y.
2. CONTRACTOR SHALL SUBMIT CONCRETE JOINT LAYOUT PLAN FOR APPROVAL. EXPANSION JOINTS SHALL BE TRANSVERSE PREFORMED EXPANSION JOINT FILLER (AASHTO M-213-65) ½ IN. THICKNESS.
3. PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED ADJACENT TO OR AROUND EXISTING STRUCTURES AND WALKWAYS.
4. EXPANSION JOINTS SHALL BE CONSTRUCTED WITH DOWELS, AS INDICATED IN DETAIL 2 LANDSCAPE DETAIL SHEET 1.
5. AFTER CONSOLIDATION, CONCRETE DEPTH SHALL BE 6 INCHES IN DEPTH FOR TRAILHEADS.
6. ENSURE THAT NO BLED WATER OR WATER SHEEN EXISTS ON THE SURFACE OF THE CONCRETE AND THAT CONCRETE HAS STARTED TO STIFFEN BEFORE ANY FINISHING OPERATIONS ARE PERFORMED.
7. AFTER TROWELING, SURFACE SHALL BE BRUSHED BY DRAWING A SOFT-BRISTLED PUSHBROOM WITH A LONG HANDLE OVER THE SURFACE OF THE CONCRETE TO PRODUCE A NON-SLIP SURFACE.
8. THE FINISHING OF CONCRETE SURFACE SHALL BE DONE BY EXPERIENCED AND COMPETENT CEMENT CONCRETE FINISHERS.
9. FINISHING SHALL BE BROOM FINISH.
10. SAW CUT CONTROL JOINTS.
11. WHEN COMPLETED, CONCRETE SHALL BE KEPT MOIST AND PROTECTED FROM TRAFFIC AND WEATHER FOR AT LEAST 3 DAYS.
12. WELDED WIRE MESH SHALL BE 6"x6" No. 10 GAUGE AND SHALL BE SHEET MESH ONLY NOT ROLLED. MESH SHALL REST ON CONCRETE BLOCKS AND BE INSTALLED AT MID DEPTH IN CONCRETE.

1 CEMENT CONCRETE PAVEMENT AT TRAILHEADS

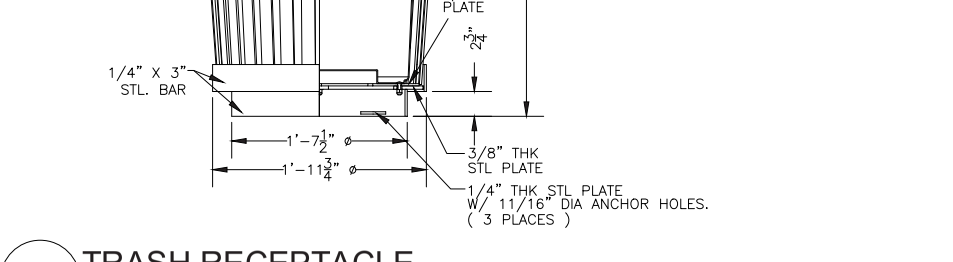
SCALE: N.T.S.



EXPANSION JOINT REQUIRED FOR EVERY +/- 225 SF OF PAVING OR EVERY 30FT ALONG WALKWAYS

EXPANSION JOINT NOTES:

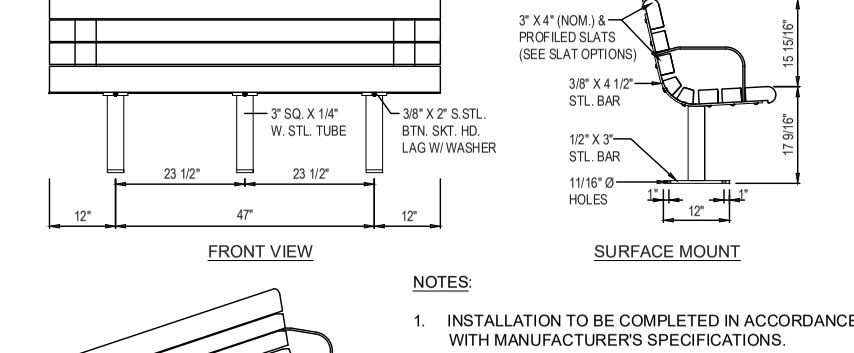
1. DOWEL IS TYPICAL AT ALL EXPANSION JOINTS EXCEPT AGAINST VERTICAL JOINTS WITH WALLS, CURBS OR SITE IMPROVEMENTS.



SAWCUT CONTROL JOINT REQUIRED FOR EVERY 36 SF OF PAVING.

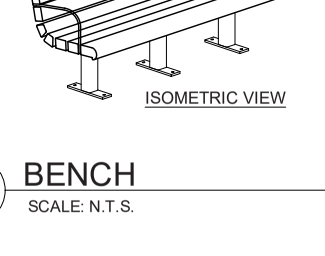
2 CONCRETE PAVEMENT JOINTS AT TRAILHEADS

SCALE: N.T.S.



FRONT VIEW

SURFACE MOUNT



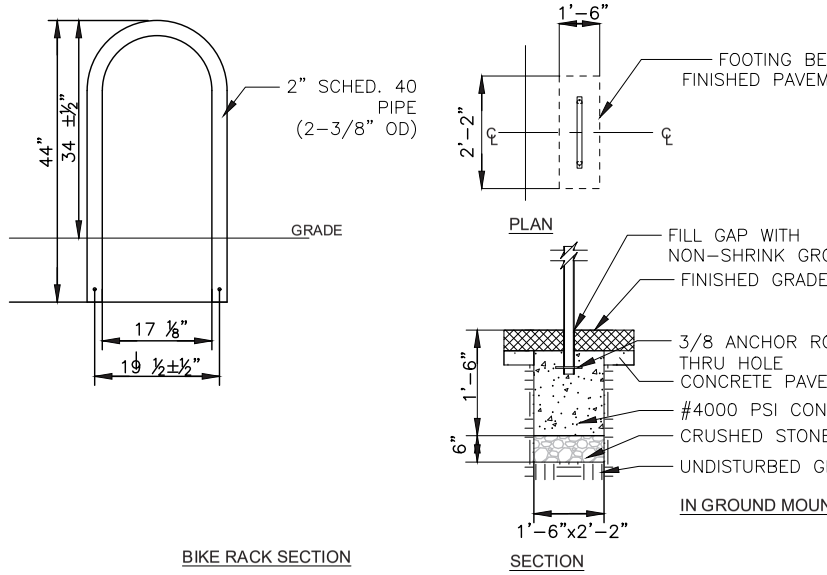
ISOMETRIC VIEW

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DRAWING NOT TO SCALE.
3. ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/POLYESTER POWDER COATING.
4. ½" x 3 ¾" EXPANSION ANCHOR BOLT 6 PER BENCH.
5. SUBMIT SHOP DRAWING FOR APPROVAL.
6. BENCH SHALL HAVE ARMREST ON BOTH ENDS.

3 BENCH

SCALE: N.T.S.



BIKE RACK SECTION

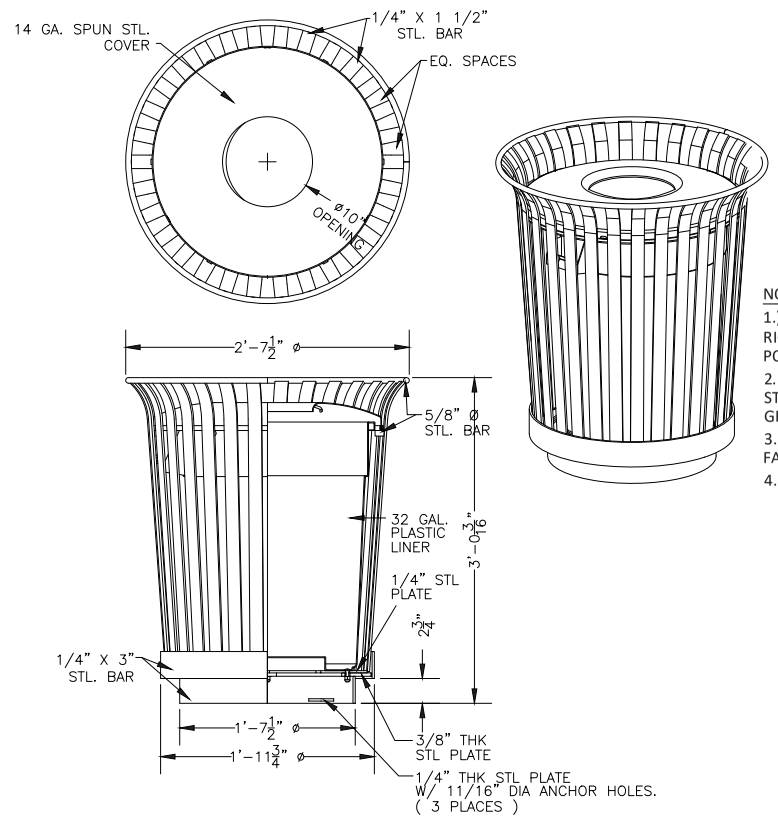
SECTION

NOTES:

1. INSTALL BIKE RACKS ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
2. SUBMIT SHOP DRAWING FOR APPROVAL.

4 BIKE RACK

SCALE: N.T.S.



NOTES:

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.

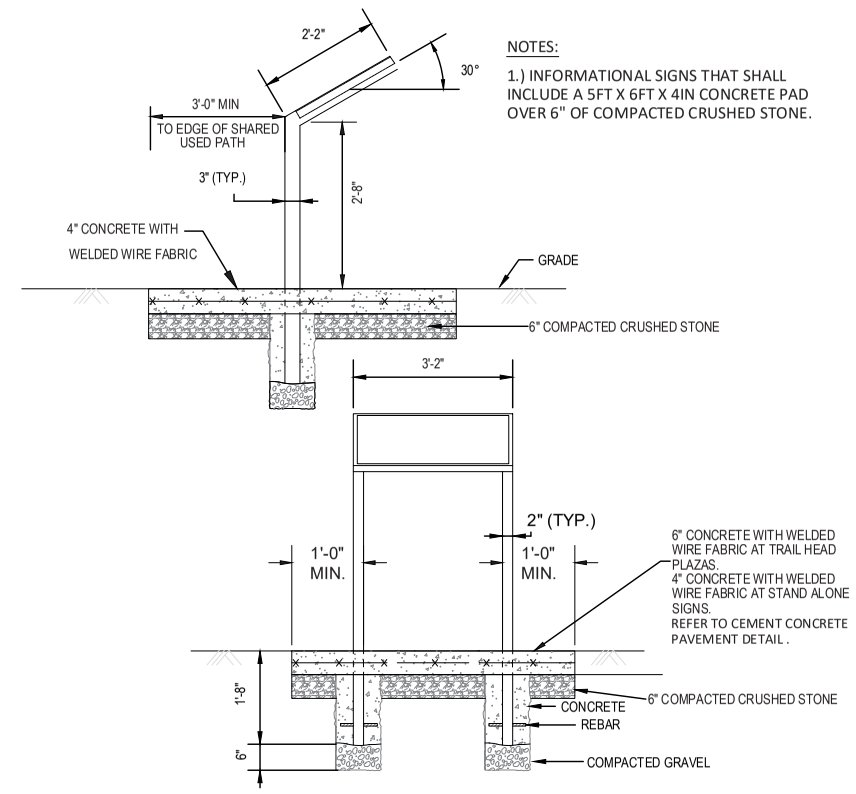
2.) ANCHOR BOLTS SHALL BE STAINLESS STEEL AND EXTENDED 3" BELOW FINISH GRADE.

3.) RECEPTACLE FULLY ASSEMBLED AT FACTORY.

4.) PROVIDE CABLE ATTACHMENT FOR LID

5 TRASH RECEPTACLE

SCALE: N.T.S.



NOTES:

1.) INFORMATIONAL SIGNS THAT SHALL INCLUDE A 5FT X 6FT X 4IN CONCRETE PAD OVER 6" OF COMPACTED CRUSHED STONE.

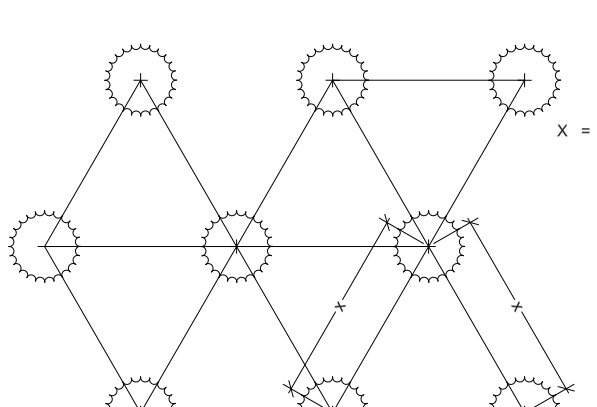
6 INFORMATIONAL SIGN

SCALE: N.T.S.

SIGN GRAPHIC CONTENT TO BE PROVIDED AND INSTALLED BY OTHERS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	50	142
PROJECT FILE NO.	609211		

LANDSCAPE DETAILS - 2

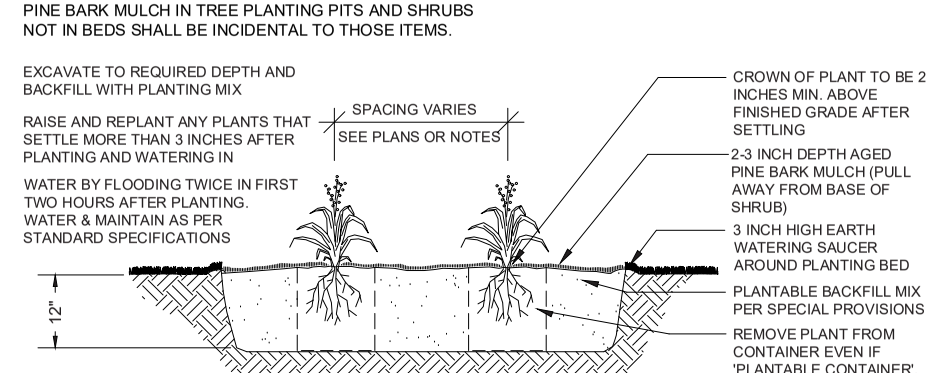


1 SHRUB, PERENNIAL AND ORNAMENTAL GRASS SPACING PLAN DETAIL

SCALE: N.T.S.

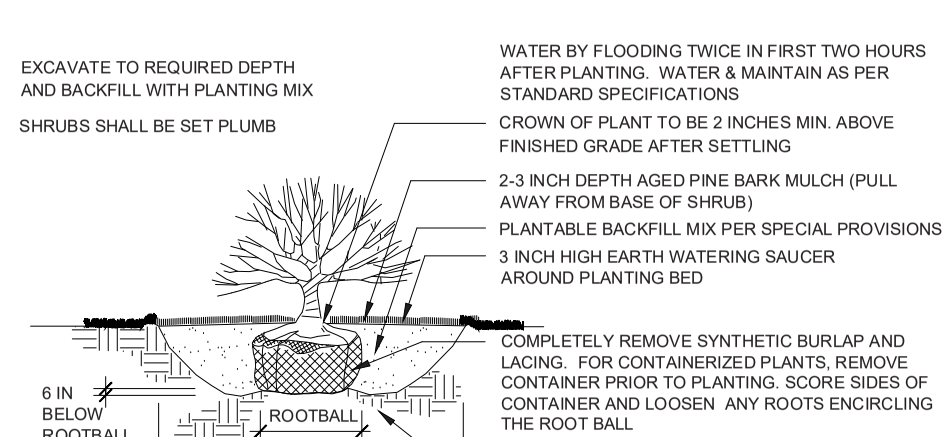
NOTE:

PINE BARK MULCH IN PERENNIAL AND SHRUB PLANTING BEDS SHALL BE PAID FOR IN PINE BARK MULCH ITEM. PINE BARK MULCH IN TREE PLANTING PITS AND SHRUBS NOT IN BEDS SHALL BE INCIDENTAL TO THOSE ITEMS.



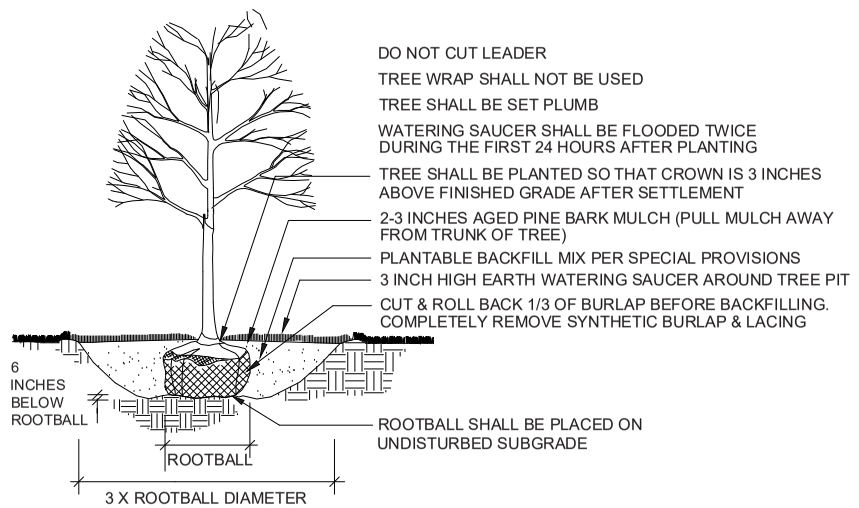
2 PERENNIAL AND ORNAMENTAL GRASS PLANTING

SCALE: N.T.S.



3 SHRUB PLANTING

SCALE: N.T.S.

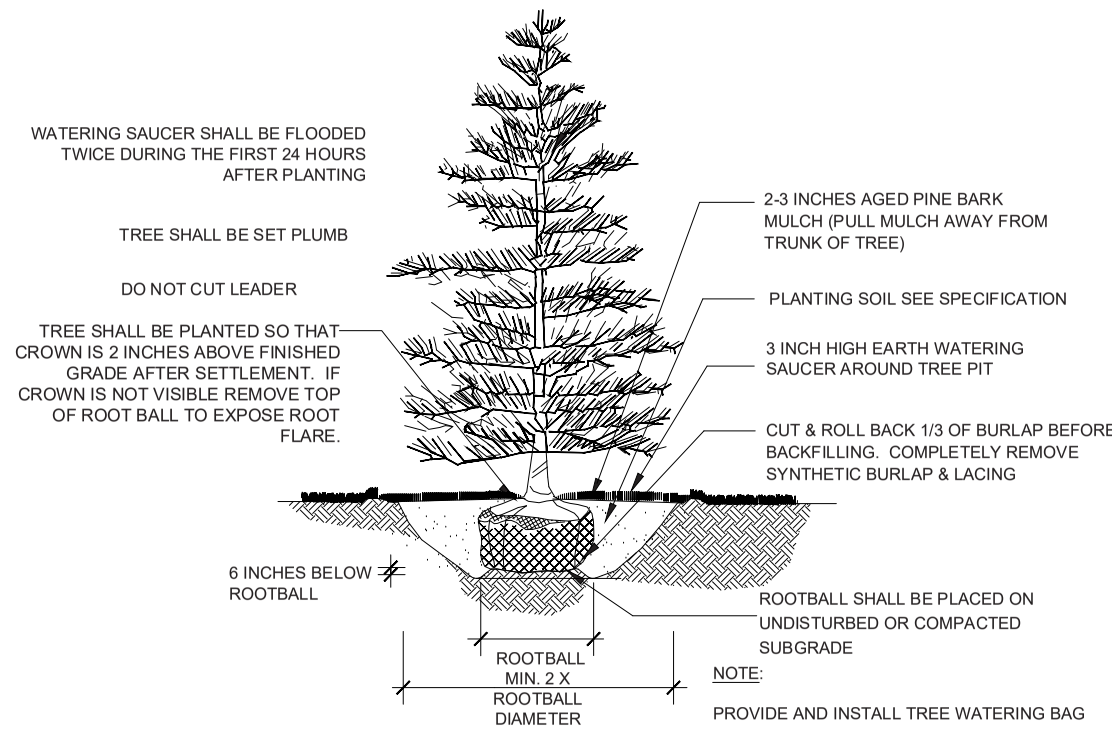


NOTE:

TREE TRUNK GUARDS SHALL BE INSTALLED AT ALL TREES. SEE SPECIAL PROVISION.

4 TREE PLANTING

SCALE: N.T.S.



NOTE:

PROVIDE AND INSTALL TREE WATERING BAG

5 EVERGREEN TREE PLANTING

SCALE: N.T.S.

Proposal No. 609211-132091
A00820 - 526

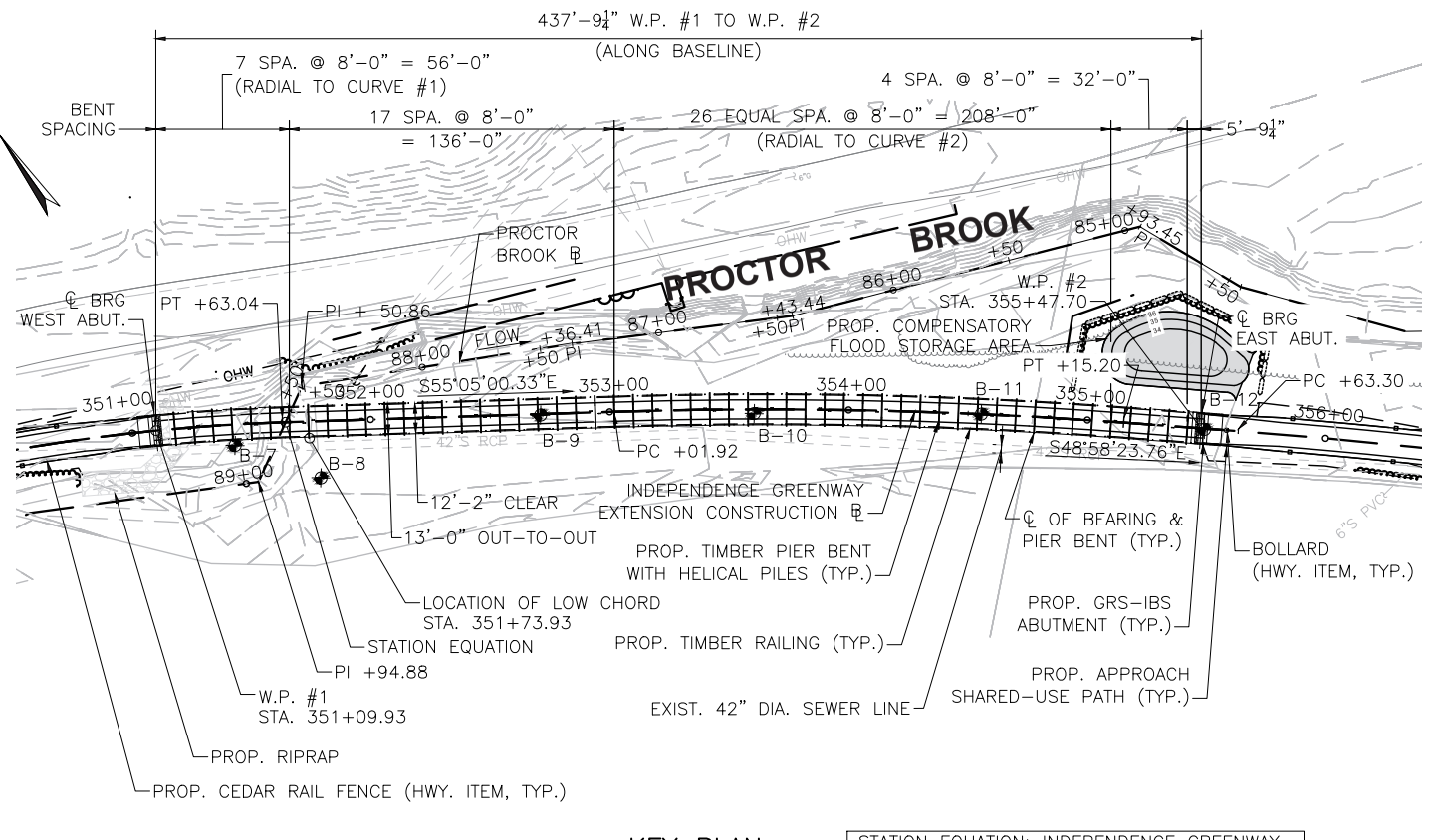
Proposal No. 609211-132091

A00829 - 527

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	#	60	142
PROJECT FILE NO.	609211		

KEY PLAN PROFILE AND LOCUS



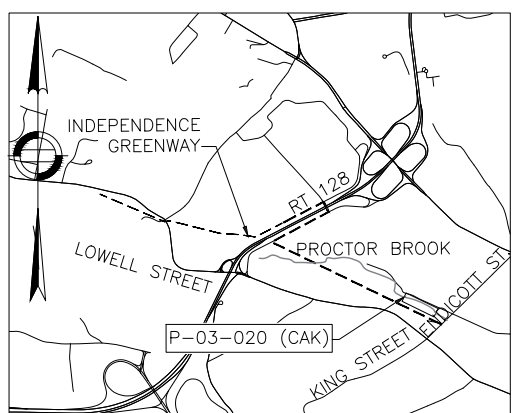
KEY PLAN

SCALE: 1" = 80'

40 0 40 80

SCALE IN FEET

STATION EQUATION: INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄ STA. 351+64.36 = PROCTOR BROOK ℄ STA. 88+67.46



LOCUS

1" = 2000'

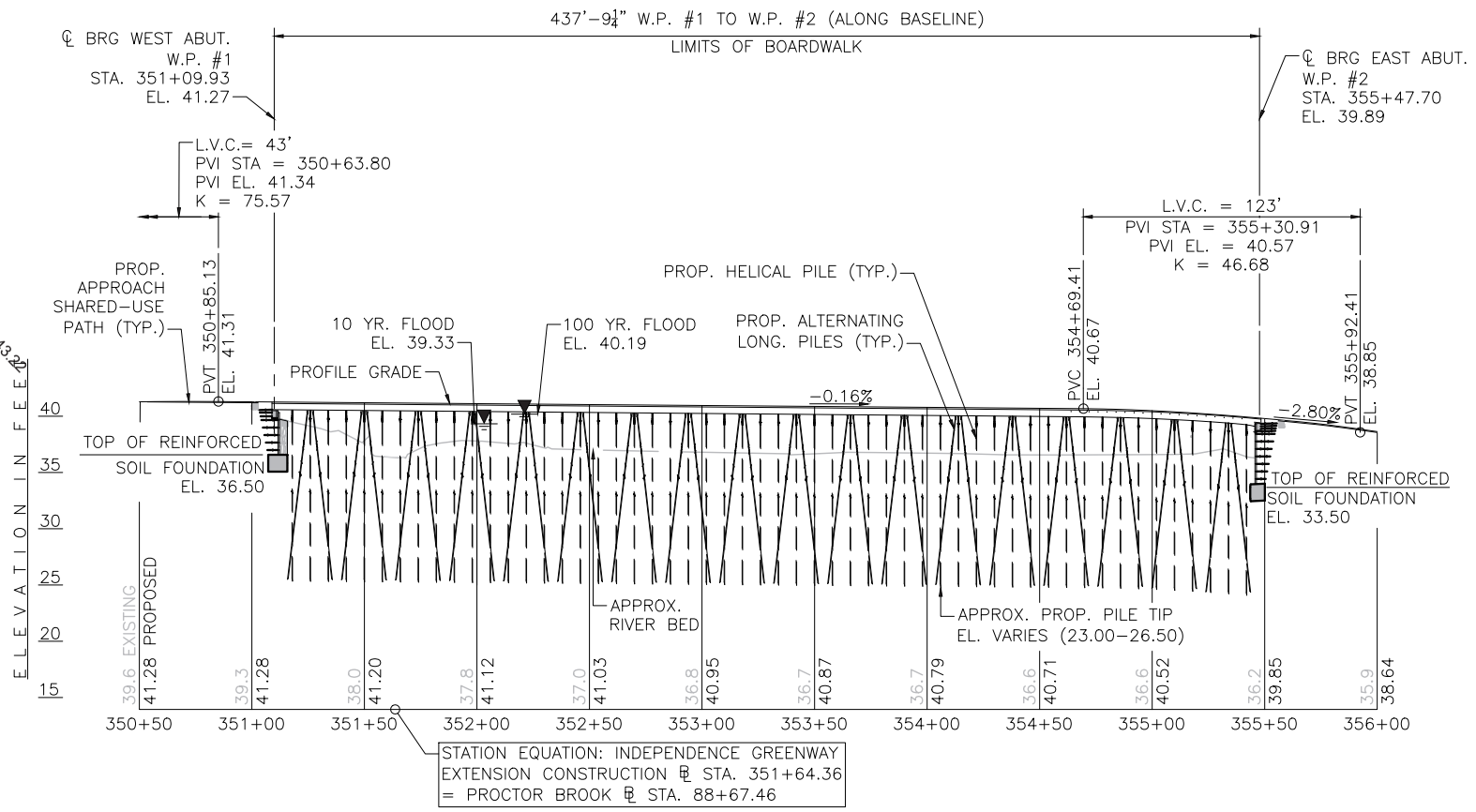
HORIZONTAL CURVE #1 DATA
PC = 349+89.58
PT = 351+63.04
Δ = 12°-25'-23"
R = 800.00'
L = 173.46'
T = 87.07'
HORIZONTAL CURVE #2 DATA
PC = 353+01.92
PT = 355+15.20
Δ = 6°-06'-37"
R = 2000.00'
L = 213.28'
T = 106.74'

ESTIMATED QUANTITIES
(NOT GUARANTEED)

BRIDGE EXCAVATION	40 CY
TEST PIT FOR EXPLORATION	19 CY
CLASS B ROCK EXCAVATION	5 CY
CRUSHED STONE FOR BRIDGE FOUNDATIONS	15 TON
GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL	55 SY
HELICAL PILE AND BRACKET ASSEMBLY	3700 FT
PRE-DRILLING FOR PILE OBSTRUCTIONS	80 FT
HELICAL PILE VERIFICATION LOAD TEST	3 EA
RIPRAP	145 TON
NATURAL STREAMBED MATERIAL	75 SY
CONTROL OF WATER - STRUCTURE NO. P-03-020	1 LS
BRIDGE STRUCTURE, BRIDGE NO. P-03-020 (CAK)	1 LS

INDEX OF DRAWINGS

TITLE	SHEET NO.
KEY PLAN PROFILE AND LOCUS	1
GENERAL NOTES	2
BORING LOGS 1 OF 3	3
BORING LOGS 2 OF 3	4
BORING LOGS 3 OF 3	5
GENERAL PLAN AND ELEVATION 1 OF 2	6
GENERAL PLAN AND ELEVATION 2 OF 2	7
HELICAL PILE LAYOUT PLAN 1 OF 2	8
HELICAL PILE LAYOUT PLAN 2 OF 2	9
HELICAL PILE LAYOUT TABLE	10
HELICAL PILE DETAILS	11
WEST ABUTMENT PLAN AND ELEVATION	12
EAST ABUTMENT PLAN AND ELEVATION	13
FRAMING PLAN 1 OF 2	14
FRAMING PLAN 2 OF 2	15
TYPICAL SECTION AND TIMBER CONNECTION DETAILS	16
CONNECTION DETAILS	17

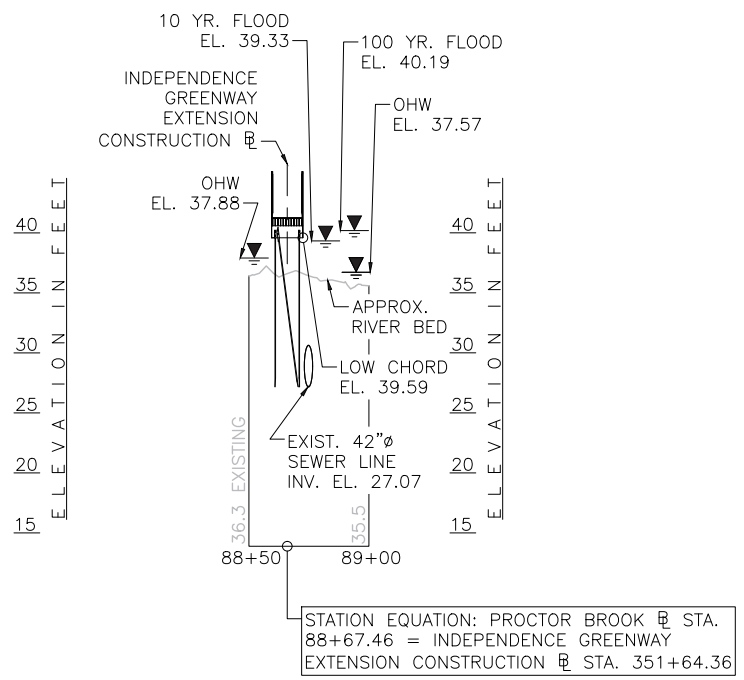


PROFILE-INDEPENDENCE GREENWAY EXTENSION

HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: 1" = 16'

8 0 8 16

SCALE IN FEET



PROFILE-PROCTOR BROOK

HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: 1" = 16'

WQC/ACOE PLAN SHEET 49 OF 63

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

MassDOT Highway Division

PROPOSED BRIDGE

PEABODY

INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
10 PARK PLAZA BOSTON, MASS

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS
TEWKSBURY, MASSACHUSETTS

STATE BRIDGE ENGINEER

CHIEF ENGINEER

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	61	142
PROJECT FILE NO.	609211		

GENERAL NOTES

GENERAL NOTES

DESIGN:
IN ACCORDANCE WITH THE 2009 AASHTO LRFD GUIDE SPECIFICATION FOR DESIGN OF PEDESTRIAN BRIDGES WITH 2015 INTERIM REVISIONS, FOR 90 PSF DESIGN PEDESTRIAN LOADING.

MASSDOT BENCH MARK:
ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

BENCHMARK: 9 – MAG NAIL SET UP #28 ON WARREN ROAD
STATION: 347+49.19 – 8.971 LT
NORTHING: 3019612.4266
EASTING: 807741.8898
ELEVATION: 41.17'

BENCHMARK: 11 – MAG NAIL SET ABOUT 1' ABOVE GROUND AT LP#6 ON ENDICOTT STREET
STATION: 359+34.38 – 79.411 LT
NORTHING: 3018945.6274
EASTING: 808725.6506
ELEVATION: 37.33'

MASSDOT SURVEY:
THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULTS OF AN AERIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.

SCALES:
SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR HALF–SIZE PRINTS.

FOUNDATIONS:
FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIAL:
ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

GEOTECHNICAL REPORT:
REFER TO GEOTECHNICAL REPORT, DATED MAY 2023, PREPARED BY GZA GEO ENVIRONMENTAL.

EXISTING CONDITIONS:
CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENTS AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUACY THEREOF, AND SHALL NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

STRUCTURAL WOOD NOTES:
ALL DIMENSIONAL LUMBER SHALL BE SOUTHERN PINE STAMPED BY A MEMBER OF THE WWPA AND KILN DRIED TO 19% MAXIMUM MOISTURE CONTENT. ALL STRUCTURAL LUMBER SHALL BE SELECT STRUCTURAL GRADE. IN ACCORDANCE WITH AASHTO TABLE 8.4.1.1.4–1 AND THE 2018 NATIONAL DESIGN SPECIFICATIONS (NDS) FOR WOOD CONSTRUCTION ALL PROPOSED TIMBER ELEMENTS SHALL HAVE A MINIMUM MODULUS OF ELASTICITY OF 1800 KSI.

STRINGERS AND PIER BENTS SHALL NOT BE NOTCHED EXCEPT WHERE SHOWN IN DETAILS. OBTAIN STRUCTURAL ENGINEER'S APPROVAL FOR ANY HOLES THROUGH OR NOTCHES IN THE TOP OF HORIZONTAL MEMBERS.

FOR BLACK LOCUST DECKING MATERIAL REQUIREMENTS PLEASE REFER TO THE SPECIAL PROVISIONS.

PROPOSED WOOD SCREWS FOR TIMBER FRAMING ELEMENTS SHALL COMPLY WITH ASME B18.6 REQUIREMENTS AND SHALL BE GALVANIZED UNLESS OTHERWISE NOTED. WOOD SCREW SIZES AND LENGTHS SHALL BE AS SHOWN ON THE PLANS.

SEE SHEET 17 FOR CONNECTION HARDWARE NOTES.

GRS–IBS MATERIALS
SEE SPECIAL PROVISIONS FOR DETAILED REQUIREMENTS.

CONCRETE MASONRY UNIT (CMU) FACING ELEMENTS
FACING ELEMENTS CONSISTING OF SPLIT–FACE CMU BLOCK UNITS SHALL MEET ASTM C90–11B AND THE REQUIREMENTS OF THE SPECIAL PROVISIONS, WITH A MINIMUM REQUIRED COMPREHENSIVE STRENGTH OF 4000 PSI AND A MAXIMUM WATER ABSORPTION RATE OF 5 PERCENT AFTER 24 HOURS.

CONSTRUCTION JOINTS
CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

BACKFILL MATERIALS
A. GEOSYNTHETIC REINFORCED SOIL (GRS) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 30 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
B. REINFORCED SOIL FOUNDATION (RSF) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.4 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 38 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
C. INTEGRATED APPROACH BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.1.
D. LEVELING COURSE BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6.

GEOSYNTHETICS
FURNISH GEOSYNTHETICS CONSISTING OF GEOTEXTILE FOR THE GRS ABUTMENT, RSF AND INTEGRATED APPROACH. THE GEOSYNTHETIC MATERIAL SHALL BE MANUFACTURED FROM POLYPROPYLENE, HIGH–DENSITY POLYETHYLENE, OR POLYESTER AND MEET THE REQUIREMENTS OF THE SPECIAL PROVISIONS.

A. GEOSYNTHETIC REINFORCED SOIL SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
B. REINFORCED SOIL FOUNDATION SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
C. INTEGRATED APPROACH SOIL SHALL INCLUDE A CLASS 2 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11.

TRAFFIC DATA	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	N/A	
AVERAGE DAILY TRAFFIC – PRESENT	N/A	
AVERAGE DAILY TRAFFIC – DESIGN YEAR	N/A	
DESIGN HOURLY VOLUME	N/A	
DIRECTIONAL DISTRIBUTION	N/A	
TRUCK PERCENTAGE – AVERAGE DAY	N/A	
TRUCK PERCENTAGE – PEAK HOUR	N/A	
DESIGN SPEED	N/A	
DIRECTIONAL DESIGN HOURLY VOLUME	N/A	

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000
DESIGN SPECTRA	
As	0.133
SDs	0.263
SD1	0.096
SITE CLASS	D
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	3.52
DESIGN FLOOD DISCHARGE (C.F.S.)	240
DESIGN FLOOD FREQUENCY (YEARS)	10
DESIGN FLOOD VELOCITY (F.P.S.)	5.97
DESIGN FLOOD ELEVATION (FEET, NAVD)	39.33
BASE (100–YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	420
BASE FLOOD ELEVATION (FEET, NAVD)	40.19
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	25
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	1.95
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	1.17
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	2.28
CHECK FLOOD PIER SCOUR DEPTH (FEET)	1.22
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	N/A
FREQUENCY (IF KNOWN, YEARS)	N/A
MAXIMUM ELEVATION (FEET, NAVD)	N/A
DATE (MM/YYYY)	N/A
HISTORY OF ICE FLOES	N/A
EVIDENCE OF SCOUR AND EROSION	N/A

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	175
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	5.56
DESIGN FLOOD ELEVATION (FEET, NAVD)	38.99,88

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091
A00829 - 528

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	62	142
PROJECT FILE NO.	609211		

BORING LOGS 1 OF 3

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire
Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N: 3019395.2599, E: 808062.9728
Ground Surface Elev. (ft.): 38.5
Final Boring Depth (ft.): 36
Date Start - Finish: 1/4/2019 - 1/4/2019
H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)				
Date	Time	Water Depth	Casing	Stab. Time
1/4/19	1300	2.8	24	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
35.70 ▼ (1/04/19)		S-1	0-2	24	14	2 5 7 4	12	S-1: Medium dense, dark brown, fine to coarse SAND, little Gravel, little Silt, trace Wood, trace Roots.	1				
		S-2	2-4	24	9	2 2 3 1	5	S-2: Loose, gray-brown to dark brown, fine to medium SAND, little Silt, little Gravel, trace Roots.	2			FILL/TOPSOIL	
		S-3	4-6	24	9	3 2 4 4	6	S-3: Loose, gray-brown, fine to medium SAND, little Gravel, little Silt, 3/4" seam of Clayey Silt 4" from bottom.	3		4		34.5'
		S-4	6-8	24	12	2 3 3 3	6	S-4: (Top 5") Brown, fine to coarse SAND, some Silt, little Gravel. (Bottom 7") Gray, fine to medium SAND, little Gravel, little Silt.					
		S-5	8-10	24	12	5 5 6 6	11	S-5: Medium dense, brown to gray with orange, fine to medium SAND, some Gravel, little Silt. Silt observed 5-6" from bottom.				SAND AND GRAVEL	
		S-6	14-16	24	9	6 9 11 11	20	S-6: Medium dense, light brown, fine to medium SAND, some Gravel, little (-) Silt.	4 5				
		S-7	19-21	24	14	21 23 21 22	44	S-7: (Top 3") Light brown, SILT & CLAY, trace fine Sand, trace Gravel. (Bottom 11") Light brown, fine to medium SAND, some Gravel, some Silt.	6		17.5 19.3	SILT & CLAY	21.0' 19.2'
											23.8	GLACIAL DEPOSIT	14.7'
	min/ft	S-8	24-24.2	2	2	100/2"	R	S-8: Very dense, gray, GRAVEL, little fine Sand, little Clayey Silt.	7		25	WEATHERED BEDROCK	13.5'
	2:00 1:30 2:30 2:30 2:45	C-1	26-31	60	56			C-1: Hard to medium hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, subhorizontal to subvertical joints/fractures. RQD=20%	8			BEDROCK	
	2:30 2:45 3:00 3:00 2:45	C-2	31-36	60	60			C-2: Hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, moderately dipping to subvertical joints/fractures. RQD=35%			36	BEDROCK	2.5'
								Bottom of boring at 36 feet.	9				

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 5.5 feet south of staked location due to restricted access and overhead wires.
3. Continuous sampling performed from sampling depths 0 to 10 feet below ground surface (bgs). Driller advanced 4-inch casing down as sampling advanced. The casing was advanced to 14 feet bgs following sampling of S-5.
4. Standard sampling performed from sample depths 14 to 24.2 feet bgs.
5. Driller advanced 4-inch casing from 14 to 24 feet bgs.
6. Clayey Silt observed in drill cuttings from 17.5 to 19 feet bgs.
7. Weathered Bedrock fragments and increased drill effort observed at 23.8 feet bgs.
8. Cored bedrock with a downward pressure of 500 psi at 1,350 rpm in 3rd gear using an NX core barrel.
9. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY: 3/18/2019

ELEVATION IN FEET: 40, 30, 20, 10, 0, -10

PROP. TOP OF REINFORCED SOIL FOUNDATION
WEST ABUTMENT
EL. 36.50

B–7
SCALE: 1/8" = 1'–0"

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N: 3019362.9337, E: 808083.6438
Ground Surface Elev. (ft.): 37.8
Final Boring Depth (ft.): 41
Date Start - Finish: 1/15/2019 - 1/15/2019
H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Safety Hammer

Groundwater Depth (ft.)				
Date	Time	Water Depth	Casing	Stab. Time
1/15/19	1520	5.8	29.5	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
32.00 ▼ (1/15/19)		S-1	0-2	24	11	6 4 4 6	8	S-1: (Top 6") Brown to light brown, fine to medium SAND, some Gravel, trace Silt, trace Roots. (Bottom 5") Dark brown, Organic CLAY & SILT, some fine to medium Sand, little Brick, trace Roots, trace Glass.	1 2				
		S-2	2-4	24	5	21 18 14 28	32	S-2: Hard, dark brown, CLAY & SILT, some fine to medium Sand, little Gravel, trace Roots.	3			FILL	
		S-3	4-6	24	7	18 15 18 12	33	S-3: Dense, gray-brown, fine to coarse SAND, some Gravel, some Clayey Silt.			4		33.8'
		S-4	6-8	24	15	17 16 13 14	29	S-4: Medium dense, light brown to gray, fine to coarse SAND, some Clayey Silt, some Gravel.					
		S-5	8-10	24	8	16 11 13 13	24	S-5: Dense, light brown, fine to medium SAND, some Gravel, little Silt.				SAND AND GRAVEL	
		S-6	14-16	24	7	6 10 9 10	19	S-6: Medium dense, light brown, fine to medium SAND, little Silt, trace (+) Gravel.					
		S-7	19-21	24	12	6 6 6 7	12	S-7: (Top 2") Light brown, fine to medium SAND, little Silt. (Bottom 10") Brown-gray, SILT & CLAY, trace fine Sand.			19.2	SILT & CLAY	18.6'
											22.5	GLACIAL DEPOSIT	15.3'
		S-8	24-26	24	6	26 22 18 23	40	S-8: Dense, gray-brown, fine to coarse SAND, some Silt, some Gravel.					
		S-9	29-29.4	5	5	100/5"	R	S-9: Very dense, gray, GRAVEL, some fine to coarse Sand, little (-) Silt.	4		30		7.8'
	min/ft 3:00 3:45 4:30 5:15 4:15 4:45 5:15 4:30 4:30 3:30	C-1	31-36	60	42			C-1: Hard, slightly to moderately weathered, coarse to medium grained, gray with purple, GRANITE, rough, irregular to planar, very close, subvertical to subhorizontal joints/fractures. RQD=0%	5				
		C-2	36-41	60	60			C-2: Hard, slightly weathered, coarse to medium grained, gray with pink and purple, GRANITE, rough, irregular to planar, very close, subhorizontal to subvertical joints/fractures. RQD=0%	6			BEDROCK	
											41		-3.2'
								Bottom of boring at 41 feet.	7				

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 3.5 feet south due to restricted access.
3. Advanced boring using 4-inch casing from sample depths 0 to 29 feet below ground surface (bgs).
4. Consistent coarse sand-sized rock fragments observed in drill cuttings from sample depths 30 to 31 feet bgs.
5. Drill rig did not have a downward pressure or RPM gauge. Cored bedrock in 3rd gear using an NX core barrel.
6. Core barrel jammed with no loss of water at sample depths 35.1 and 38.3 feet bgs.
7. Borehole backfilled to approximate ground surface with drill cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY: 3/18/2019

APPROX. PROP. PILE TIP VARIES
EL. 23.00–25.50

B–8
SCALE: 1/8" = 1'–0"

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B–#
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.
6. B–7 AND B–8 WERE MADE IN JANUARY 2019 AND B–9 THROUGH B–12 WERE MADE IN FEBRUARY 2022.
7. BORINGS WERE MADE BY NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH, 03038.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

4 0 4 8
SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

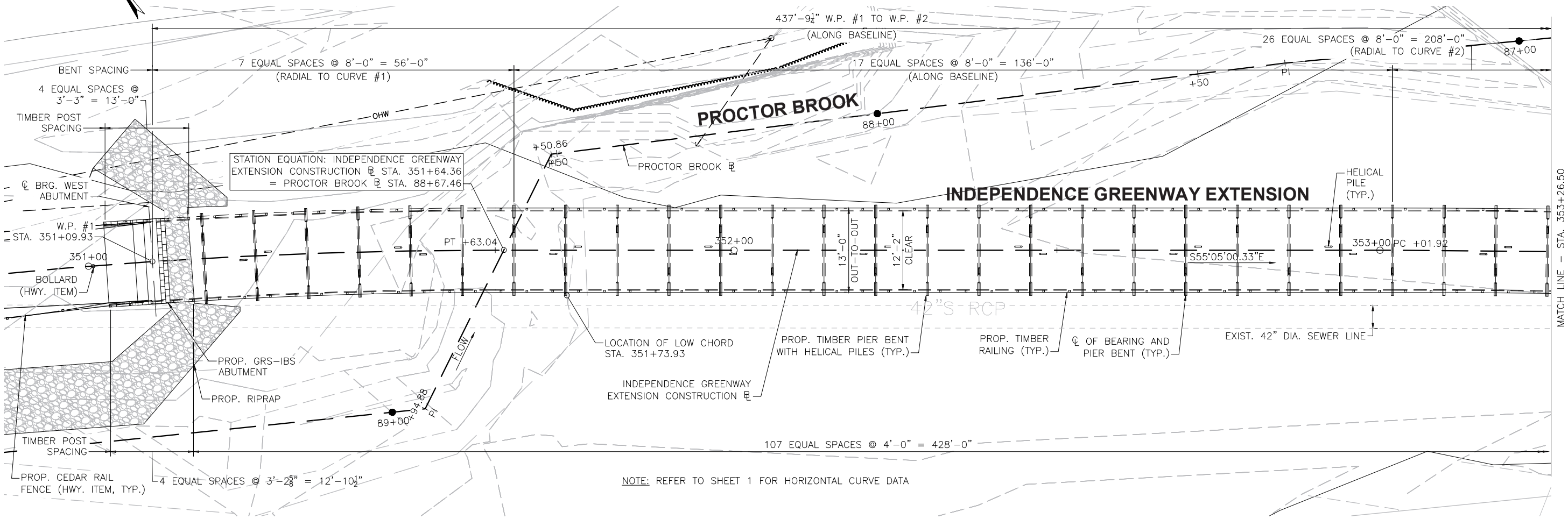
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 51 OF 63

SHEET 3 OF 17 SHEETS BRIDGE NO. P–03–020 (CAK)

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	65	142
PROJECT FILE NO.	609211		

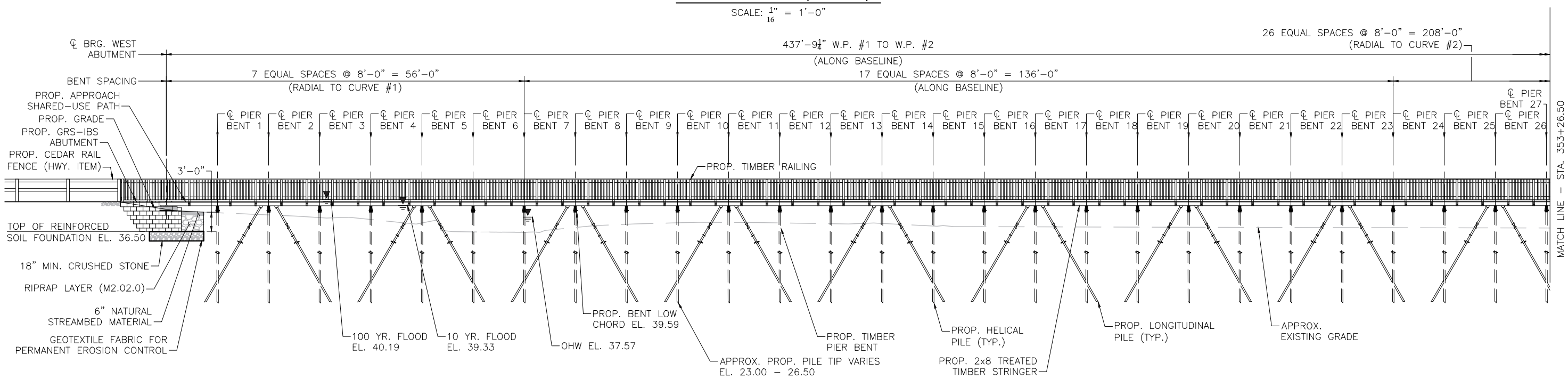
GENERAL PLAN AND ELEVATION 1 OF 2



NOTE: REFER TO SHEET 1 FOR HORIZONTAL CURVE DATA

GENERAL PLAN (1 OF 2)

SCALE: 1/16" = 1'-0"



TYPICAL ELEVATION (1 OF 2)

SCALE: 1/16" = 1'-0"

8 0 8 16

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 54 OF 63

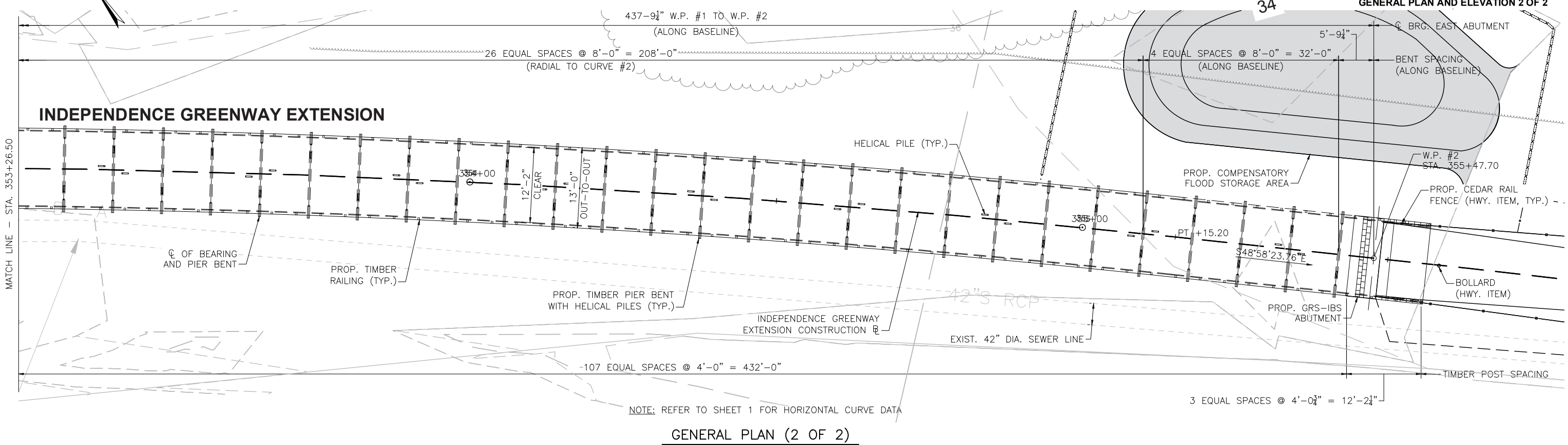
SHEET 6 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

Proposal No. 609211-132091

A00829 - 530

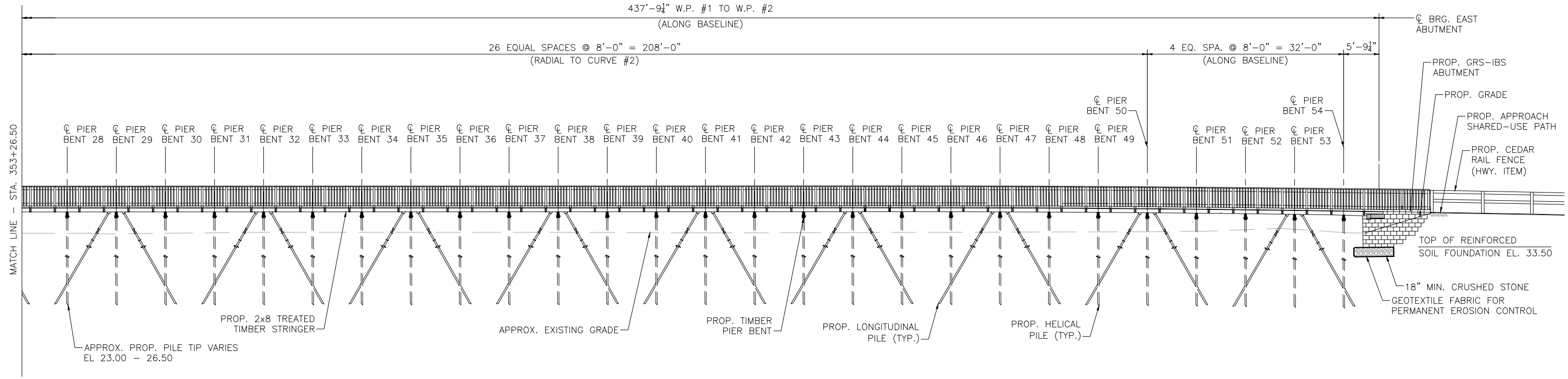
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

GENERAL PLAN AND ELEVATION 2 OF 2



GENERAL PLAN (2 OF 2)

SCALE: 1/16" = 1'-0"



TYPICAL ELEVATION (2 OF 2)

SCALE: 1/16" = 1'-0"

8 0 8 16

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 55 OF 63

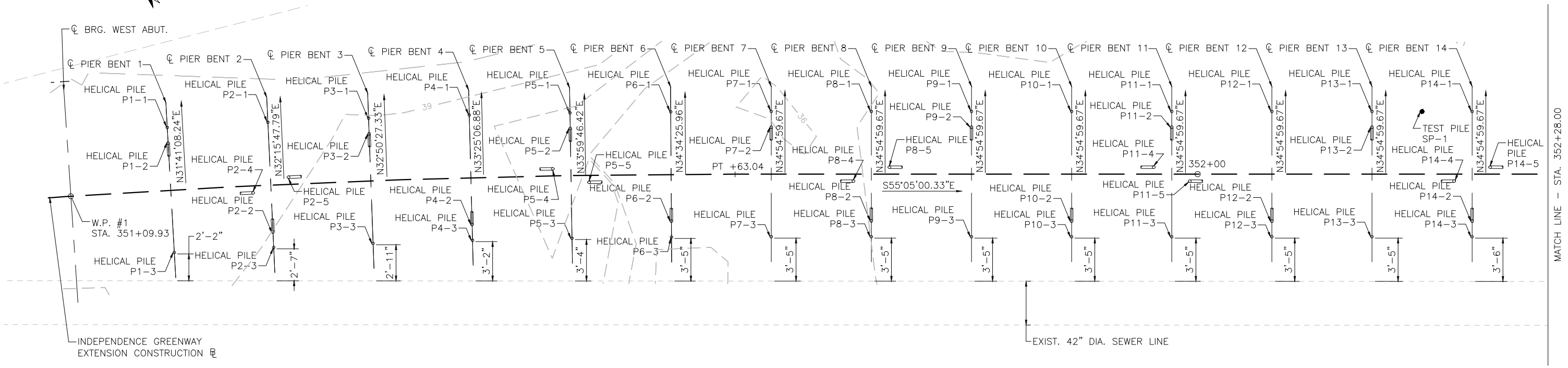
SHEET 7 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

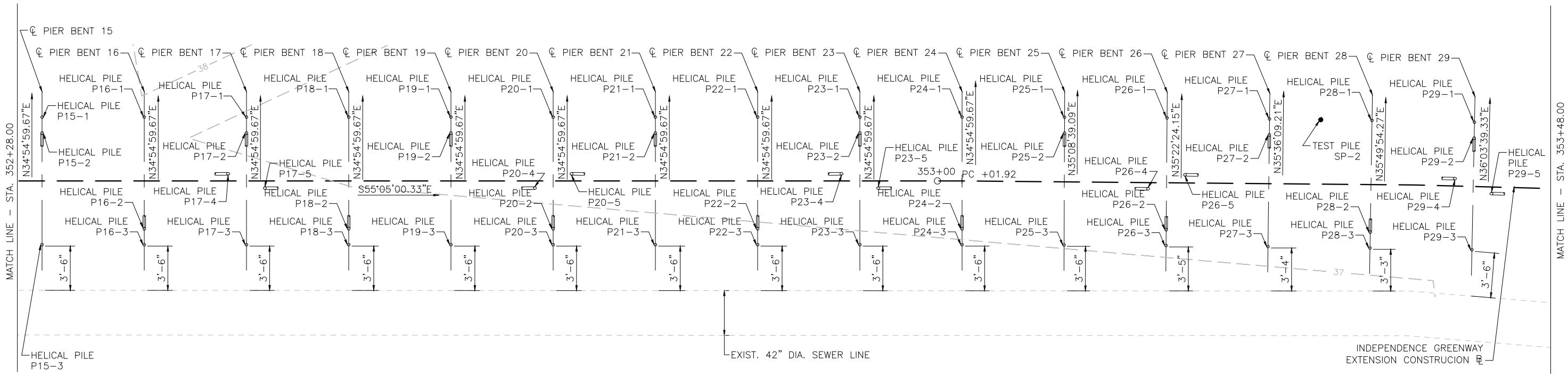
Proposal No. 609211-132091
A00829 - 531

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	67	142
PROJECT FILE NO.		609211	

HELICAL PILE LAYOUT PLAN 1 OF 2





NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'-6" TO THE TOP HELICE FOR ALL P#-3 LOCATIONS WITH AN OFFSET LESS THAN 3'-6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
6. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
7. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

LEGEND:

- ∘ HELICAL PILE P#-#
- ● TEST PILE SP-#

HELICAL PILE LAYOUT PLAN 1

SCALE: $\frac{1}{8}$" = 1'-0"

4 0 4 8
SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 56 OF 63

SHEET 8 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

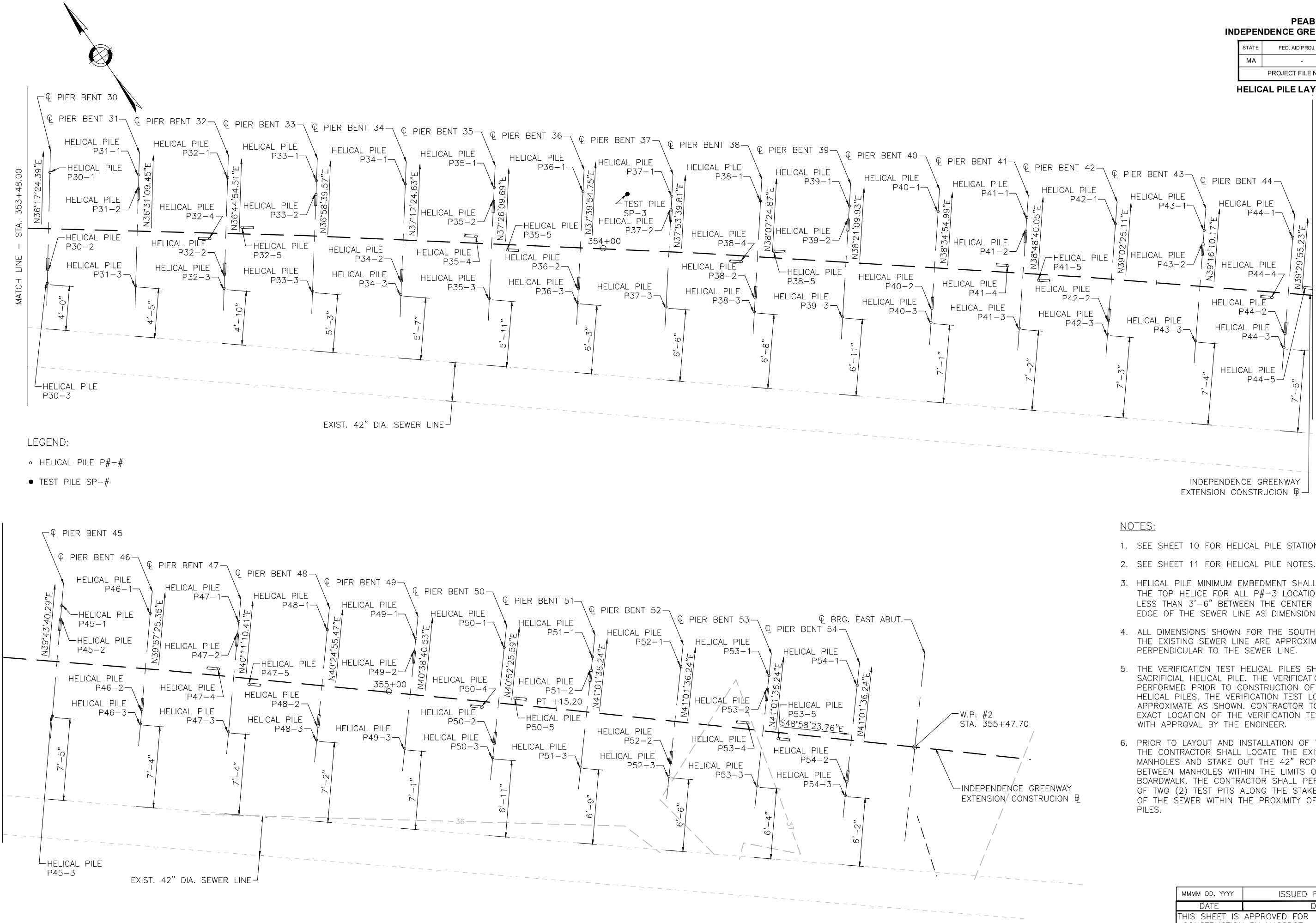
Proposal No. 609211-132091

A00829 - 532

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	68	142
PROJECT FILE NO.	609211		

HELICAL PILE LAYOUT PLAN 2 OF 2



LEGEND:

- ◦ HELICAL PILE P#–#
- ● TEST PILE SP–#

NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'–6" TO THE TOP HELICE FOR ALL P#–3 LOCATIONS WITH AN OFFSET LESS THAN 3'–6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
5. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
6. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 57 OF 63

4 0 4 8
SCALE IN FEET

HELICAL PILE LAYOUT PLAN 2
SCALE: $\frac{1}{8}$" = 1'–0"

Proposal No. 609211-132091
A00829 - 533

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	69	142
PROJECT FILE NO.	609211		

HELICAL PILE LAYOUT TABLE

HELICAL PILE	STATION	OFFSET
P1–1	351+17.93	5.00 LT
P1–2	351+17.93	3.75 LT
P1–3	351+17.93	5.00 RT
P2–1	351+25.93	5.00 LT
P2–2	351+25.93	3.75 RT
P2–3	351+25.93	5.00 RT
P3–1	351+33.93	5.00 LT
P3–2	351+33.93	3.75 LT
P3–3	351+33.93	5.00 RT
P4–1	351+41.93	5.00 LT
P4–2	351+41.93	3.75 RT
P4–3	351+41.93	5.00 RT
P5–1	351+49.93	4.99 LT
P5–2	351+49.93	3.76 LT
P5–3	351+49.93	5.01 RT
P6–1	351+57.93	4.99 LT
P6–2	351+57.93	3.74 RT
P6–3	351+57.93	5.01 RT
P7–1	351+65.93	5.00 LT
P7–2	351+65.93	3.75 LT
P7–3	351+65.93	5.00 RT
P8–1	351+73.93	5.00 LT
P8–2	351+73.93	3.73 RT
P8–3	351+73.93	5.00 RT
P9–1	351+81.93	5.00 LT
P9–2	351+81.93	3.75 LT
P9–3	351+81.93	5.00 RT
P10–1	351+89.93	5.00 LT
P10–2	351+89.93	3.75 RT
P10–3	351+89.93	5.00 RT
P11–1	351+97.93	5.00 LT
P11–2	351+97.93	3.75 LT
P11–3	351+97.93	5.00 RT
P12–1	352+05.93	5.00 LT
P12–2	352+05.93	3.75 RT
P12–3	352+05.93	5.00 RT
P13–1	352+13.93	5.00 LT
P13–2	352+13.93	3.75 LT
P13–3	352+13.93	5.00 RT
P14–1	352+21.93	5.00 LT
P14–2	352+21.93	3.75 RT
P14–3	352+21.93	5.00 RT
P15–1	352+29.93	5.00 LT
P15–2	352+29.93	3.75 LT
P15–3	352+29.93	5.00 RT
P16–1	352+37.93	5.00 LT
P16–2	352+37.93	3.75 RT
P16–3	352+37.93	5.00 RT
P17–1	352+45.93	5.00 LT
P17–2	352+45.93	3.75 LT
P17–3	352+45.93	5.00 RT
P18–1	352+53.93	5.00 LT
P18–2	352+53.93	3.75 RT
P18–3	352+53.93	5.00 RT
P19–1	352+61.93	5.00 LT
P19–2	352+61.93	3.75 LT
P19–3	352+61.93	5.00 RT
P20–1	352+69.93	5.00 LT
P20–2	352+69.93	3.75 RT
P20–3	352+69.93	5.00 RT
P21–1	352+77.93	5.00 LT
P21–2	352+77.93	3.50 LT
P21–3	352+77.93	5.00 RT
P22–1	352+85.93	5.00 LT
P22–2	352+85.93	3.75 RT
P22–3	352+85.93	5.00 RT
P23–1	352+93.93	5.00 LT
P23–2	352+93.93	3.75 LT
P23–3	352+93.93	5.00 RT
P24–1	353+01.93	5.00 LT
P24–2	353+01.93	3.75 RT
P24–3	353+01.93	5.00 RT
P25–1	353+09.93	5.00 LT
P25–2	353+09.93	3.75 LT
P25–3	353+09.93	5.00 RT
P26–1	353+17.93	5.00 LT
P26–2	353+17.93	3.75 RT
P26–3	353+17.93	5.00 RT
P27–1	353+25.93	5.00 LT
P27–2	353+25.93	3.75 LT
P27–3	353+25.93	5.00 RT
P28–1	353+33.93	5.00 LT
P28–2	353+33.93	3.75 RT
P28–3	353+33.93	5.00 RT
P29–1	353+41.93	5.00 LT
P29–2	353+41.93	3.75 LT
P29–3	353+41.93	5.00 RT
P30–1	353+49.93	5.00 LT
P30–2	353+49.93	3.75 RT
P30–3	353+49.93	5.00 RT
P31–1	353+57.93	5.00 LT
P31–2	353+57.93	3.75 LT
P31–3	353+57.93	5.00 RT
P32–1	353+65.93	5.00 LT
P32–2	353+65.93	3.75 RT
P32–3	353+65.93	5.00 RT
P33–1	353+73.93	5.00 LT
P33–2	353+73.93	3.75 LT
P33–3	353+73.93	5.00 RT
P34–1	353+81.93	5.00 LT
P34–2	353+81.93	3.74 RT
P34–3	353+81.93	5.00 RT
P35–1	353+89.93	5.00 LT
P35–2	353+89.93	3.76 LT
P35–3	353+89.93	5.00 RT
P36–1	353+97.93	5.00 LT
P36–2	353+97.93	3.74 RT
P36–3	353+97.93	5.00 RT
P37–1	354+05.93	5.00 LT
P37–2	354+05.93	3.76 LT
P37–3	354+05.93	5.00 RT
P38–1	354+13.93	5.00 LT
P38–2	354+13.93	3.74 RT
P38–3	354+13.93	5.00 RT
P39–1	354+21.93	5.00 LT
P39–2	354+21.93	3.76 LT
P39–3	354+21.93	5.00 RT
P40–1	354+29.93	5.00 LT
P40–2	354+29.93	3.74 RT
P40–3	354+29.93	5.00 RT
P41–1	354+37.93	5.00 LT
P41–2	354+37.93	3.76 LT
P41–3	354+37.93	5.00 RT
P42–1	354+45.93	5.00 LT
P42–2	354+45.93	3.73 RT
P42–3	354+45.93	5.00 RT
P43–1	354+53.93	5.00 LT
P43–2	354+53.93	3.77 LT
P43–3	354+53.93	5.00 RT
P44–1	354+61.93	5.00 LT
P44–2	354+61.93	3.73 RT
P44–3	354+61.93	5.00 RT
P45–1	354+69.93	5.00 LT
P45–2	354+69.93	3.77 LT
P45–3	354+69.93	5.00 RT
P46–1	354+77.93	5.00 LT
P46–2	354+77.93	3.73 RT
P46–3	354+77.93	5.00 RT
P47–1	354+85.93	5.00 LT
P47–2	354+85.93	3.78 LT
P47–3	354+85.93	5.00 RT
P48–1	354+93.93	5.00 LT
P48–2	354+93.93	3.72 RT
P48–3	354+93.93	5.00 RT
P49–1	355+01.93	5.00 LT
P49–2	355+01.93	3.78 LT
P49–3	355+01.93	5.00 RT
P50–1	355+09.93	5.00 LT
P50–2	355+09.93	3.72 RT
P50–3	355+09.93	5.00 RT
P51–1	355+17.93	5.00 LT
P51–2	355+17.93	3.78 LT
P51–3	355+17.93	5.00 RT
P52–1	355+25.93	5.00 LT
P52–2	355+25.93	3.74 RT
P52–3	355+25.93	5.00 RT
P53–1	355+33.93	5.00 LT
P53–2	355+33.93	3.77 LT
P53–3	355+33.93	5.00 RT
P54–1	355+41.93	5.00 LT
P54–2	355+41.93	3.78 RT
P54–3	355+41.93	5.00 RT
P2–4	351+24.49	0.56 RT
P2–5	351+27.37	0.56 LT
P5–4	351+48.48	0.56 LT
P5–5	351+51.37	0.56 RT
P8–4	351+72.49	0.56 RT
P8–5	351+75.37	0.56 LT
P11–4	351+96.49	0.56 LT
P11–5	351+99.37	0.56 RT
P14–4	352+20.49	0.56 RT
P14–5	352+23.37	0.56 LT
P17–4	352+44.50	0.56 LT
P17–5	352+47.37	0.56 RT
P20–4	352+68.50	0.56 RT
P20–5	352+71.37	0.56 LT
P23–4	352+92.49	0.56 LT
P23–5	352+95.37	0.56 RT
P26–4	353+16.50	0.56 RT
P26–5	353+19.37	0.56 LT
P29–4	353+40.50	0.56 LT
P29–5	353+43.37	0.56 RT
P32–4	353+64.49	0.56 RT
P32–5	353+67.37	0.56 LT
P35–4	353+88.50	0.56 LT
P35–5	353+91.38	0.56 RT
P38–4	354+12.50	0.56 RT
P38–5	354+15.38	0.56 LT
P41–4	354+36.50	0.56 LT
P41–5	354+39.38	0.56 RT
P44–4	354+60.51	0.56 RT
P44–5	354+63.38	0.56 LT
P47–4	354+84.51	0.56 LT
P47–5	354+87.38	0.56 RT
P50–4	355+8.49	0.56 RT
P50–5	355+11.37	0.56 LT
P53–4	355+32.50	0.56 LT
P53–5	355+35.37	0.56 RT

SACRIFICIAL HELICAL TEST PILE	STATION	OFFSET
SP–1	352+17.93	5.00 LT
SP–2	353+29.93	5.00 LT
SP–3	354+01.93	5.00 LT

NOTE:

SEE SHEETS 8 AND 9 FOR PILE LAYOUT AND ADDITIONAL NOTES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

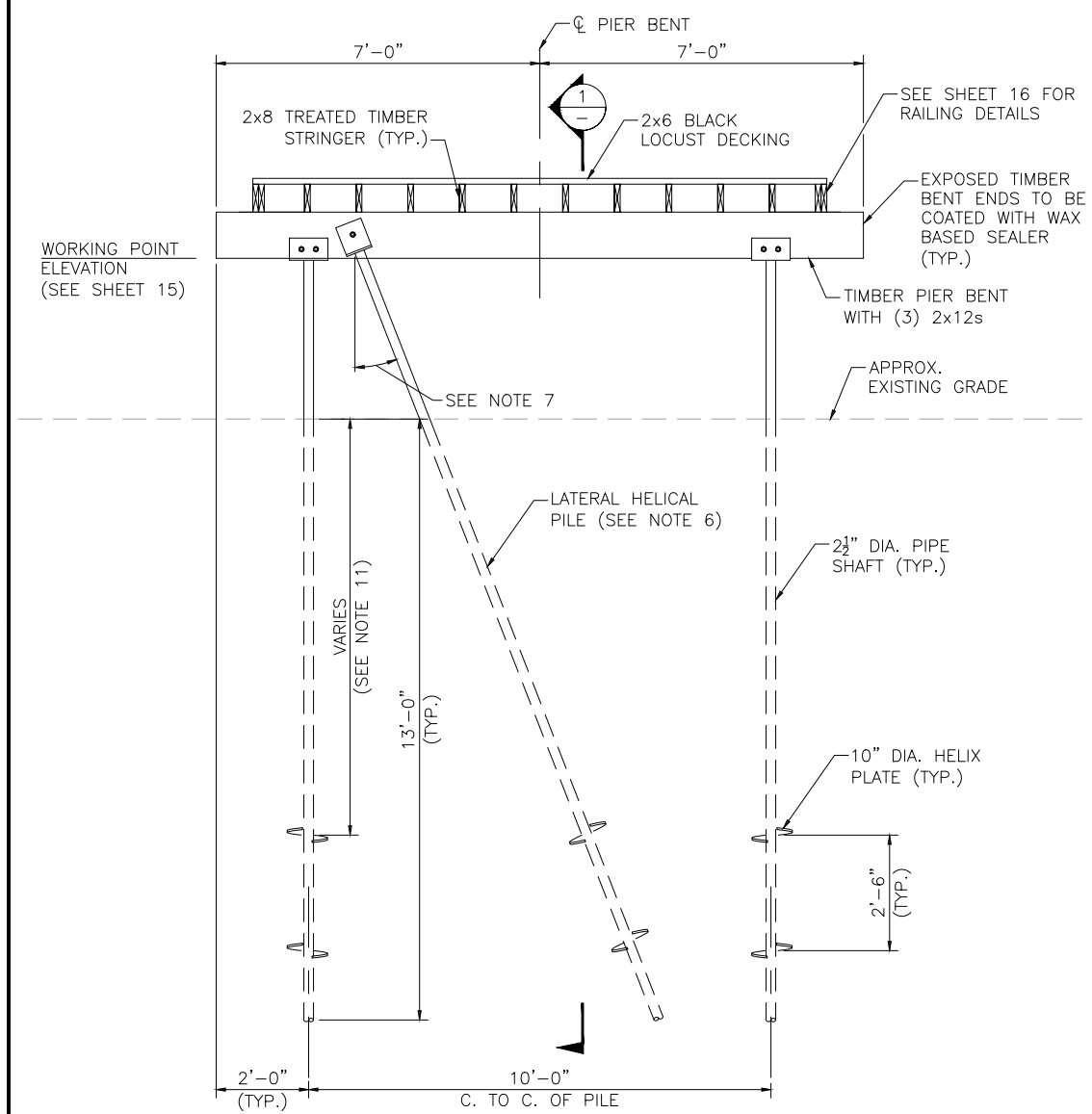
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091

A00829 - 534

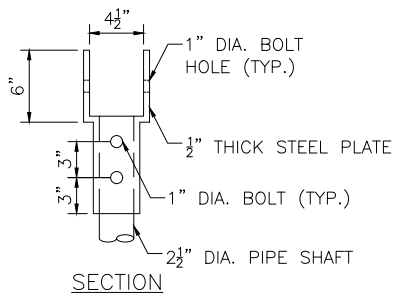
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	70	142
PROJECT FILE NO.	609211		

HELICAL PILE DETAILS

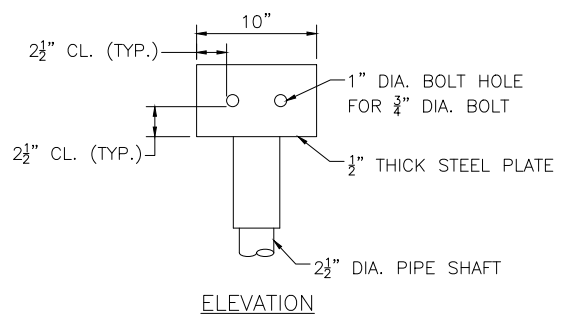


HELICAL PILE TYPICAL SECTION

SCALE: 1/4" = 1'–0"



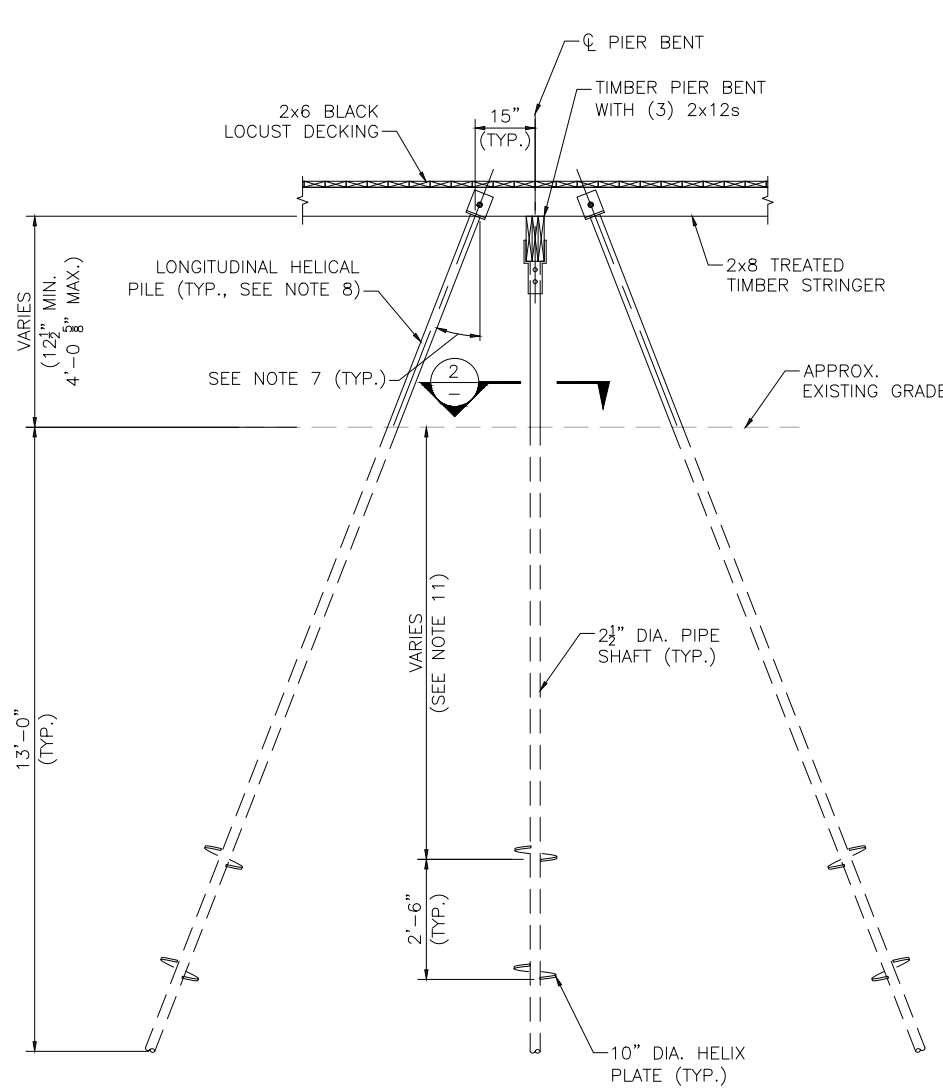
SECTION



ELEVATION

HELICAL PILE ATTACHMENT ASSEMBLY

SCALE: 3/4" = 1'–0"

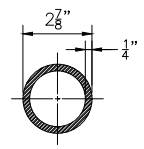


2 0 2 4

SCALE IN FEET

SECTION 1 –

SCALE: 1/4" = 1'–0"

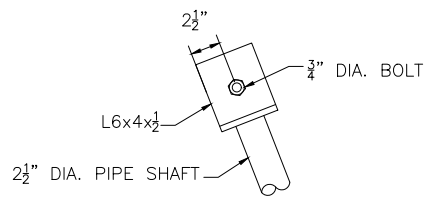


SECTION 2 –

SCALE: 3/2" = 1'–0"

8" 0 8" 1'-4"

SCALE IN FEET



8" 0 8" 1-4"

SCALE IN FEET

LATERAL AND LONGITUDINAL HELICAL PILE ATTACHMENT ASSEMBLY

SCALE: 3/4" = 1'–0"

NOTES:

1. THE TABLE BELOW SUMMARIZES THE FACTORED AXIAL DESIGN LOADS PER PILE FOR AASHTO LRFD BRIDGE SPECIFICATIONS STRENGTH I LOAD COMBINATIONS. THE NOMINAL GEOTECHNICAL RESISTANCE, AND THE FACTORED GEOTECHNICAL RESISTANCE PER PILE:

	FACTORED DESIGN LOADS	NOMINAL GEOTECHNICAL RESISTANCE	FACTORED GEOTECHNICAL RESISTANCE**
HELICAL PILE (COMPRESSION)	10.00 KIPS	17.00 KIPS	11.90 KIPS
HELICAL PILE (TENSION)	5.00 KIPS	14.80 KIPS	10.35 KIPS

**FACTORED GEOTECHNICAL RESISTANCE IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE AND A RESISTANCE FACTOR OF 0.70.

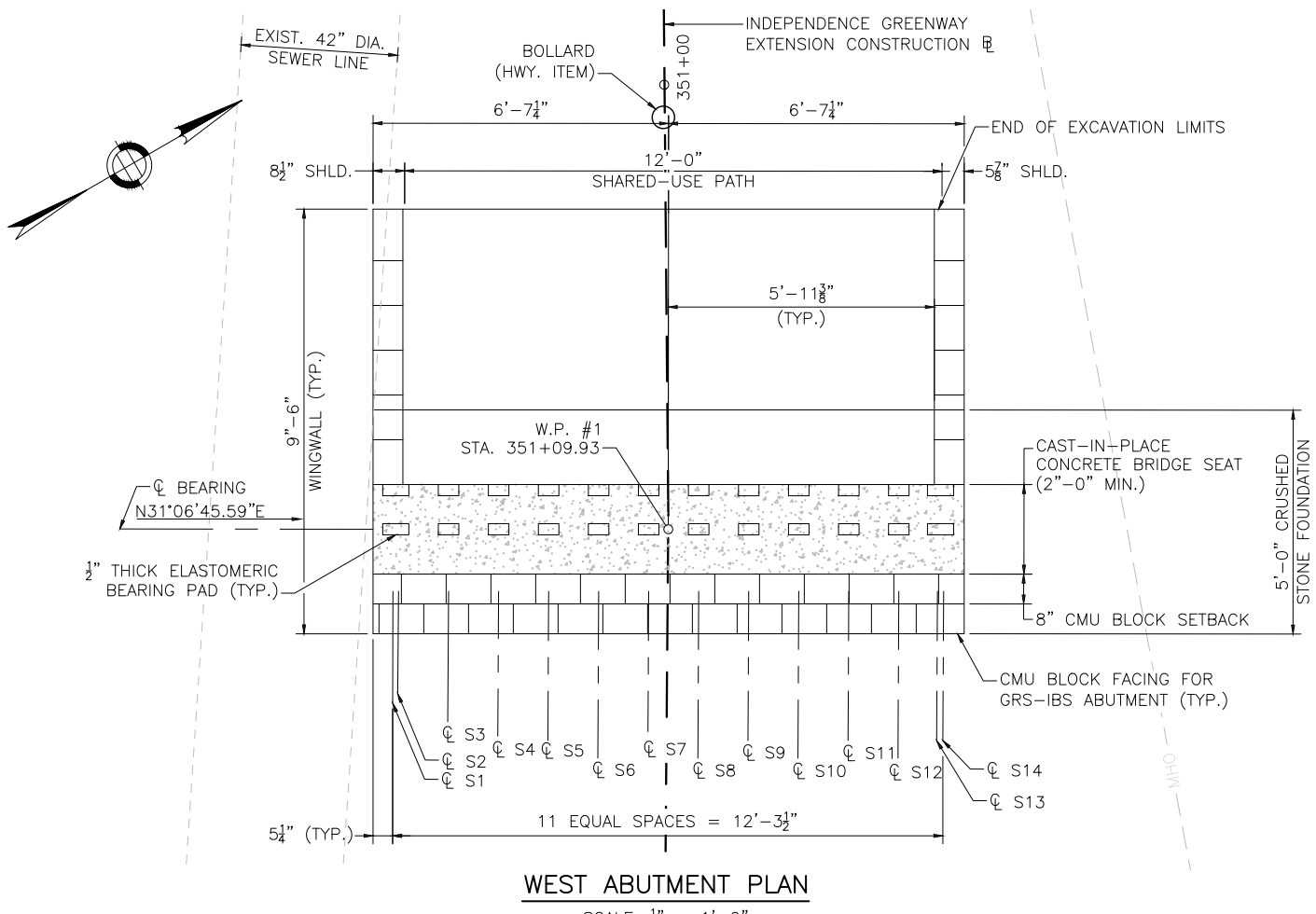
2. THE TOP HELIX OF ALL PROPOSED HELICAL PILES SHALL BE TORQUED TO A MINIMUM EMBEDMENT OF 9 FEET BELOW EXISTING GRADE, EXCEPT AS NOTED ON SHEET 8 ADJACENT TO THE SEWER LINE.
3. THREE PRE–PRODUCTION VERIFICATION LOAD TESTS FOR THREE SACRIFICIAL PILES ARE REQUIRED TO CONFIRM THE HELICAL PILE NOMINAL RESISTANCE. LOAD TESTING SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIAL PROVISION REQUIREMENTS, THE GEOTECHNICAL REPORT RECOMMENDATIONS, AND THE SACRIFICIAL PILE LOCATIONS SHALL BE AGREED UPON BY THE CONTRACTOR AND ENGINEER. A RESISTANCE FACTOR OF 0.70 MAY BE UTILIZED UPON SUCCESSFUL COMPLETION OF STATIC LOAD TESTING.
4. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS FOR THE PROPOSED HELICAL PILES SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER LICENSED IN THE COMMONWEALTH OF MASSACHUSETTS.
5. ALTERNATIVE ATTACHMENT AND ASSEMBLIES CAN BE SUBMITTED THROUGH THE SHOP DRAWING PROCESS FOR REVIEW AND APPROVAL.
6. LATERAL PILES ALTERNATE DIRECTION EVERY BENT.
7. LATERAL AND LONGITUDINAL PILE ANGLE CAN RANGE BETWEEN 25° AND 35°.
8. LONGITUDINAL BATTERED PILES SHALL BE AT EVERY THIRD PIER BENT TO RESIST LONGITUDINAL LOADING.
9. HELICAL PILES AND CONNECTIONS SHALL BE HOT–DIPPED GALVANIZED.
10. REMOVAL OF SURFICIAL COBBLES/BOULDERS WILL BE REQUIRED PRIOR TO HELICAL PILE INSTALLATION. PRE–DRILLING MAY BE REQUIRED TO PENETRATE THE COBBLES AND BOULDERS.
11. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'–6" TO THE TOP HELICE FOR ALL P#–3 LOCATIONS WITH AN OFFSET LESS THAN 3'–6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE. MINIMUM EMBEDMENT FOR ALL REMAINING PILES SHALL BE 9'–0".
12. FOR ADDITIONAL HELICAL PILE REQUIREMENTS, SEE SPECIAL PROVISION ITEM NO. 943.20.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

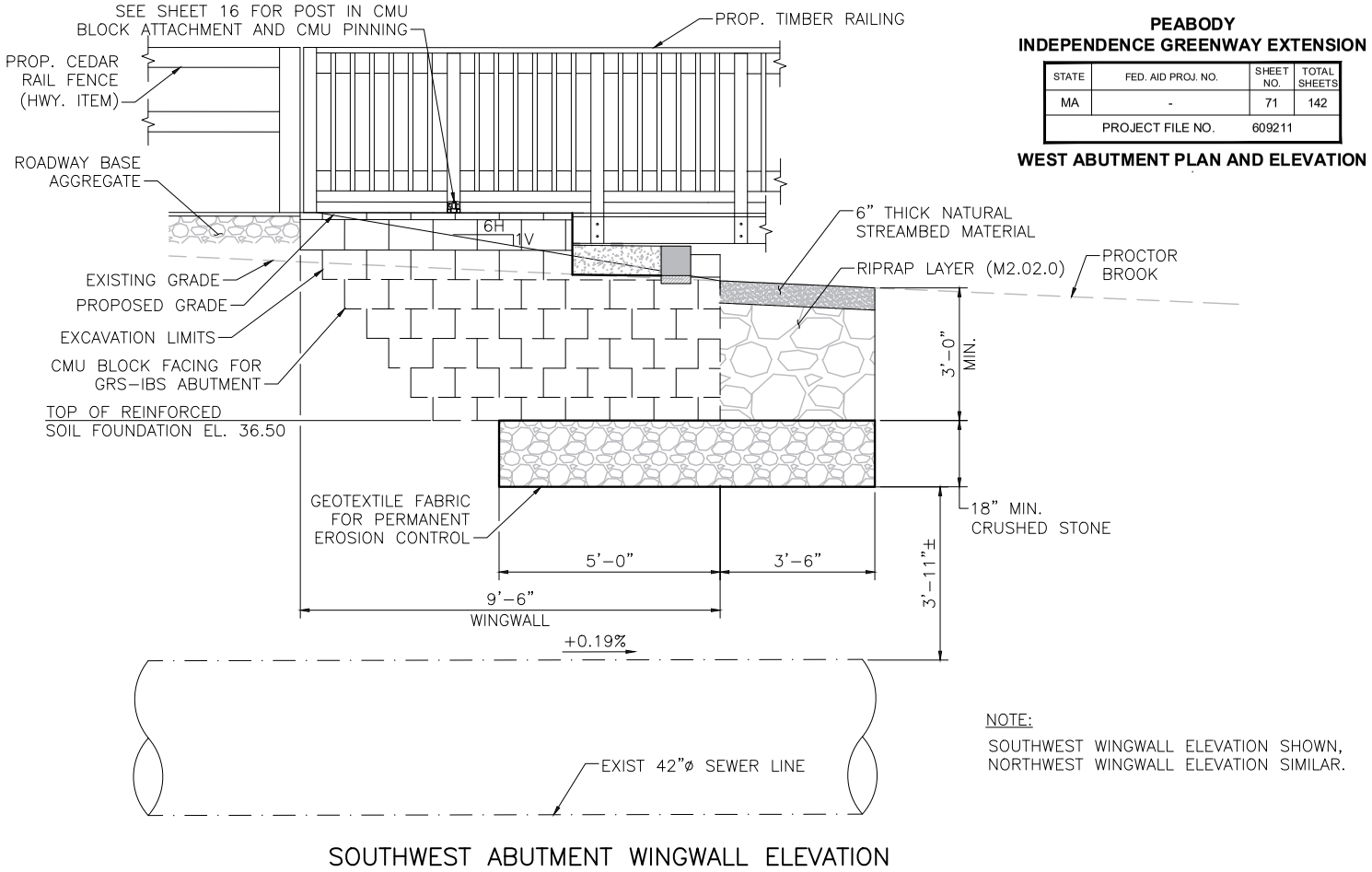
Proposal No. 609211-132091

A00829 - 535



WEST ABUTMENT PLAN

SCALE: ¼" = 1'-0"



SOUTHWEST ABUTMENT WINGWALL ELEVATION

SCALE: ¼" = 1'-0"

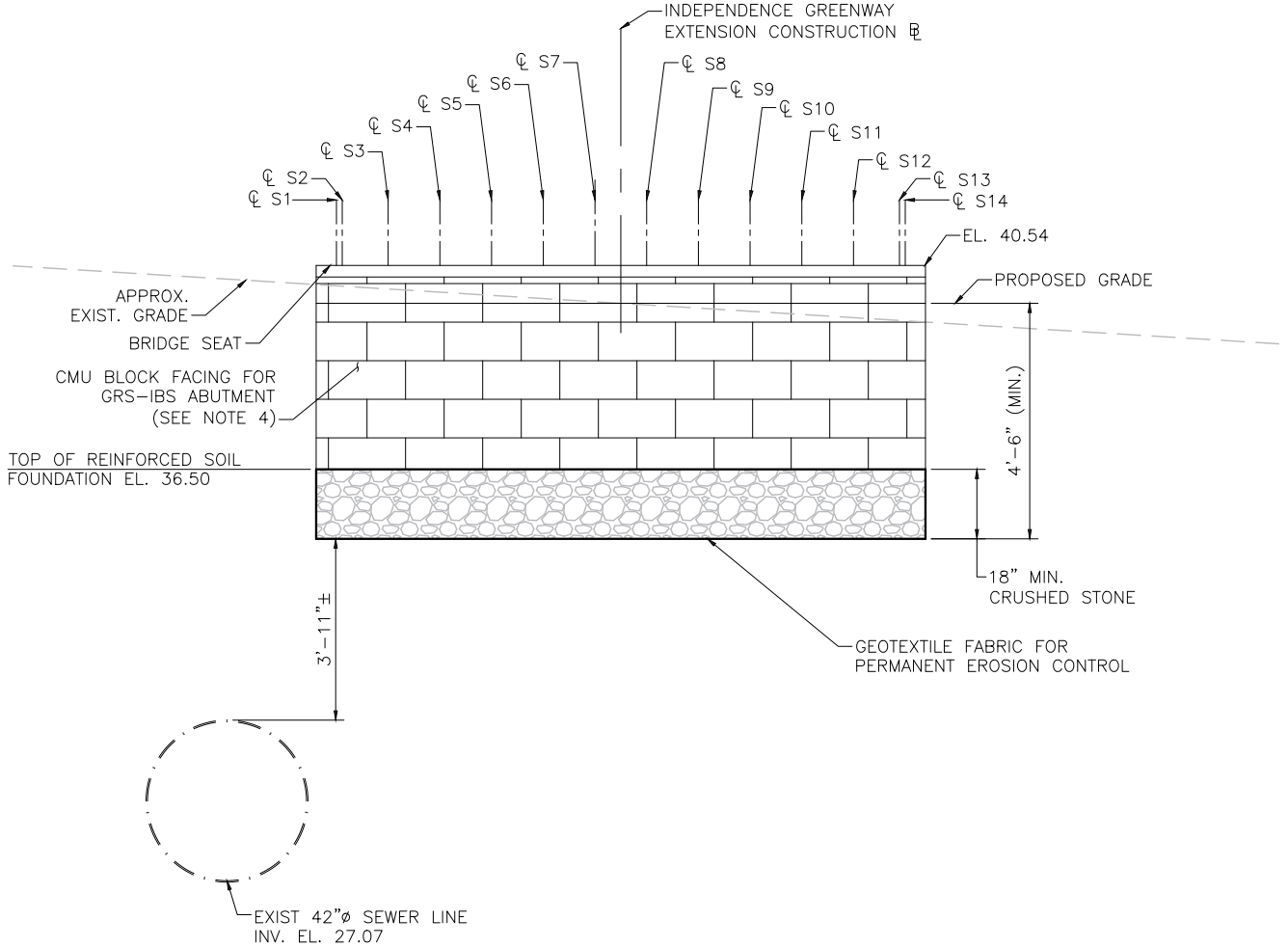
NOTE:

SOUTHWEST WINGWALL ELEVATION SHOWN, NORTHWEST WINGWALL ELEVATION SIMILAR.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

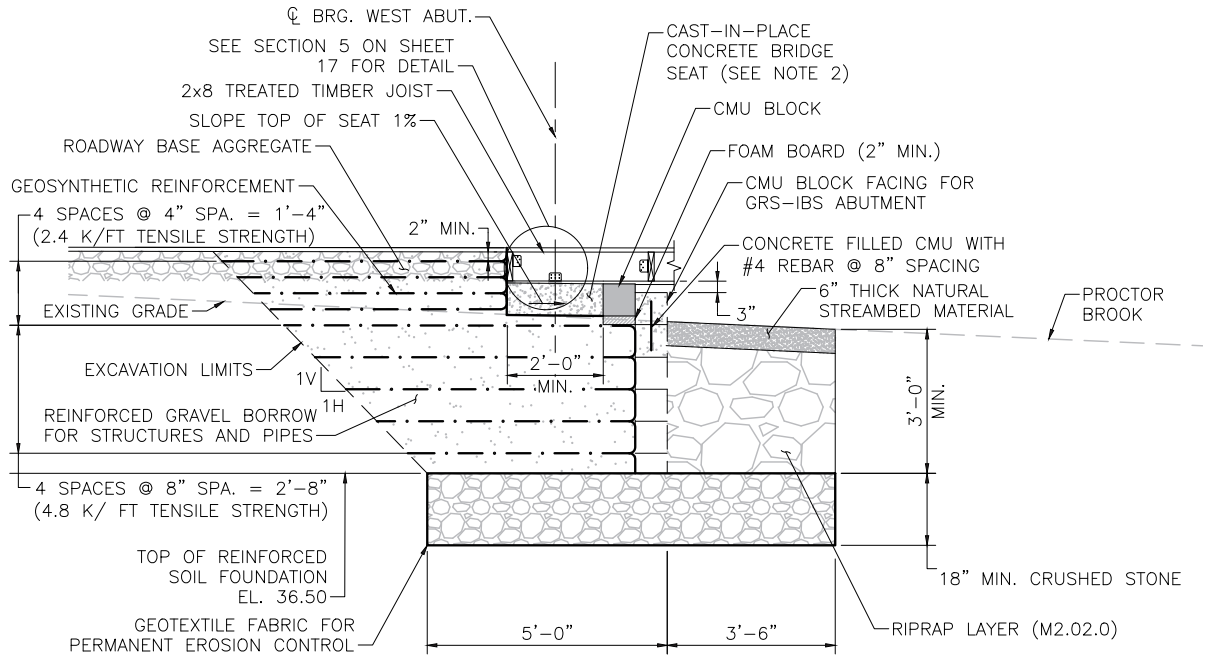
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	71	142
PROJECT FILE NO.	609211		

WEST ABUTMENT PLAN AND ELEVATION



WEST ABUTMENT ELEVATION

SCALE: ¼" = 1'-0"



WEST ABUTMENT TYPICAL SECTION

SCALE: ¼" = 1'-0"

GRS-IBS ABUTMENT NOTES:

1. THE FACTORED BEARING PRESSURE = 0.897 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.8 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.65.

2. CAST-IN-PLACE CONCRETE BEARING SEAT SHALL BE 5000 PSI HP CEMENT CONCRETE WITH ONE LAYER OF #4 WELDED WIRE FABRIC PLACED AT MID-HEIGHT.

3. THE GEOTEXTILE REINFORCEMENT SHALL EXTEND BETWEEN THE LAYERS OF CMU BLOCK.

4. ALL CMU BLOCKS ABOVE PROPOSED GRADE AND THE FIRST BLOCK BELOW GRADE SHALL BE HOLLOW AND FILLED WITH BLOCK WALL CONCRETE FILL. ALL CMU BLOCKS BELOW THAT POINT SHALL BE SOLID. SEE SECTION VIEW FOR LIMITS OF CONCRETE FILL CMU BLOCKS ABOVE GRADE.

2 0 2 4

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

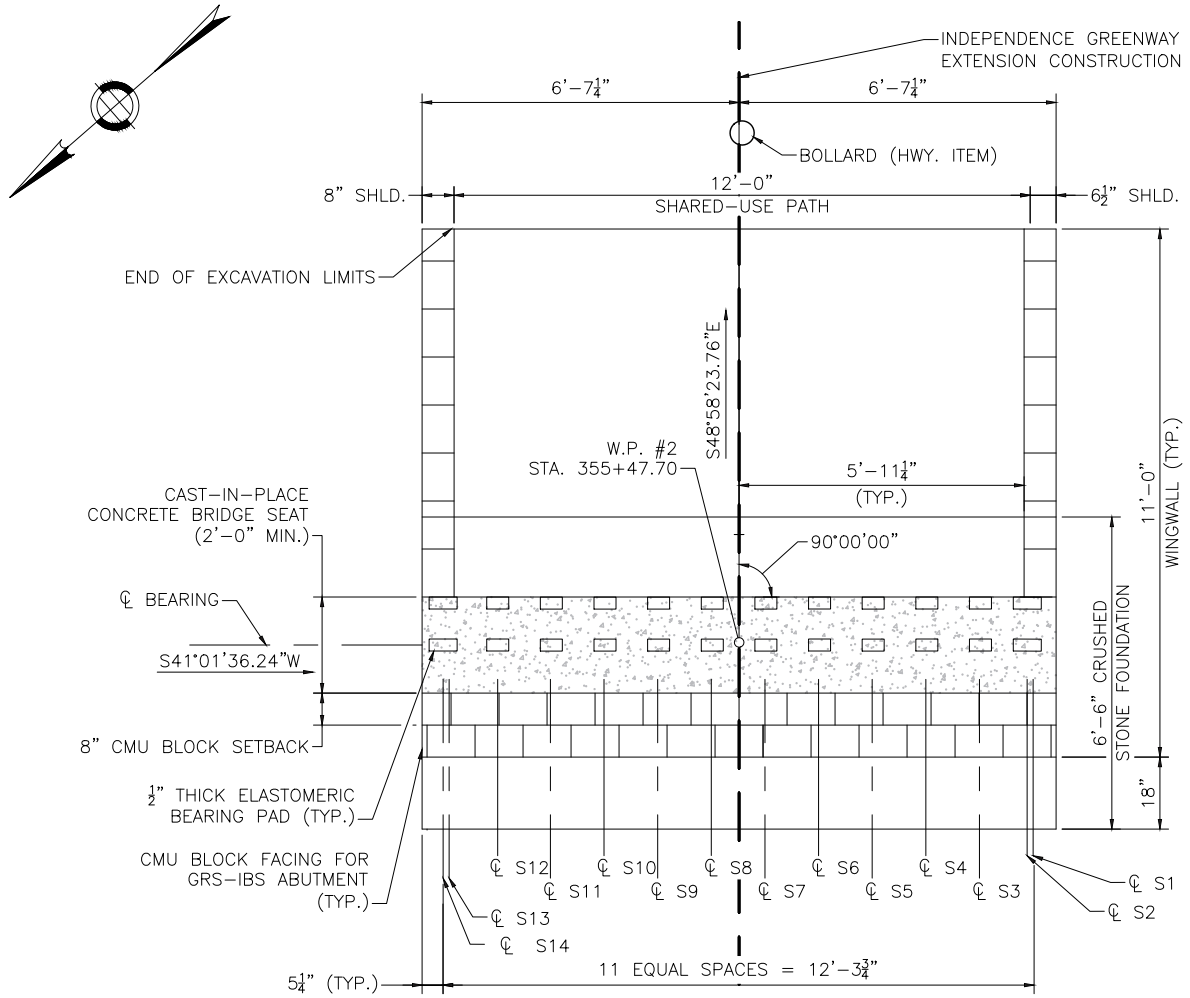
A00829 - 536

Proposal No. 609211-132091

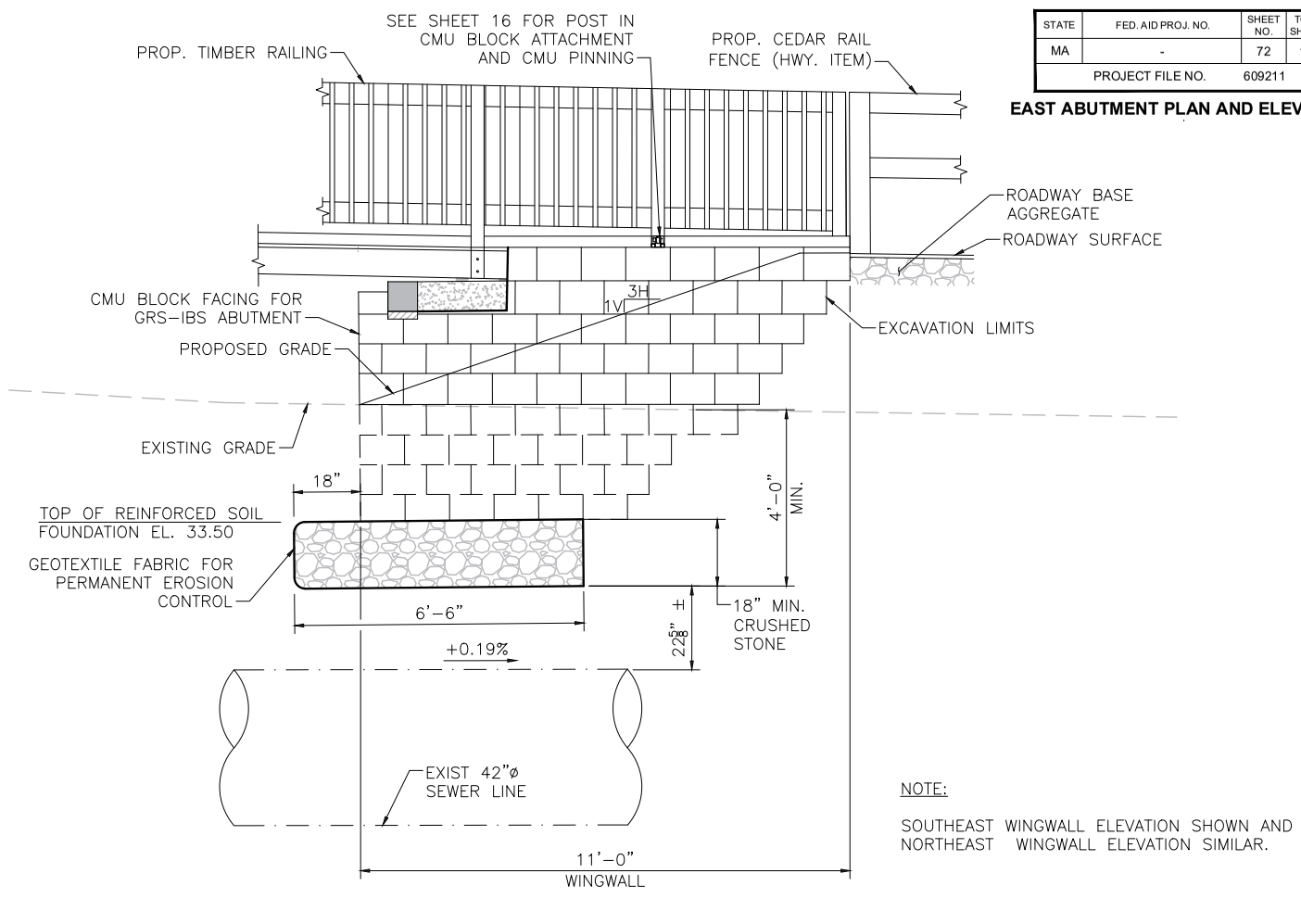
PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	72	142
PROJECT FILE NO.	609211		

EAST ABUTMENT PLAN AND ELEVATION



EXIST. 42" DIA. SEWER LINE

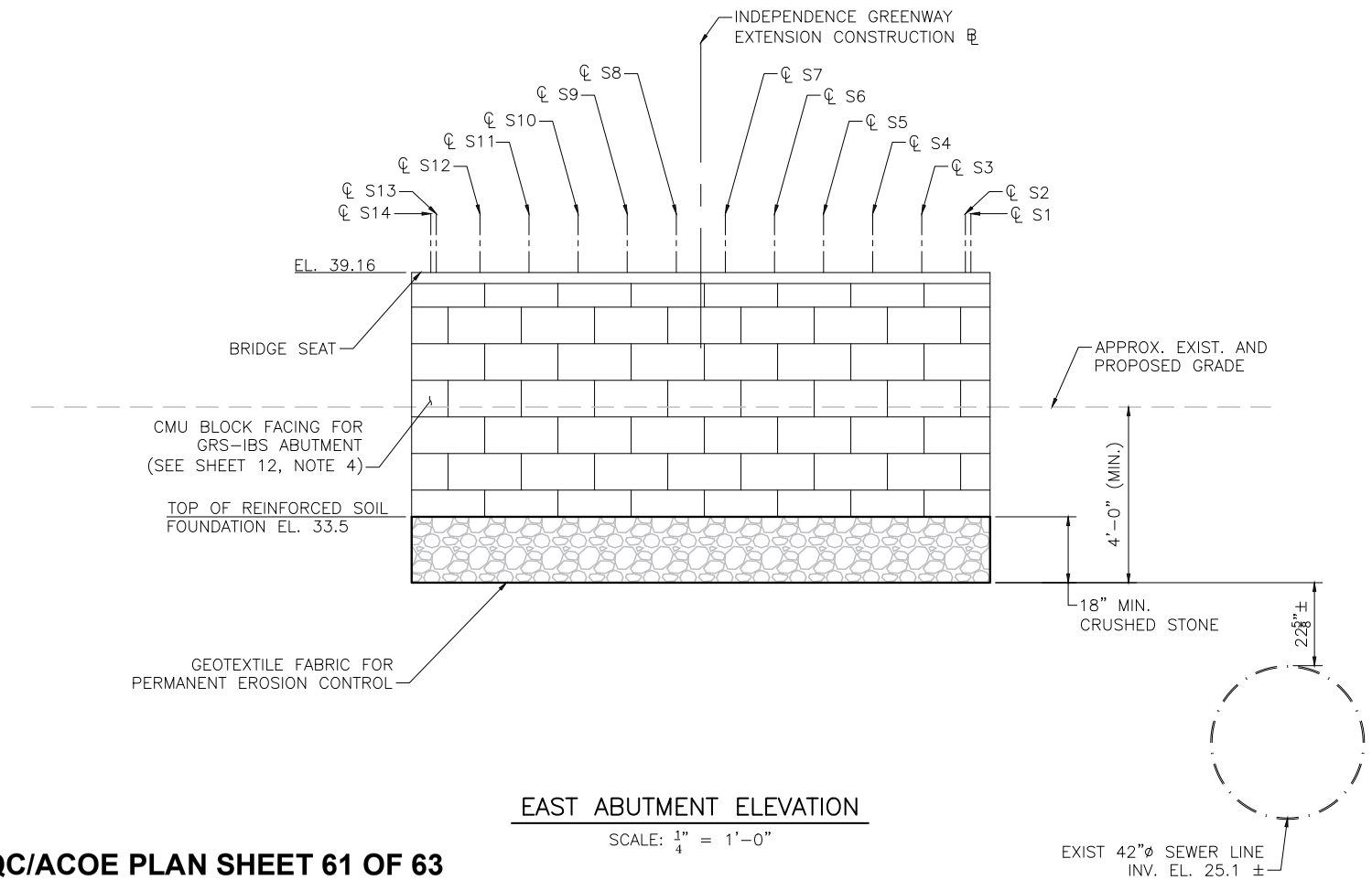


NOTE:

SOUTHEAST WINGWALL ELEVATION SHOWN AND NORTHEAST WINGWALL ELEVATION SIMILAR.

EAST ABUTMENT PLAN

SCALE: ¼" = 1'-0"

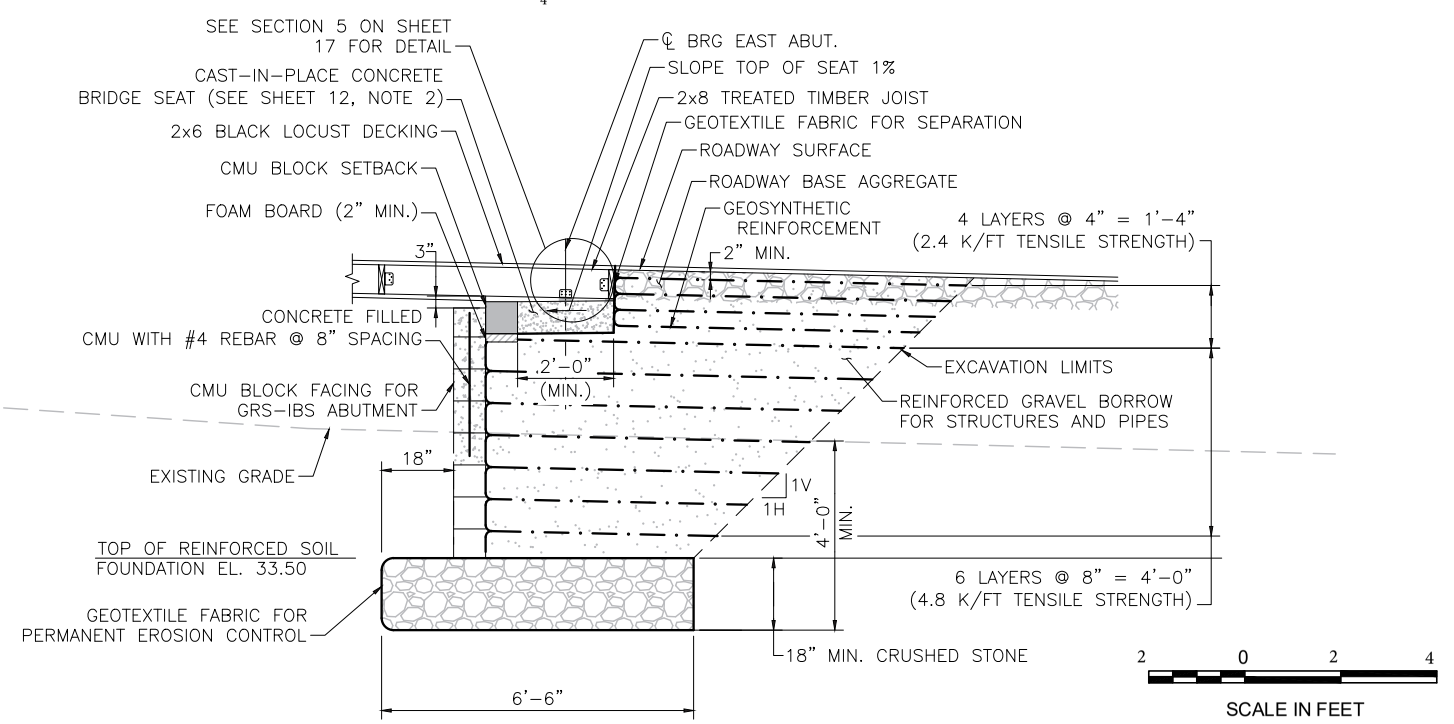


EAST ABUTMENT ELEVATION

SCALE: ¼" = 1'-0"

SOUTHEAST ABUTMENT WINGWALL ELEVATION

SCALE: ¼" = 1'-0"



2 0 2 4
SCALE IN FEET

EAST ABUTMENT SECTION

SCALE: ¼" = 1'-0"

NOTE:

SEE SHEET 12 FOR GRS-IBS ABUTMENT NOTES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

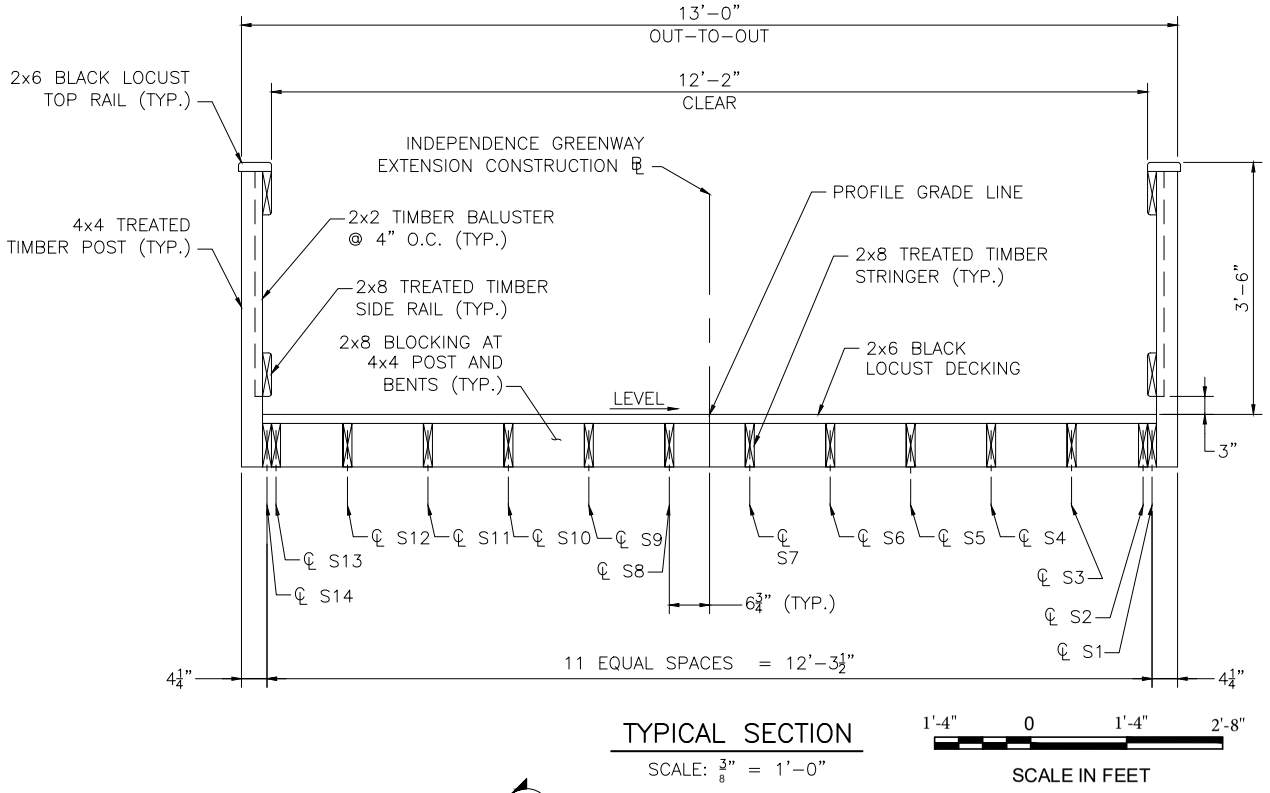
WQC/ACOE PLAN SHEET 61 OF 63

A00829 - 537

PEABODY
INDEPENDENCE GREENWAY EXTENSION

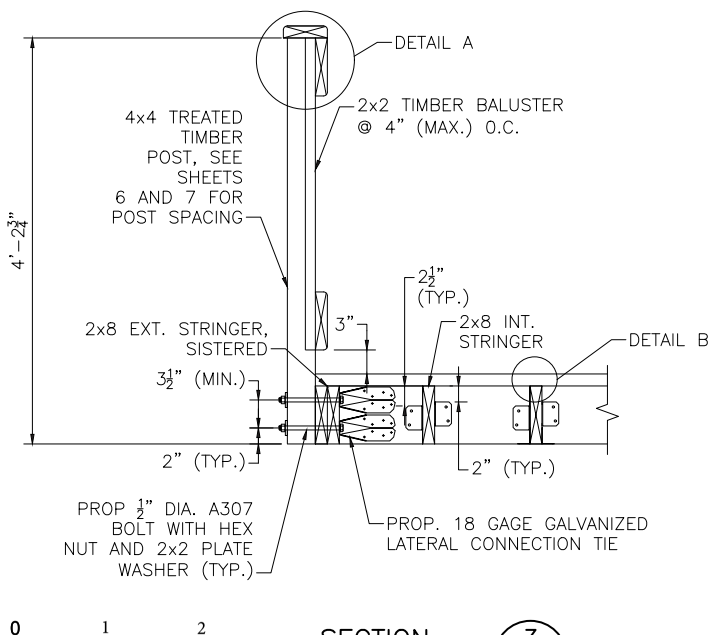
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	75	142
PROJECT FILE NO.	609211		

TYPICAL SECTION AND TIMBER CONNECTION DETAILS



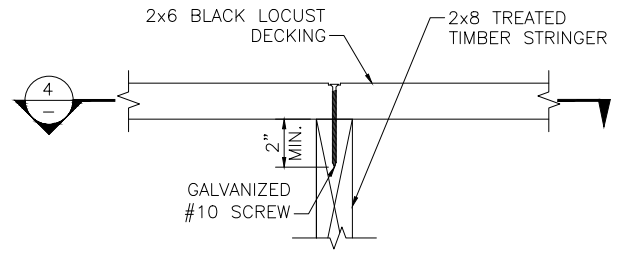
TYPICAL SECTION
SCALE: ⅜" = 1'-0"

1'-4" 0 1'-4" 2'-8"
SCALE IN FEET

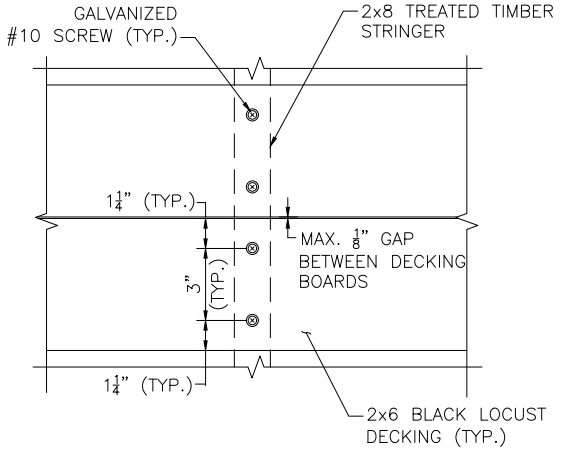


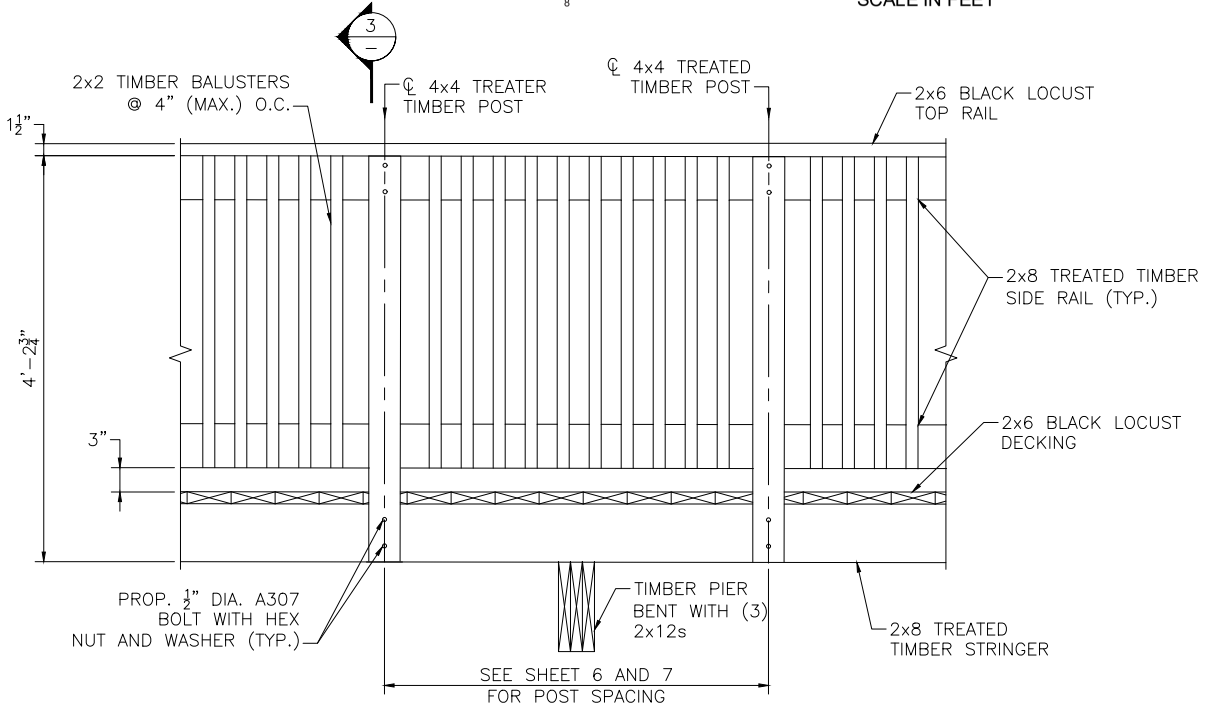
1 0 1 2
SCALE IN FEET

SECTION 3
SCALE: 1" = 2'-0"



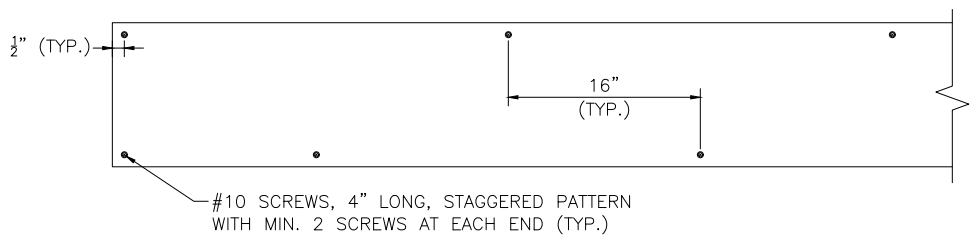
DETAIL B
SCALE: ½" = 1'-0"





RAILING ELEVATION
SCALE: 1" = 2'-0"

1 0 1 2
SCALE IN FEET

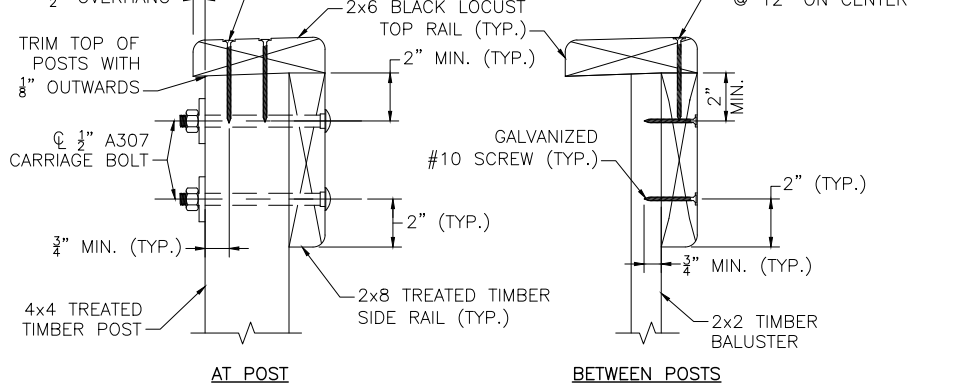


NOTES:

1. DETAIL SHOWN FOR PIER CAP ASSEMBLY, SISTERED EXTERIOR STRINGERS SIMILAR.
2. FOR CONNECTION OF 3 MEMBERS, SCREWS TO BE INSTALLED ON BOTH SIDES. FOR CONNECTIONS OF 2 MEMBERS SCREWS TO BE INSTALLED ON ONE SIDE

PIER CAP ASSEMBLY DETAIL
SCALE: ¾" = 1'-0"

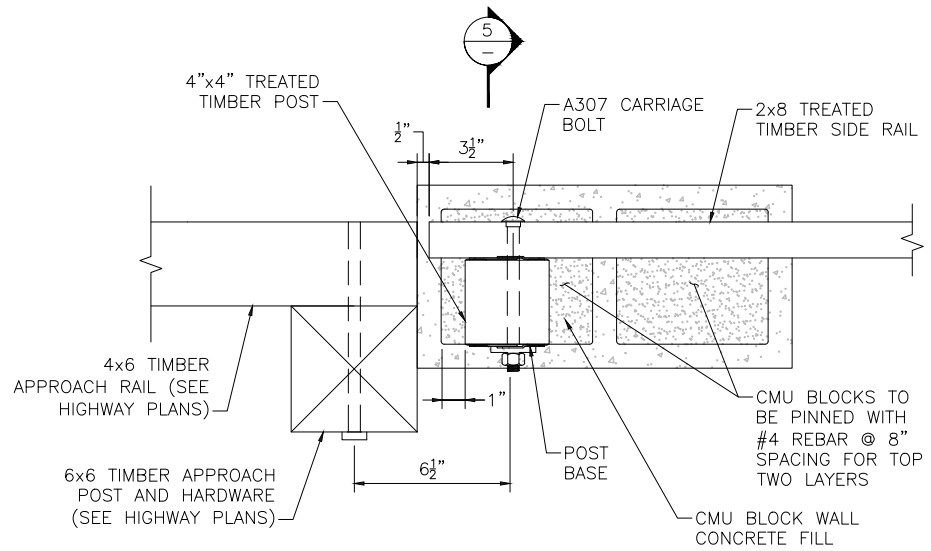
8" 0 8" 1-4"
SCALE IN FEET



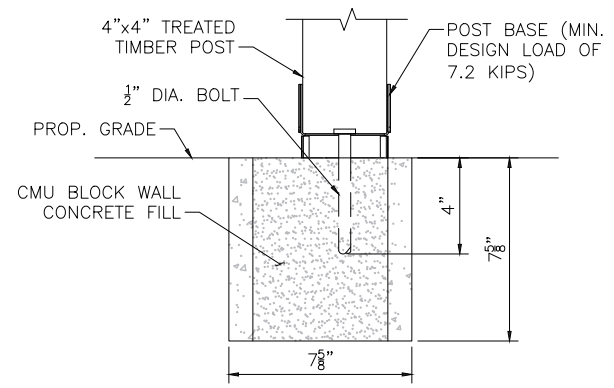
NOTE:
RUB RAIL CONNECTION NOT SHOWN BUT SIMILAR.

8" 0 8" 1'-4"
SCALE IN FEET

DETAIL A
SCALE: ½" = 1'-0"



RAILING POST IN CMU BLOCK PLAN
SCALE: ½" = 1'-0"



SECTION 5
SCALE: ½" = 1'-0"

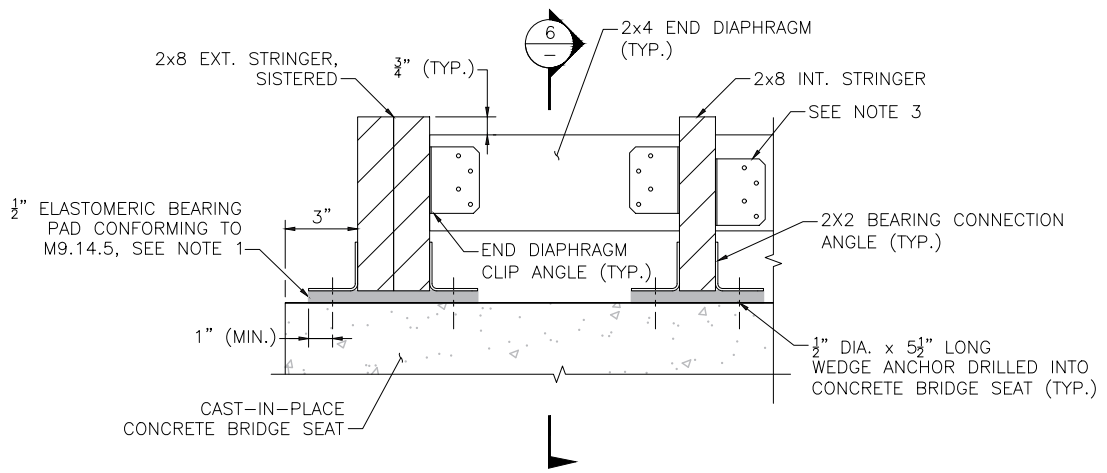
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	76	142
PROJECT FILE NO.	609211		

TYPICAL SECTION AND TIMBER CONNECTION DETAILS



NOTES:

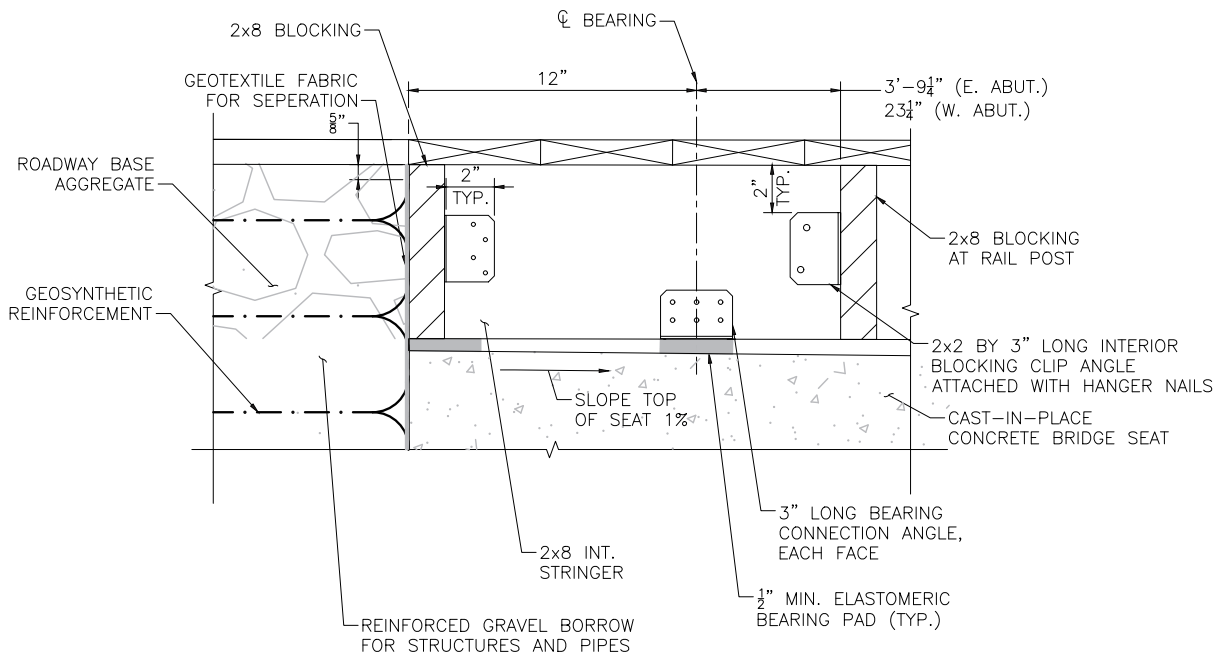
1. ELASTOMERIC BEARING PAD SHALL BE CUT TO SIZE TO MATCH THE PLAN VIEW LIMITS OF THE CONNECTION ANGLES AND STRINGER(S) IN BETWEEN.
2. TIMBER DECKING NOT SHOWN FOR CLARITY.
3. INTERIOR BLOCKING CLIP ANGLES STAGGERED UP TO ½" VERTICALLY AT EACH FACE OF STRINGER TO AVOID CONFLICT WITH SCREW INSTALLATION.

END DIAPHRAGM & BEARING ELEVATION

SCALE: 3/2" = 1'-0"

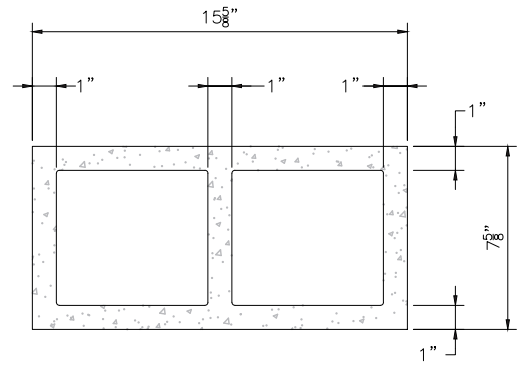
4" 0 4" 8"

SCALE IN FEET



SECTION 6

SCALE: 3/2" = 1'-0"



NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.

8" CMU PLAN VIEW

SCALE: 3/2" = 1'-0"

NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.

NOTES:

1. TIMBER DECKING NOT SHOWN FOR CLARITY.

STRINGER AT PIER BENT SUPPORT ELEVATION

SCALE: 3/2" = 1'-0"

4" 0 4" 8"

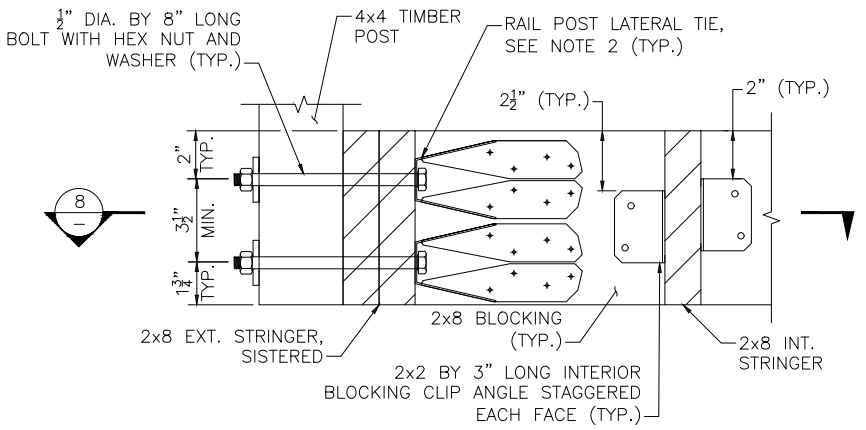
SCALE IN FEET

8" 0 8" 1-4"

SCALE IN FEET

SECTION 7

SCALE: 3/2" = 1'-0"



NOTES:

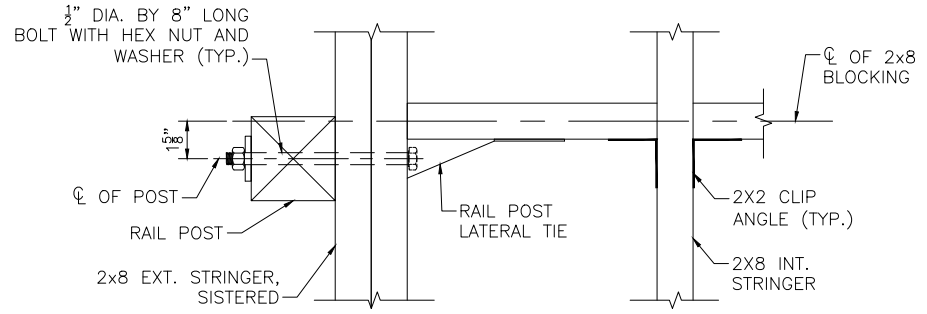
1. TIMBER DECKING NOT SHOWN FOR CLARITY.
2. LATERAL TIES SHALL BE STAINLESS STEEL, GALVANIZED, OR ZINC COATED. EACH TIE SHALL PROVIDE A MINIMUM LATERAL TENSILE CAPACITY OF 1,500 LBS.

RAIL POST CONNECTION TO STRINGER ELEVATION

SCALE: 3/4" = 1'-0"

TYPICAL CMU BLOCK ELEVATION

SCALE: 3/4" = 1'-0"



SECTION 8

SCALE: 3/2" = 1'-0"

CONNECTION HARDWARE GENERAL NOTES:

1. ALL CONNECTION COMPONENTS, OTHER THAN BOLTS, SHALL BE 33 KSI STAINLESS STEEL, GALVANIZED STEEL, OR ZINC COATED STEEL, UNLESS OTHERWISE SPECIFIED.
2. ALL CONNECTION COMPONENTS SHALL BE A MINIMUM OF 18 GAUGE STEEL.
3. ALL PROPOSED BOLTS SHALL BE EITHER ASTM A307 GALVANIZED BOLTS, OR ASTM SS316 STAINLESS STEEL BOLTS.
4. ALL WOOD OR LAG SCREWS SHALL BE GALVANIZED OR STAINLESS STEEL #10 BY 1½" LONG, UNLESS OTHERWISE NOTED.

WQC/ACOE PLAN SHEET 63 OF 63

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER	
USE ONLY PRINTS OF LATEST DATE	

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00830

ARMY CORPS OF ENGINEERS

Permit Application

*** THIS PAGE IS INTENTIONALLY LEFT BLANK ***

July 9, 2024

To:	Dan Vasconcelos, USACE (via daniel.b.vasconcelos@usace.army.mil)
Cc:	Heidi Davis, MassDEP (via heidi.davis@mass.gov) Tyler Lewis, MassDEP (via tyler.lewis@mass.gov) Ryan Hale, MassDEP (via ryan.hale@mass.gov) Erica Larner, MassDOT (via erica.n.larner@dot.state.ma.us) Cori Beckwith, MassDOT (via corinna.beckwith@dot.state.ma.us) Melissa Lenker, MassDOT (via melissa.lenker@dot.state.ma.us)
From:	Oxana Fartushnaya, Green International Affiliates, Inc. (via ofartushnaya@greenintl.com) Danielle Spicer, Green International Affiliates, Inc. (via dspicer@greenintl.com)
Date:	July 9, 2024
Project Name:	Independence Greenway Extension, Peabody, MA
Project Number:	Green No. 17118
Subject:	**Response to ACOE Review letter for 404 PCN Application No. NAE-2024-01390**

This memorandum provides the responses to ACOE Additional Info Review letter for 404 PCN Application No. NAE-2024-01390.

Responses to each technical review comment are noted below in **Bold.**

1. "Appendix B – Wetland Delineation Report with Data Forms" was missing from the application. Please provide the report and forms.

Appendix B – Wetland Delineation Report with Data Forms is included as an attachment to this memo.

2. Please provide photographs of the inlet and outlet of the 24" CMP connecting Wetland V and Proctor Brook at Sta. 342+20.

Below is a photo of the outfall of the hydrologic connection between Wetland V and Proctor Brook, on the Proctor Brook side at approximately Sta. 242+20. Please note this is not a stream crossing but a hydrologic connection only.

Existing 24” CMP Culvert outlet on a Proctor Brook side (Sta. 342+20 north)

3. The shading for permanent and temporary waterway impacts appears to be reversed on some sheets (see impact plan sheets 5-7). Please revise as necessary.

The permanent and temporary waterway impacts hatching has been revised on all WQC/ACOE impact sheets. The revised WQC/ACOE Impact Plans Sheets 1-8 are included as an attachment to this letter.

4. Detail sheets were only provided for two culverts and the boardwalk. Please provide cross-section and profile views for the three remaining culverts, at Sta. 340+10, 342+20, and 358+50.

Attached please find the cross-section and profile views sheet for the embedded 36” culvert at Sta. 340+10 conveying intermittent stream beneath the proposed bikepath.

The existing 15” RCP and 24” Corrugated Metal Pipe (CMP) culverts are not perched as can be seen in photos included in response to #2 (24” CMP at Sta 342+20) as well as a photo below for the views of 15” Reinforced Concrete Pipe (RCP) at Sta 358+50. The proposed 16” DIP and 24” DIP invert elevations at both inlet and outlet will match existing invert elevations. The revised impact plans are attached to these responses.

The existing 24”at Sta 342+20 does not convey a stream and it does not have an OHW line going through it. This culvert conveys a hydrological connection between a wetland V-series and Proctor Brook. As noted above, it will be replaced in-kind. The OHW mark associated with Proctor Brook exists only at the outlet side of this culvert where we propose stone for pipe ends within the brook (see screenshot below). The flow direction is from wetland V-series to Proctor Brook, so there would not be any OHW in that culvert and the stone for pipe ends will be places exactly to match the existing surface elevations within a riverbed, as noted in our Application.

As noted in the Application, the existing 15-inch RCP culvert conveying the intermittent stream at Sta. 358+50 is proposed to be replaced with a 16-inch Ductile Iron Pipe (DIP) to be able to support the H-20 vehicle loading with a shallow depth of cover.

Existing 15” RCP Culvert inlet (Sta. 358+50 south)

Existing 15” RCP Culvert outlet (Sta. 358+50 north)

Existing 15” RCP Culvert beneath the existing abandoned railroad (Sta. 358+50)

5. The Ordinary High Water (OHW) mark should be shown extending through the culverts for all streams, including those at Sta. 340+10 and 358+50, and impacts to the stream within the culverts calculated. Note that my supervisor typically considers replacing a culvert to result in permanent discharges of fill.

The plans have been revised to show the Ordinary High Water (OHW) mark extending through the culverts for all streams, including those at Sta. 340+10 and 358+50, and added callouts for the OHW elevations at each culvert. Additionally, the plans have been revised to show the permanent ACOE impacts to WOTUS extending through the culverts at Sta. 340+10 and 358+50. The revised table of WOTUS impacts is included below in Response #7.

6. On impact plan sheet 6, on the south side of the road at the culvert at Sta. 340+10, there appears to be an unshaded area of rip-rap below the OHW mark of the intermittent stream. If there is rip-rap being placed in this location it should be shaded as a permanent impact. Please confirm and revise the plans and impact calculations as necessary.

At Sta. 340+10, the riprap at the inlet of the culvert within the intermittent stream is within a wetland and will result in filling of the wetland. This area was inadvertently not included as VW impacts; but the WQC/ACOE impact plans have been revised to include this area as permanent VW impacts. The revised table is included below and the revised WQC/ACOE plans are included as an attachment to this letter.

Wetland Area Series (STA. #)	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)
Z (STA. 329+85)	264	245
Y (STA. 329+85)	447	58
V (STA. 340+10)	293	122
V (STA. 342+20)	183	435
V (STA. 346+20)	914	216
E (STA. 346+20)	126	72
E (STA. 346+90)	117	66
X (STA. 352+00)	6	3,461
Total	**2,350**	**4,675**

7. On impact plan sheet 7, the stream impacts do not appear to match those in Table 5.2. At Sta. 345+50, Table 5.2 indicates there are 13 square feet of permanent and 72 square feet of temporary impact. I am unable to find these impacts called out on the plans. The plans also have a callout for 151 square feet of temporary impact at Sta. 346+20 that is not found in Table 5.2. Please review and ensure the impacts in the table and on the plans agree.

The callout at Sta. 345+50 on WQC/ACOE Impacts Plan Sheet 7 has been revised. Additionally, as part of addressing MassDEP comments, the riprap within LUW/WOTUS at Culvert No. 1 at Sta. 329+85 has been reduced. The revised Table 5.2 with updated LUW/WOTUS impacts is shown below

with updated numbers shown in red and revised WQC/ACOE impacts plans are included as an attachment to this letter.

Table 5.2: LUW/WOTUS Impacts

Resource Area	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)	Dredge Volume (cy)
STA. 329+85*	6,309	1,107	1,210
STA. 340+10	151	32	16
STA. 342+20	79	64	12
STA. 345+50	13	72	-
STA. 346+20	1,474	283	241
STA. 351+50	305	550	12
STA. 358+50	345	202	--
Total	**8,676**	**2,310**	**1,491**

* impacts at station 329+85 were previously updated as part of the response to DEP's technical deficiency letter on 6/11/2024

8. On impact plan sheet 8 there are linear "bank" impacts at intermittent stream X. It appears there may be areas of grading and/or rip-rap below the OHW mark of this stream. Is there a corresponding area of impact (in square feet) below OHW in these locations? If so, these impact areas should be calculated, shaded, and called out on the plans.

The WQC/ACOE impact plans have been revised to include this area as permanent ACOE impacts to WOTUS. The revised table is included above in response #7 and the revised WQC/ACOE plans are included as an attachment to this letter.

9. Temporary impacts to wetlands and below OHW are depicted on the plans associated with the pile-supported boardwalk. In non-navigable waters Corps jurisdiction is limited to discharges of fill pursuant to Section 404 of the Clean Water Act. It is unclear from the plans what fills are causing the impacts associated with the boardwalk. Please clarify the nature of these impacts. The specifications mention temporary mats will be used. If mats are to be used and are the source of the temporary impacts, they should be labeled on the plans.

The 6 square feet of permanent BVW impacts for the boardwalk are associated with the installation of the approximately 2.5-inch diameter helical piles within the wetland. The 305 square feet of permanent LUW/WOTUS impacts are associated with the installation of the approximately 2.5-inch diameter helical piles within Proctor Brook as well as the placement of riprap within Proctor Brook at the start of the boardwalk to protect the bank and the pedestrian path at the bend of Proctor Brook in this area. The timber matting is to be used within the limits of the proposed boardwalk within the wetland area. A note has been added to the Construction Plan and Profile – 7 as well as the WQC/ACOE impacts plans to clarify, which are both included as attachments to this letter.

10. There appears to be a FEMA Floodway associated with Proctor Brook. To assist with our required FEMA coordination, at a minimum we need a statement on whether or not the project will result in

any increase in the base flood elevation (BFE) or alter the existing floodway delineation. If a Hydraulic Study Report/No-Rise Analysis was produced, please provide a copy.

The Hydraulic and Scour Study was performed by Green International Affiliates, Inc. (Green) for MassDOT for Proctor Brook along the Independence Greenway Extension in Peabody, MA. As found and explained in the study, the project implementation will neither result in any increase to the waterway's Base (100-year) Flood Elevation (BFE) profile, nor necessitate alteration of the waterway's floodway delineation, anywhere within the affected community. See Section 5.0 CONCLUSIONS in the attached Hydraulic and Scour Analysis Summary Report, dated November 2023.

11. IPaC now lists the tricolored bat (Proposed Endangered) as potentially present at the project site. Please state the lead federal agency's (FHWA or MassDOT on behalf of FHWA) effect determination for this species and provide documentation of any coordination that was completed with USFWS.

The Tricolored Bat (*Perimyotis subflavus*) species is only proposed to be endangered, as the USFWS has not made a determination on the uplisting and is currently under review. It is expected that they will make a determination this summer. If they determine the species warrants listing under the ESA we would then consult with the USFWS for Tricolor on any project in construction with potential stressors on the species in its range, as well the ad program going forward. But at this time, no official determination can be made for a species that's not listed.

Enclosed with this letter response are the following documents:

- Appendix B – Wetland Delineation Report with Data Forms
- Revised WQC/ACOE Impact Plan (Sheets 1-8)
- Culvert Cross Section Sheet for Culvert at Sta 340+10
- Construction Plan and Profile -7
- Hydraulic and Scour Analysis Summary Report, dated November 2023

\\Egnytedrive\Greenintl\Shared\Engineering\Projects\2017\17118\Documents\ENV\ACOE\ACOE PCN Comments\Responses To 20240610_ADDINFO_NAE-2024-01390 - Peabody.Docx

October 12, 2022

To:	Danielle Spicer, P.E.
Cc:	Oxana Fartushnaya
From:	Brandon Faneuf, PWS
Date:	October 12, 2022
Project Name:	Peabody Bikeway Extension, Peabody, MA
Project Number:	Green No. 17118.0228
Subject:	Wetland Description

Introduction

This memo is to describe the types and extents of wetlands and wetland jurisdictional areas at the above-referenced site (Site). Wetland delineation work was originally performed on February 15, 2018 in conformance with the Massachusetts Wetlands Protection Act (MGL c. 131, §40)(WPA) and its Regulations (310 CMR 10.00). The site was reflagged, and the wetland boundaries were reconfirmed in 2022. Peabody has promulgated a local Wetlands & Rivers Protection Ordinance (The Ordinance) and Wetlands and Rivers Protection Regulations (Chapter 32) that exceed jurisdictional areas and performance standards of the WPA and 310 CMR 10.00. The project site is between Yankee Division Highway and Endicott Street, following the unfinished portion of the Independence Greenway bike trail and parallel to Proctor Brook.

Area of Interest (AOI)

The area between Yankee Division Highway and Endicott St., along Proctor Brook as referenced above, was investigated for wetland resource areas. To ensure that all potential jurisdictional areas that may extend onto the Area of Interest (AOI) were located and defined, all land within 200 feet of the AOI was investigated to the best possible extent while respecting private property rights.

The area of the AOI is heavily disturbed with a variety of developments and infrastructure. Along Proctor Brook, there is a historic railroad that is now decommissioned (i.e. the proposed Independence Greenway bike path). Left in its place is fill and grading that has affected the flow of the river and its floodplain. On either side of Proctor Brook there are housing developments including condominiums and single-family dwellings. Yankee Division Highway runs directly through the AOI in the western part. As a result of the historic disturbance, there is very little natural area left in the AOI and invasive, non-native plant species dominate much of the area.

Wetland Resource Areas

Wetland Resource Areas exist on either side of Yankee Division Highway adjacent to both Essex Center Drive and Northshore Road as well on either side of the abandoned railway between Northshore Road and Endicott Street. Wetlands revolve around a perennial stream, Proctor Brook, that flows west-to-east through the AOI and into a pond that exists to the southeast. Per 310 CMR 10.00 and the Ordinance, Proctor Brook is a perennial river and receives a two-hundred foot (200') Riverfront Area (RFA).

Multiple Bordering Vegetated Wetlands (BVW/BVW's) exist along the southern and western banks of Proctor Brook. These BVW's are delineated separately but are all hydrologically connected, mainly through Proctor Brook. Each alpha-numerically delineated section of BVW retains a one-hundred foot (100') buffer zone per 310 CMR 10.00 and the Ordinance.

The wetland types on site:

- Inland Bank- same as the mean annual high-water (aka bankfull conditions) mark, as delineated in the field with the 'MAHW' flags. This represents the first observable break-in-slope along the bank of the Brook.

- Land Under Waterbodies & Waterways- land between the two (2) mean low water marks (currently underwater and not flagged in the field).

- 200' Riverfront Area ("RFA") of the River. The inner boundary of the RFA is represented by the 'MAHW' flags along the Inland Bank. The RFA extends perpendicularly from the 'MAHW' flags without regard for topography.

- Bordering Vegetated Wetland ("BVW"), as delineated in the field with 'A', 'B', 'C', 'E', 'V', 'Y', and 'Z' series flags. These flags represent the edge of the BVW where it changes to from vegetated wetland to upland. Per 310 CMR 10.00 and The Ordinance, these receive 100' buffer zones.

- Bordering Land Subject to Flooding ("BLSF") associated with the River. This is the 100 year floodplain as delineated by FEMA (see attached FEMA Firmette). This follows Proctor Brook in the AOI.

Soils in the area consist of fine sandy loams and loamy sands on 0-8% slopes. The topography in the area is generally flat with land rising as it gets farther from Proctor Brook.

Table 1. Wetland Resource Areas

Flag Series	Wetland Type	Approx. Location
A1-A14 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Northwest of Independence Greenway and southwest of the parking area associated with Lahey Medical Center.
B1-B10 (pink flags)	N/A	Drainage ditch to between Independence Greenway and Yankee Division Highway.
C1-C7 (pink flags)	N/A	Drainage ditch between Northshore Road and Garden Road.
E1-E12 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Travels east-to-west along the northern bank of Proctor Brook south of the Peabody Municipal Light Plant.
V1-V17 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the southern bank of Proctor Brook and travels west. Located northeast of Jennifer Lane.
W1-W4 (blue flags)	Bank of Intermittent Stream w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Makes a semicircle adjacent to Endicott Street and south of Proctor Brook.
X1-X11 (blue flags)	Bank of Intermittent Stream w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off MAHW-11 and travels east along the southern portion of the AOI to Endicott Street.
Y1-Y7 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the southern bank of Proctor Brook and travels east. It is located north of Castle Circle. Starts at the end of the MAHW1-MAHW87 series.
Z1-Z8 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the northern bank of Proctor Brook and travels west. Located southwest of the condominium development, "Terrace Estates."

MAHW1-MAHW87 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins at Endicott Street and travels northwest. It delineates the southern Bank of Proctor Brook in the eastern portion of the AOI.
MAHW101-MAHW138 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins off of Warren Street Extension directly south of the Peabody Municipal Light Plant and travels northwest. It delineates the northern Bank of Proctor Brook.
MAHW201-MAHW230 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins off of Northshore Road and travels southeast. It delineates the northern Bank of Proctor Brook.

Other Resources

A search of other critical resources within the project area was conducted using GIS software and data available through various governmental agencies (FEMA, DEP, and others). The results of our search are listed in the table below.

Table 2. Selected MASSGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓[1]
NHESP Potential Vernal Pool		✓
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones (BLSF)	✓[2]	
Surface Water Protection Area		✓
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area		✓
Zone II Wellhead Protection Area		✓
Mass DCR Designated Coldwater Fisheries		✓

1. A NHESP Certified Vernal Pool exists just outside of the AOI to the southeast. It is located to the southwest of the intersection of the railroad right-of-way and Yankee Division Highway.
2. BLSF closely follows Proctor Brook in the area of the AOI (see attached Figures 5, 6, & 7).

Regulatory Jurisdiction

The wetland resource areas described above are regulated by the Massachusetts Department of Environmental Protection (DEP), through the Peabody Conservation Commission. The City of Peabody has its own City of Peabody Wetlands & Rivers Protection The Ordinance (The Ordinance) and Peabody Conservation Commission Bylaw (Bylaw).

View of Proctor Brook Looking Downstream (west) from Endicott Street

View of X-Series Intermittent Stream

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 1 & 2

View of Proctor Brook Looking Upstream (east) from Northshore Road

View of C-Series Drainageway Looking Southeast

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 3 & 4

View Looking Across Proctor Brook North-to-South near the Z-Series BVW

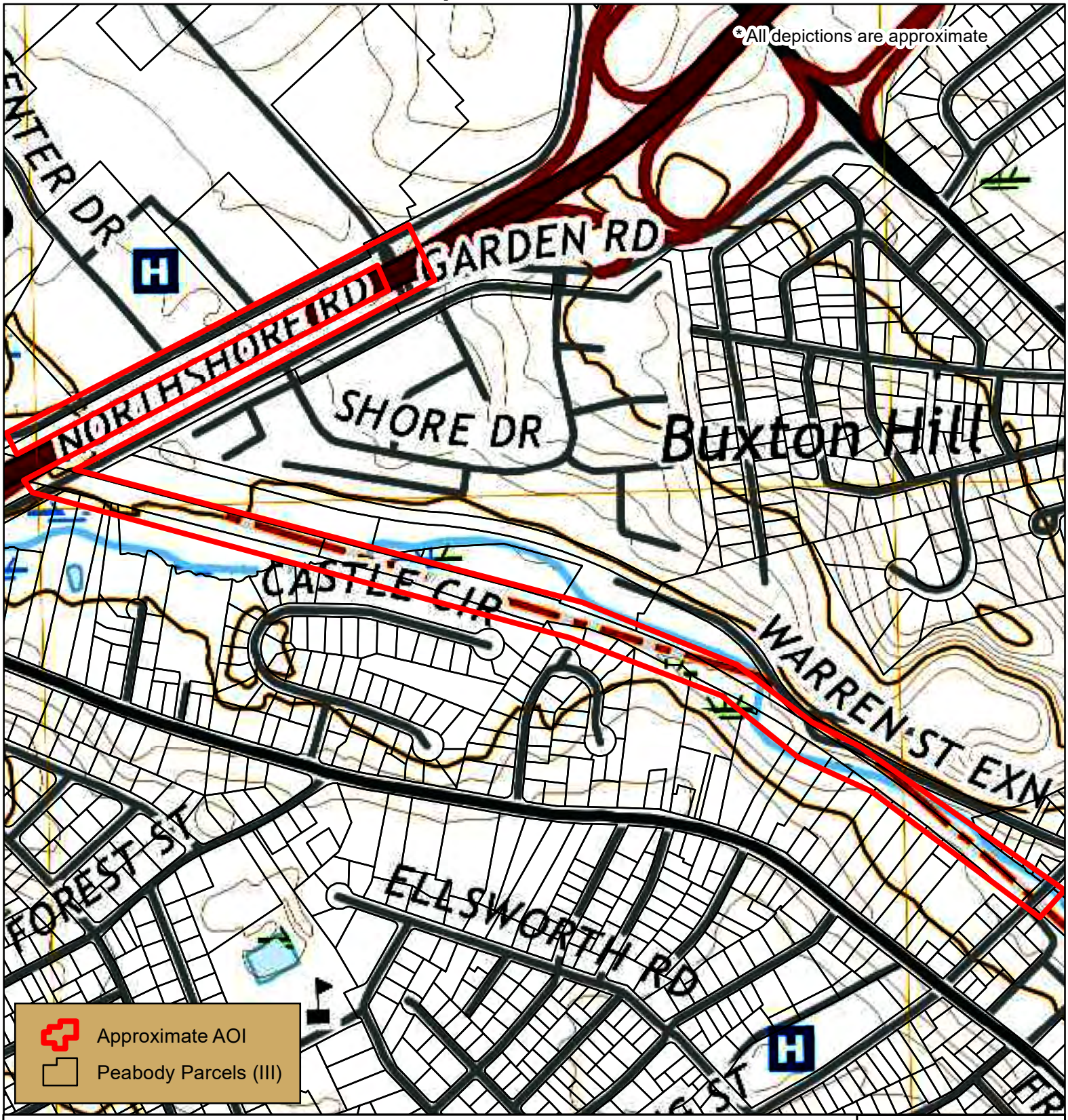
View of Typical Forest Interior Inside of the AOI

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 5 & 6

View of Phragmites Marsh Inside of MAHW-300 Series

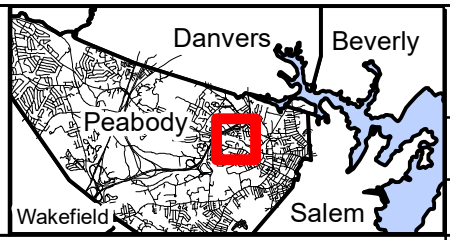
View of B-Series Drainageway Looking Northeast

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 7 & 8



Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 1



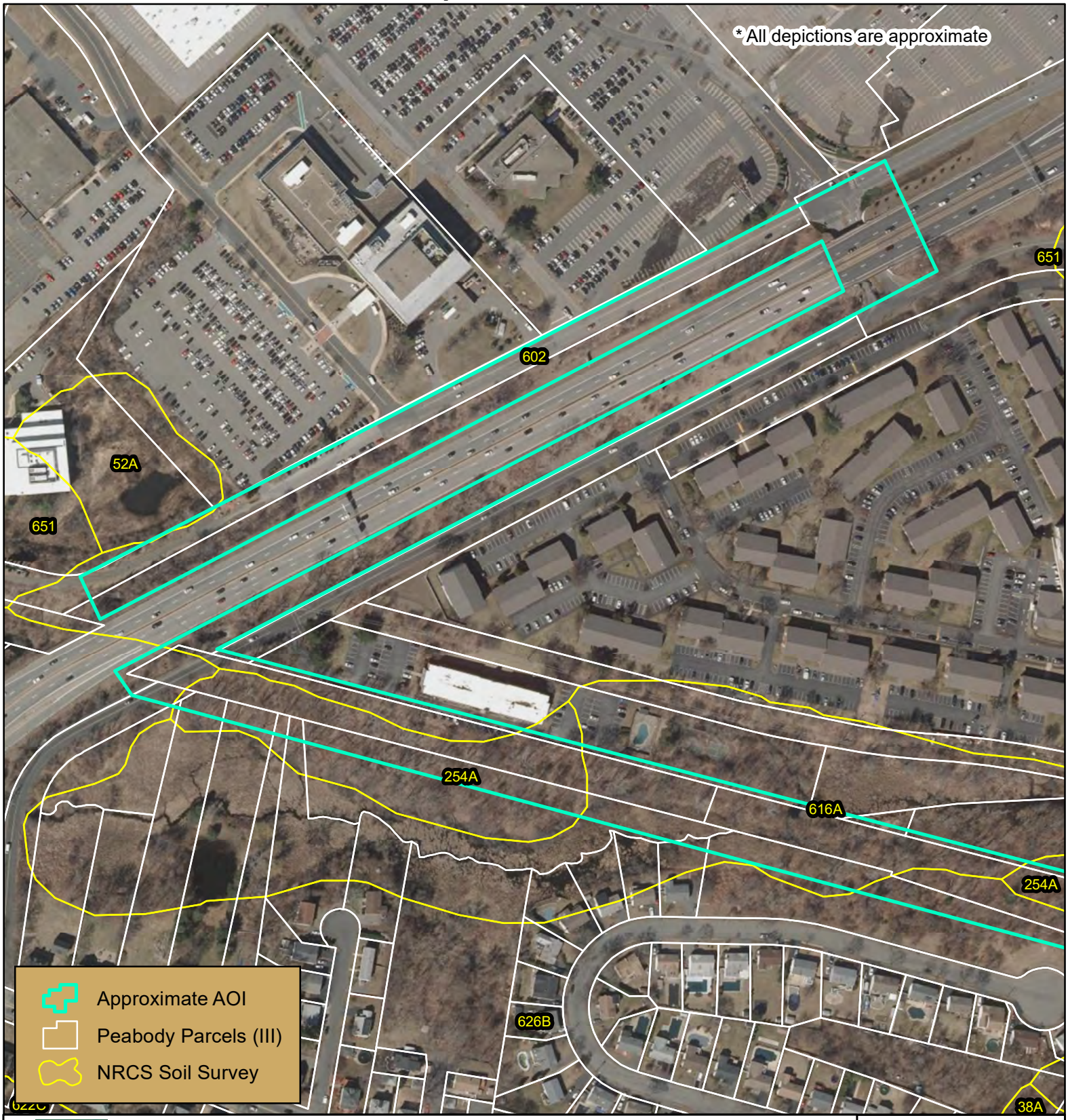
USGS Topographic Map
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 500 feet

Salem Quadrant (2021)

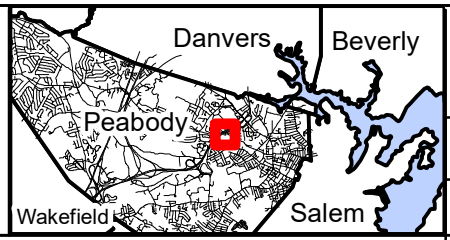
MASS GIS

0 250 500 1,000 1,500 Feet



Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 2



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

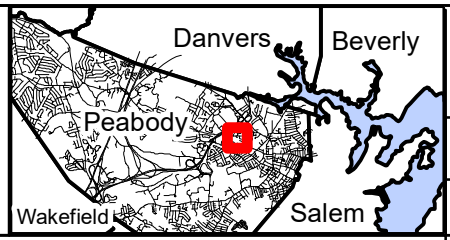
Aerial Orthophoto (2019)

MASS GIS

0 125 250 500 750 Feet

Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 3



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

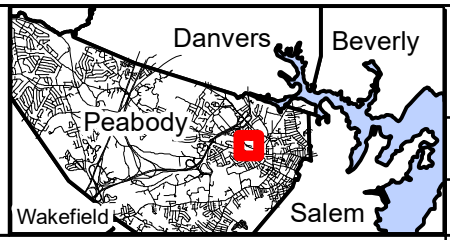
Aerial Orthophoto (2019)

MASS GIS

0 125 250 500 750 Feet

Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 4



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

Aerial Orthophoto (2019)

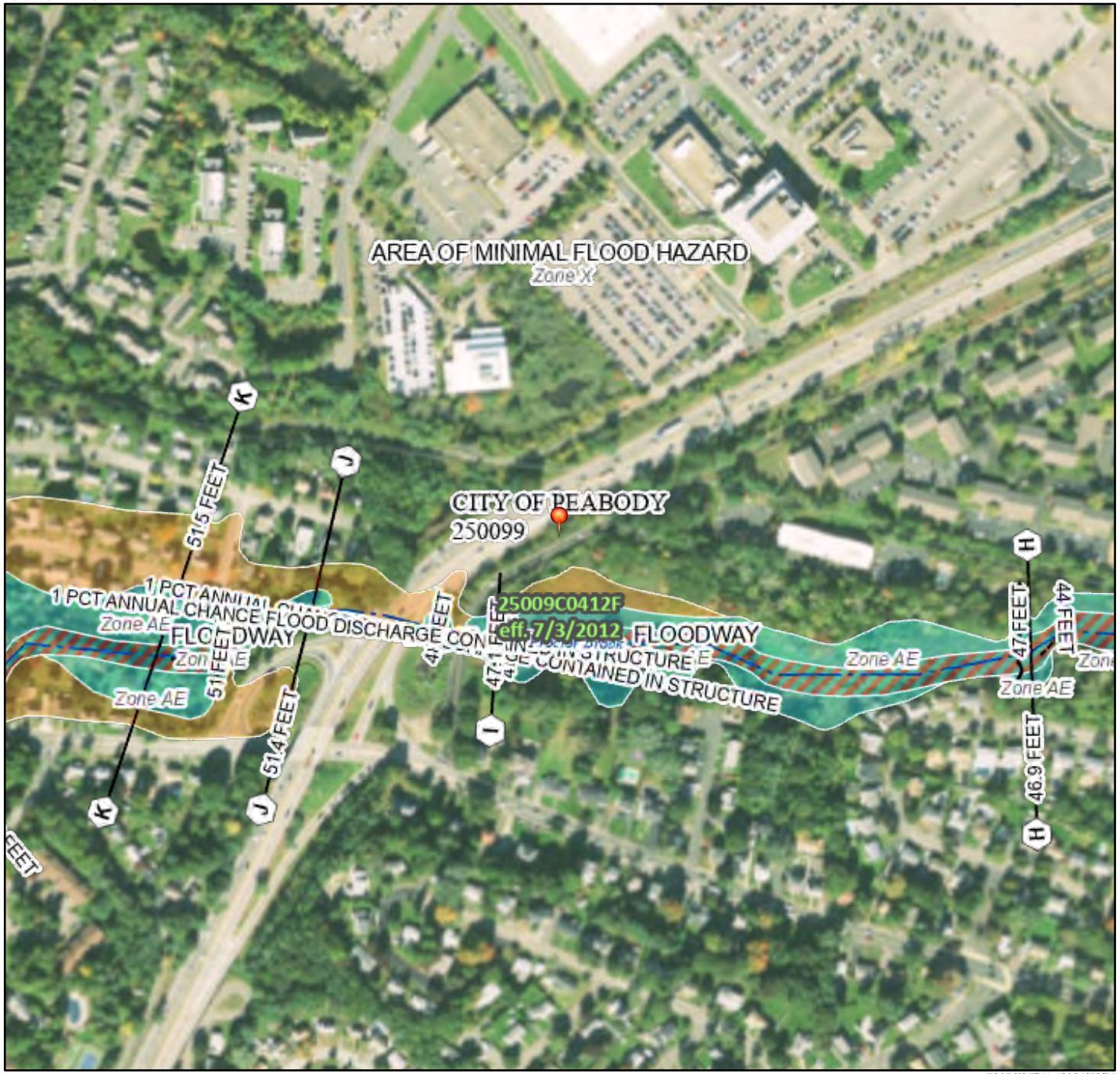
MASS GIS

0 125 250 500 750 Feet

National Flood Hazard Layer FIRMette

FEMA

70°57'13"W 42°32'20"N



70°56'35"W 42°31'53"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

Figure 5

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:07 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

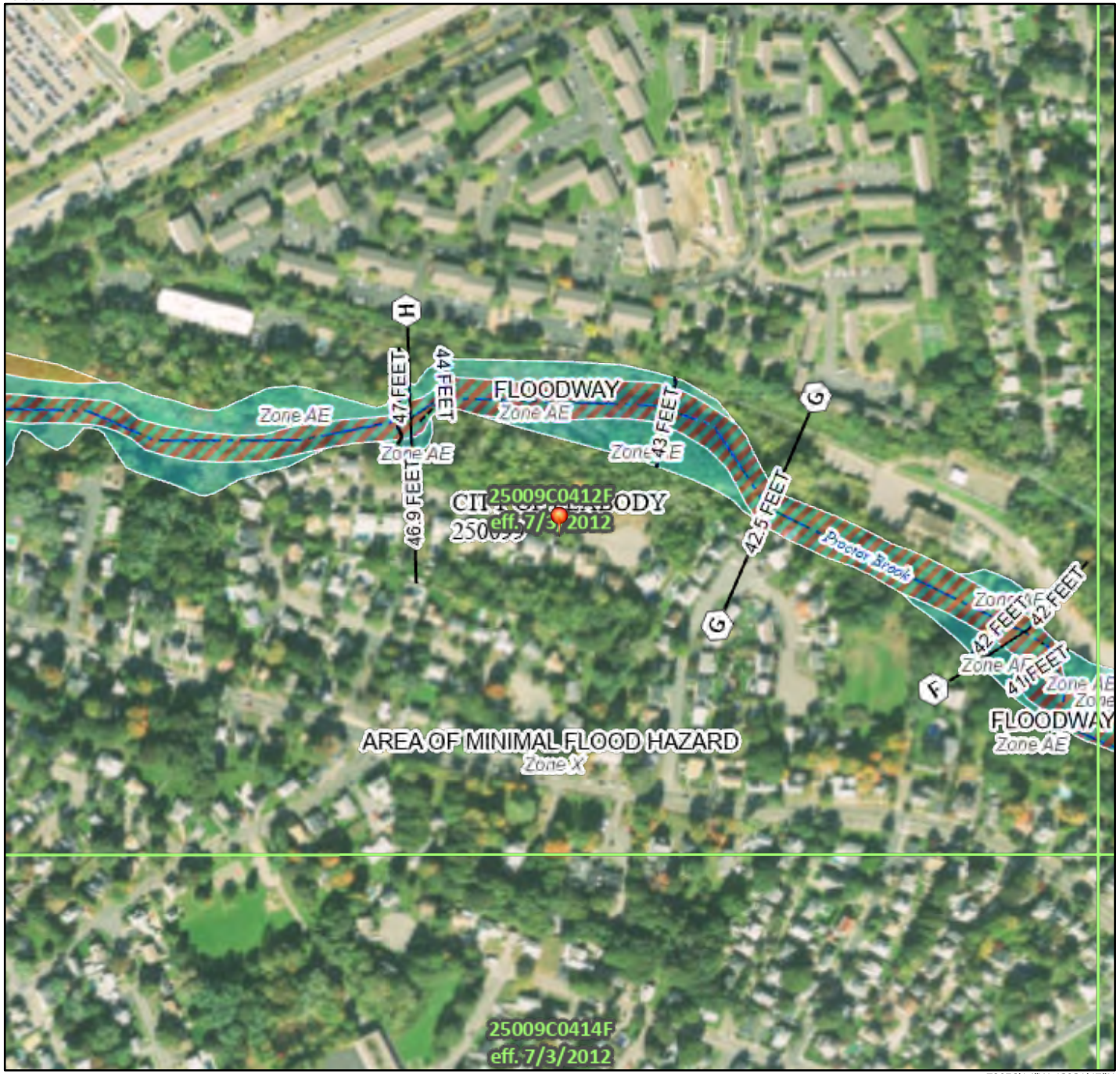
Proposal No. 609211-132091

A00830 - 22

National Flood Hazard Layer FIRMette

FEMA

70°56'52"W 42°32'14"N



70°56'14"W 42°31'47"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend FIGURE 6

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:05 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

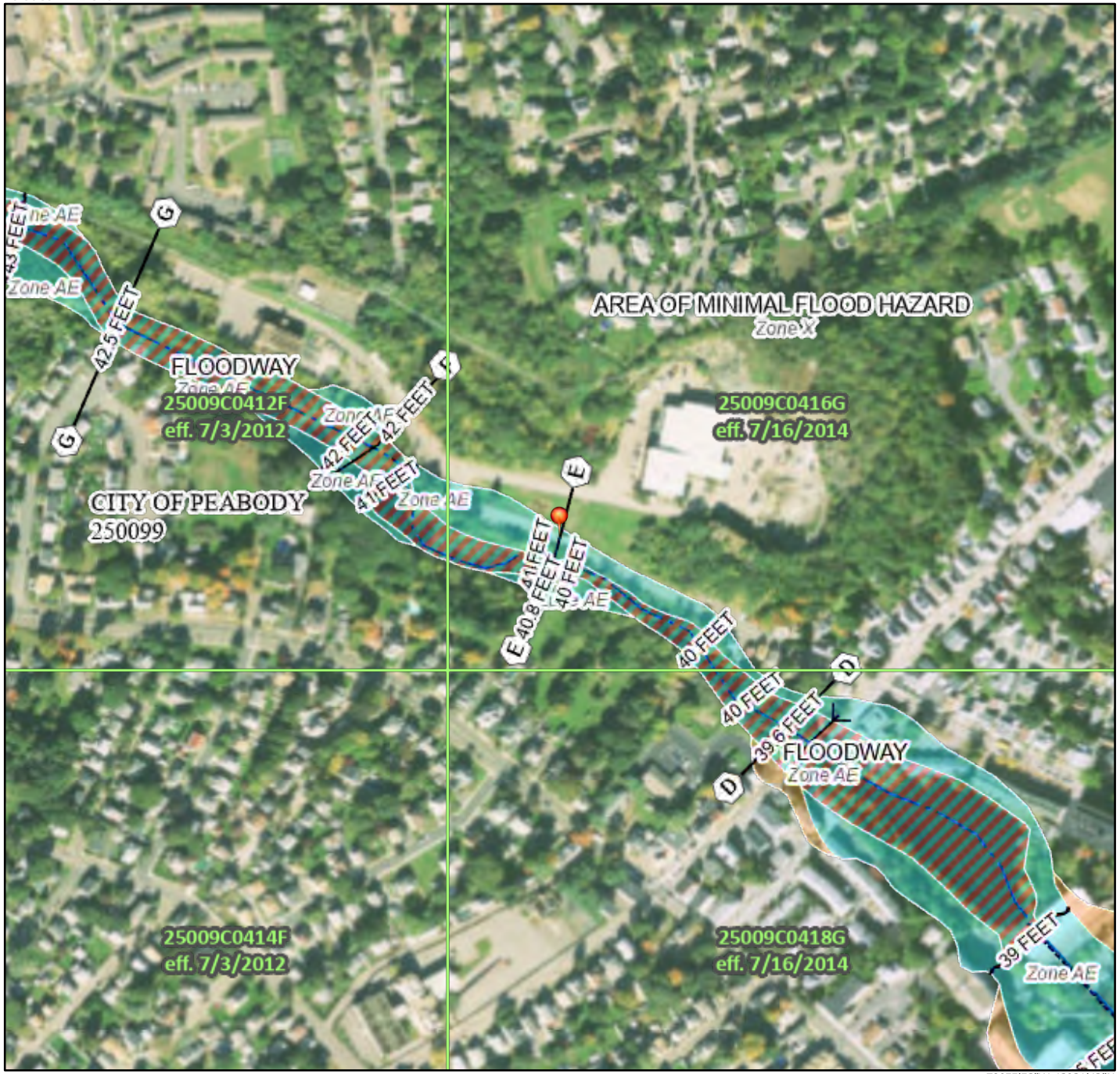
Proposal No. 609211-132091

A00830 - 23

National Flood Hazard Layer FIRMette

FEMA

70°56'30"W 42°32'9"N



70°55'53"W 42°31'43"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

FIGURE 7

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:06 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00830 - 24

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **A-8**		Transect Number: **Upland**	Date of Delineation: **10/5/2022**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Crabapple/*Pyrus malus*	38.0%	100.0%	YES	UPL
Shrub Layer:				
Staghorn Sumac/*Rhus typhina*	63.0%	75.0%	YES	UPL
Red-Osier Dogwood/*Cornus stolonifera*	20.5%	25.0%	YES	FACW+*
Groundcover:				
Canada Goldenrod/*Solidago canadensis*	10.5%	100.0%	YES	FACU

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **1** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00830 - 26

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions: **52A Freetown Muck, 0-1% slopes**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oe	**0-2”**	**10YR 3/2 fine sandy loam**	
A	**2-6”**	**10YR 3/3 fine sandy loam**	
Bw	**6-20”**	**10YR 5/6 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____
Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **A-8**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Northern White Cedar/*Thuja occidentalis*	38.0%	100.0%	YES	FACW*
Shrub Layer:				
Speckled Alder/*Alnus rugosa*	38.0%	50.0%	YES	FACW+*
Red-Osier Dogwood/*Cornus stolonifera*	38.0%	50.0%	YES	FACW+*
Groundcover:				
Common Reed/*Phragmites australis*	85.5%	100.0%	YES	FACW*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00830 - 28

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions: **52A Freetown Muck, 0-1% slopes**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa1	**0-13"**	**N 2/0 sapric muck**	
Oa2	**13-20"**	**7.5YR 4/4 & 10YR 2/1 sapric muck**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ **Site Inundated**: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **B-6**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Crabapple/*Pyrus malus*	10.5%	22.0%	YES	UPL
Eastern White Pine/*Pinus strobus*	38.0%	78.0%	YES	FACU
Shrub Layer:				
Staghorn Sumac/*Rhus typhina*	38.0%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-10”**	**10YR 3/4 fine sandy loam**	
Bw	**10-20”**	**10YR 5/5 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____
Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **B-6**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Shrub Layer:				
Red-Osier Dogwood/*Cornus stolonifera*	38.0%	100.0%	YES	FACW+*
Groundcover:				
Cinnamon Fern/*Osmunda cinnamomea*	10.5%	34.0%	YES	FACW*
Sensitive Fern/*Onoclea sensibilis*	20.5%	66.0%	YES	FACW*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **3** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00830 - 32

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa	**0-5"**	**10YR 2/1 sapric muck**	
A	**5-20"**	**10YR 3/1 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ **Depth to soil saturation in observation hole**: **@ surface**
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **C-4**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Eastern Red Cedar/*Juniperus virginiana*	10.5%	100.0%	YES	FACU
Groundcover:				
Manicured Lawn	85.5%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **1**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-7”**	**10YR 4/2 fine sandy loam**	
Bw	**7-20”**	**10YR 5/3 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__**X**__
Wetland hydrology present:		
Hydric soil present	____	__**X**___
Other indicators of hydrology present	____	__**X**___
Sample location is in a BVW	____	__**X**___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **C-4**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Groundcover:				
Manicured Lawn	63.0%	75.0%	YES	UPL
Tussock Sedge/*Carex stricta*	20.5%	25.0%	YES	OBL*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **1** Number of dominant non-wetland indicator plants: **1**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa	**0-20"**	**10YR 2/1 sapric muck**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ **Site Inundated**: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **E-7**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Norway Maple/*Acer platanoides*	38.0%	78.0%	YES	UPL
Eastern Red Cedar/*Juniperus virginiana*	10.5%	22.0%	YES	FACU
Shrub Layer:				
Eastern Burning-Bush/*Euonymus atropurpureus*	20.5%	35.0%	YES	FACU
Multiflora Rose/*Rosa multiflora*	38.0%	65.0%	YES	FACU
Woody Vines:				
Oriental Bittersweet/*Celastrus orbiculate*	20.5%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **301B Montauk fine sandy loam, 0-8% slopes, stony**
hydric soil inclusions: **616A Fluvaquents**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-5"**	**10YR 3/2 fine sandy loam**	
Bw1	**5-10"**	**10YR 4/3 fine sandy loam**	
Bw2	**10-20"**	**10YR 4/6 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **E-7**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Red Maple/*Acer rubrum*	63.0%	86.0%	YES	FAC*
Gray Birch/*Betula populifolia*	10.5%	14.0%	NO	FAC*
Shrub Layer:				
Highbush Blueberry/*Vaccinium corymbosum*	20.5%	50.0%	YES	FACW-*
Speckled Alder/*Alnus rugosa*	20.5%	50.0%	YES	FACW+*
Woody Vines:				
Poison Ivy/*Toxicodendron radicans*	10.5%	100.0%	YES	FAC*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **301B Montauk fine sandy loam, 0-8% slopes, stony**
hydric soil inclusions: **616A Fluvaquents**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-7"**	**10YR 4/1 loamy fine sand**	
C	**7-20"**	**10YR 3/1 fine sand**	**7.5YR 4/4**

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ **Depth to soil saturation in observation hole**: **@ surface**
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **V16** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Goldenrod	*Solidago sp.*	10.5	50	YES	NO	FACU
	Dewberry	*Rubus hispidus*	10.5	50	YES	YES	FACW
Shrub	Glossy buckthorn*	*Frangula alnus*	20.5	40	YES	YES	FAC
	Multiflora rose	*Rosa multiflora*	20.5	40	YES	NO	FACU
	Tree-of-heaven	*Ailanthus altissima*	10.5	20	YES	NO	NI
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Green ash*	*Fraxinus pennsylvanica*	20.5	50	YES	YES	FACW
	Black cherry	*Prunus serotina*	20.5	50	YES	NO	FACU

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **3** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Upland @ ***V16***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%

Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C	**0-20**	**10YR 4/3**	**-**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **W** Transect #: **V16** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Spotted touch-me-not*	*Impatiens capensis*	38	100	YES	YES	FACW
Shrub	Multiflora rose	*Rosa multiflora*	10.5	25	YES	NO	FACU
	Glossy buckthorn*	*Frangula alnus*	10.5	25	YES	YES	FAC
	White ash	*Fraxinus americana*	10.5	25	YES	NO	FACU
	Silky dogwood*	*Cornus amomum*	10.5	25	YES	YES	FACW
Vine	N/A	*N/A*	N/A	N/A	N/A	NO	N/A
Tree	Willow*	*Salix sp.*	10.5	100	YES	YES	FACW

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **2**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Wetland @ ***V16***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%

Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-10**	**10YR 3/2**	**5YR 4/3**
Cg	**10-20**	**10YR 4/1**	**5YR 4/6**

Remarks:

3. Other: Intermittent Stream adjacent to test location.

Conclusion: Is soil hydric? **Yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☑ Depth to soil saturation in observation hole: 0"
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☑ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☑ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐
Sample location is in a BVW	**YES**	

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Y5** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Poison ivy*	*Toxicodendron radicans*	3	50	YES	YES	FAC
	Goldenrod	*Solidago sp.*	3	50	YES	NO	FACU
Shrub	Glossy buckthorn*	*Frangula alnus*	10.5	50	YES	YES	FAC
	Honeysuckle*	*Lonicera spp.*	10.5	50	YES	YES	FAC
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Black cherry	*Prunus serotina*	20.5	39	YES	NO	FACU
	Gray birch*	*Betula populifolia*	10.5	20	YES	YES	FAC
	Black locust	*Robinia pseudoacacia*	10.5	20	YES	NO	FACU-
	Northern red oak	*Quercus rubra*	10.5	20	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Upland @ ***Y5***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%

Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C	**0-20**	**10YR 4/3**	**-**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Ecosystem Solutions** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Y5** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Bristly blackberry*	*Rubus hispidus*	3	33	YES	YES	FACW
	Poison ivy*	*Toxicodendron radicans*	3	33	YES	YES	FAC
	Goldenrod	*Solidago sp.*	3	33	YES	NO	FACU
Shrub	Honeysuckle*	*Lonicera spp.*	10.5	28	YES	YES	FAC
	Black cherry	*Prunus serotina*	10.5	28	YES	NO	FACU
	Speckled alder	*Alnus incana*	3	8	NO	NO	NI
	Silky dogwood*	*Cornus amomum*	10.5	28	YES	YES	FACW
	Green ash*	*Fraxinus pennsylvanica*	3	8	NO	YES	FACW
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Red maple*	*Acer rubrum*	20.5	60	YES	YES	FAC
	Gray birch*	*Betula populifolia*	10.5	31	YES	YES	FAC
	Big-tooth aspen	*Populus grandidentata*	3	9	NO	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **6** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Upland @ ***Y5***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
Title/date: Essex County, Southern Part
Map number: Accessed via Web Soil Survey
Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%
Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-7**	**10YR 2/2**	**-**
Bg	**7-20**	**10YR 6/3**	**5YR 4/6**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☑ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion

	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐

Sample location is in a BVW **YES**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Z7** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Sedge*	*Carex spp.*	10.5	100	YES	YES	FACW
Shrub	Honeysuckle*	*Lonicera spp.*	38	48	YES	YES	FAC
	Box-elder*	*Acer negundo*	10.5	13	NO	YES	FAC+
	Glossy buckthorn*	*Frangula alnus*	10.5	13	NO	YES	FAC
	Japanese knotweed	*Polygonum cuspidatum*	10.5	13	NO	NO	FACU-
	Green ash*	*Fraxinus pennsylvanica*	10.5	13	NO	YES	FACW
Vine	Oriental bittersweet	*Celastrus orbiculatus*	3	50	YES	NO	NI
	Fox grape	*Vitis labrusca*	3	50	YES	NO	FACU
Tree	Black cherry	*Prunus serotina*	10.5	50	YES	NO	FACU
	Black locust	*Robinia pseudoacacia*	10.5	50	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **2** Number of dominant non-wetland indicator plants: **4**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Upland @ ***Z7***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
Title/date: Essex County, Southern Part
Map number: Accessed via Web Soil Survey
Soil type mapped: 316A- Fluvaquents, frequently flooded, 0-3%
Hydric soil inclusions: Swansea, Unnamed Soils

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C1	**0-8**	**10YR 4/3**	**-**
^C2	**8-20**	**10YR 6/3**	**-**

Remarks: Fill is associated with a buried sewer pipe between the BVW and Procotor Brook.

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **W** Transect #: **Z7** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Dewberry	*Rubus hispidus*	10.5	25	YES	YES	FACW
	White avens	*Geum canadense*	10.5	25	YES	NO	FACU
	Goldenrod	*Solidago sp.*	10.5	25	YES	NO	FACU
	Poison ivy*	*Toxicodendron radicans*	10.5	25	YES	YES	FAC
Shrub	American elder*	*Sambucus canadensis*	10.5	25	YES	YES	FACW-
	Glossy buckthorn*	*Frangula alnus*	10.5	25	YES	YES	FAC
	Honeysuckle*	*Lonicera spp.*	10.5	25	YES	YES	FAC
	Silky dogwood*	*Cornus amomum*	10.5	25	YES	YES	FACW
Vine	N/A	*N/A*		N/A	N/A	N/A	N/A
Tree	Box-elder*	*Acer negundo*	10.5	50	YES	YES	FAC+
	Black locust	*Robinia pseudoacacia*	10.5	50	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **7** Number of dominant non-wetland indicator plants: **2**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

*Wetland @ **Z7***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 616A- Fluvaquents, frequently flooded, 0-3%

Hydric soil inclusions: Swansea, Unnamed Soils

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-10**	**10YR 2/2**	**-**
Bg	**10-20**	**10YR 6/2**	**5YR 4/6**

Remarks:

3. Other:

Conclusion: Is soil hydric? **Yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☑ Depth to soil saturation in observation hole: 12"
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion

	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐

Sample location is in a BVW **YES**

Proposal No. 609211-132091

WQC/ACOE PLAN SHEET 17 OF 63, REVISED 07/03/2024

BANK (INTERMITTENT STREAM)
BANK/OHW (PERENNIAL STREAM)
DITCH
VEGETATED WETLAND (VW)

TOTAL PERMANENT IMPACT AREA = 11,026 SF ±
DREDGE VOLUME = 1,491 CY
FILL VOLUME = 1,491 CY

PERMANENT LUW IMPACT AREA = 8,676 SF ±

PERMANENT VW IMPACT AREA = 2,350 SF ±

TOTAL PROJECT IMPACTS TO WATERS OF THE UNITED STATES:

TOTAL TEMPORARY IMPACT AREA = 6,990 SF ±

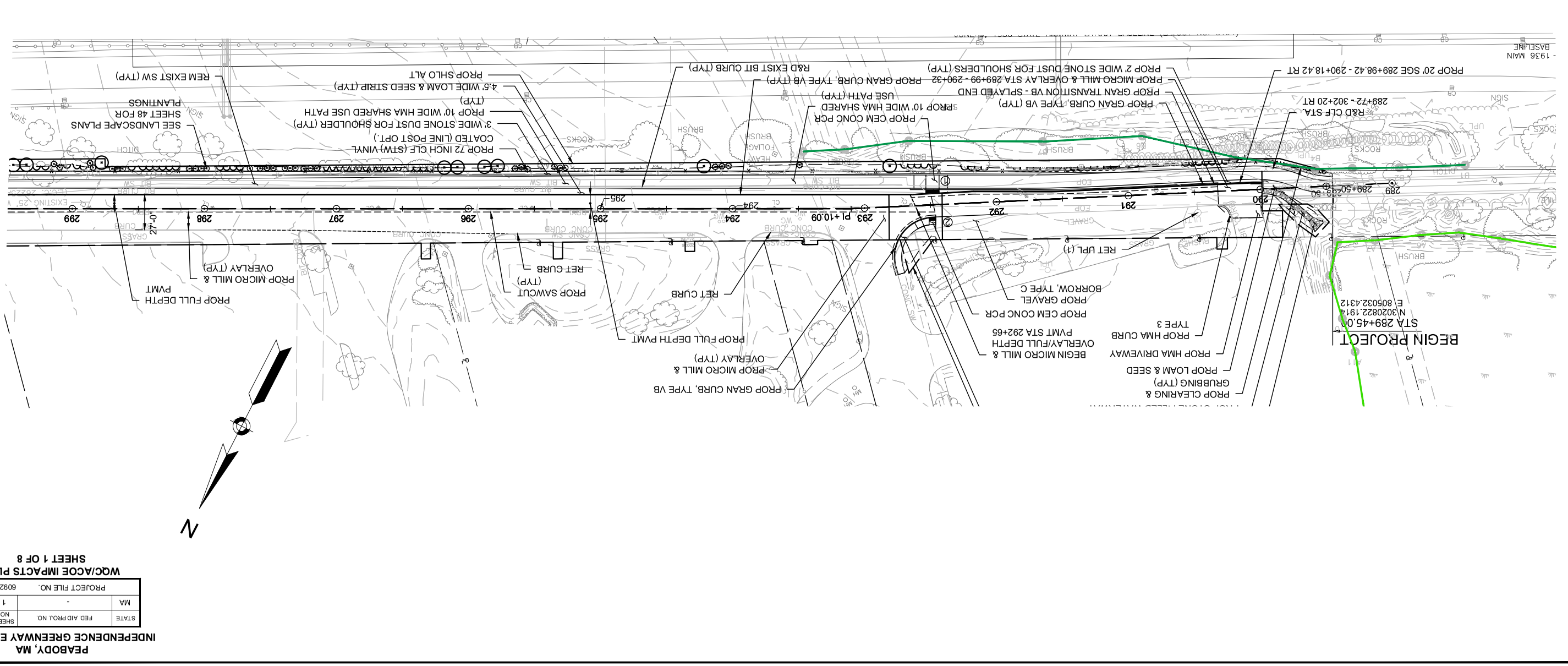
TEMPORARY LUW/WOTUS IMPACT AREA = 2,310 SF ±

TEMPORARY VW IMPACT AREA = 4,675 SF ±

PERMANENT STREAM/BANK IMPACT = 588 LF ±

TEMPORARY STREAM/BANK IMPACT = 166 LF ±

SCALE IN FEET
1" = 40'
40 0 40 80



WQC/ACOE IMPACTS PLAN
SHEET 1 OF 8

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	8
PROJECT FILE NO. 609211			

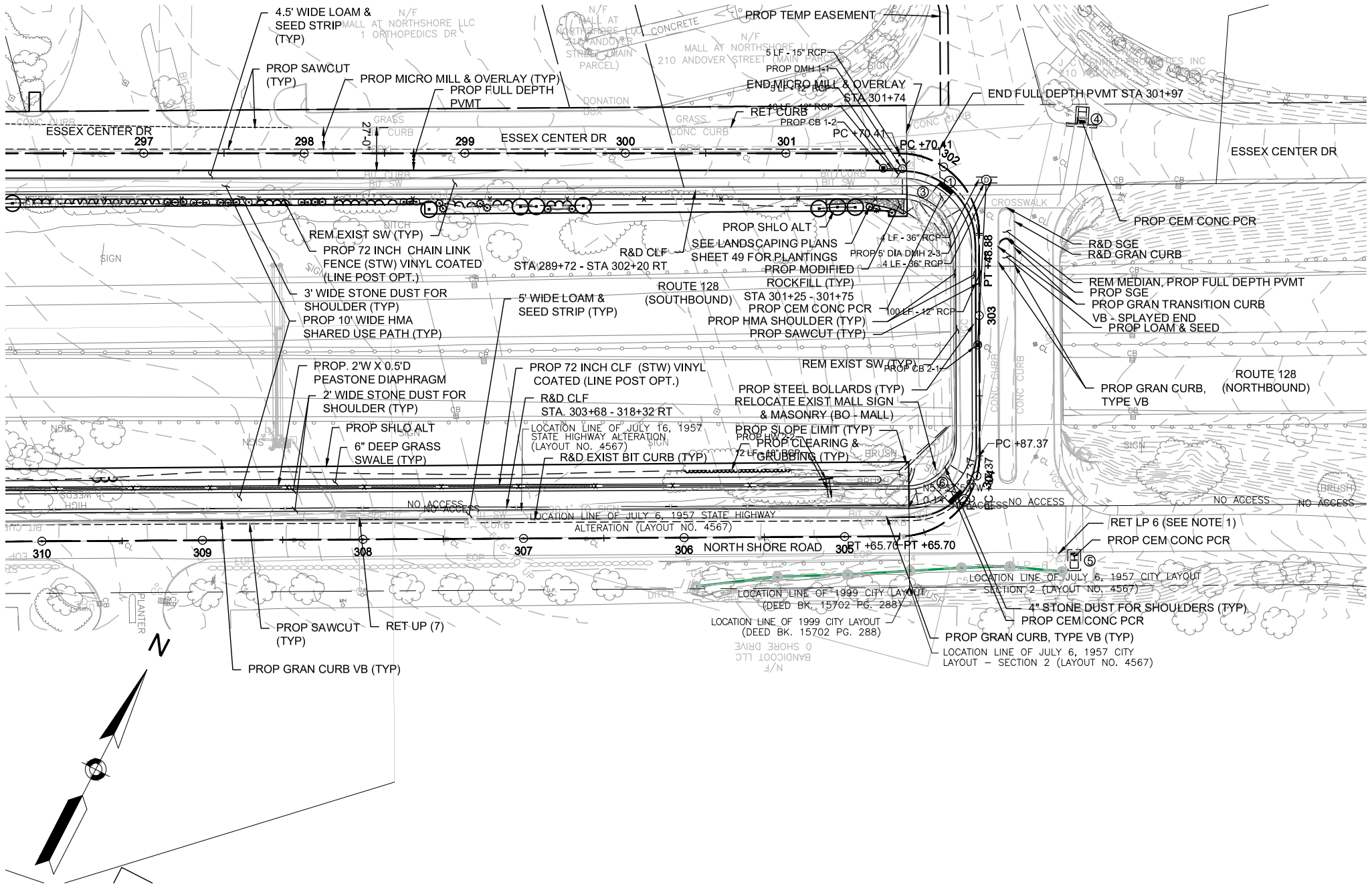
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

A00830 - 54

Proposal No. 609211-132091

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 2 OF 8



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 40'

WQC/ACOE PLAN SHEET 18 OF 63, REVISED 07/03/2024

Proposal No. 609211-132091
A00830 - 55

WQC/ACOE PLAN SHEET 19 OF 63, REVISED 07/03/2024

PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

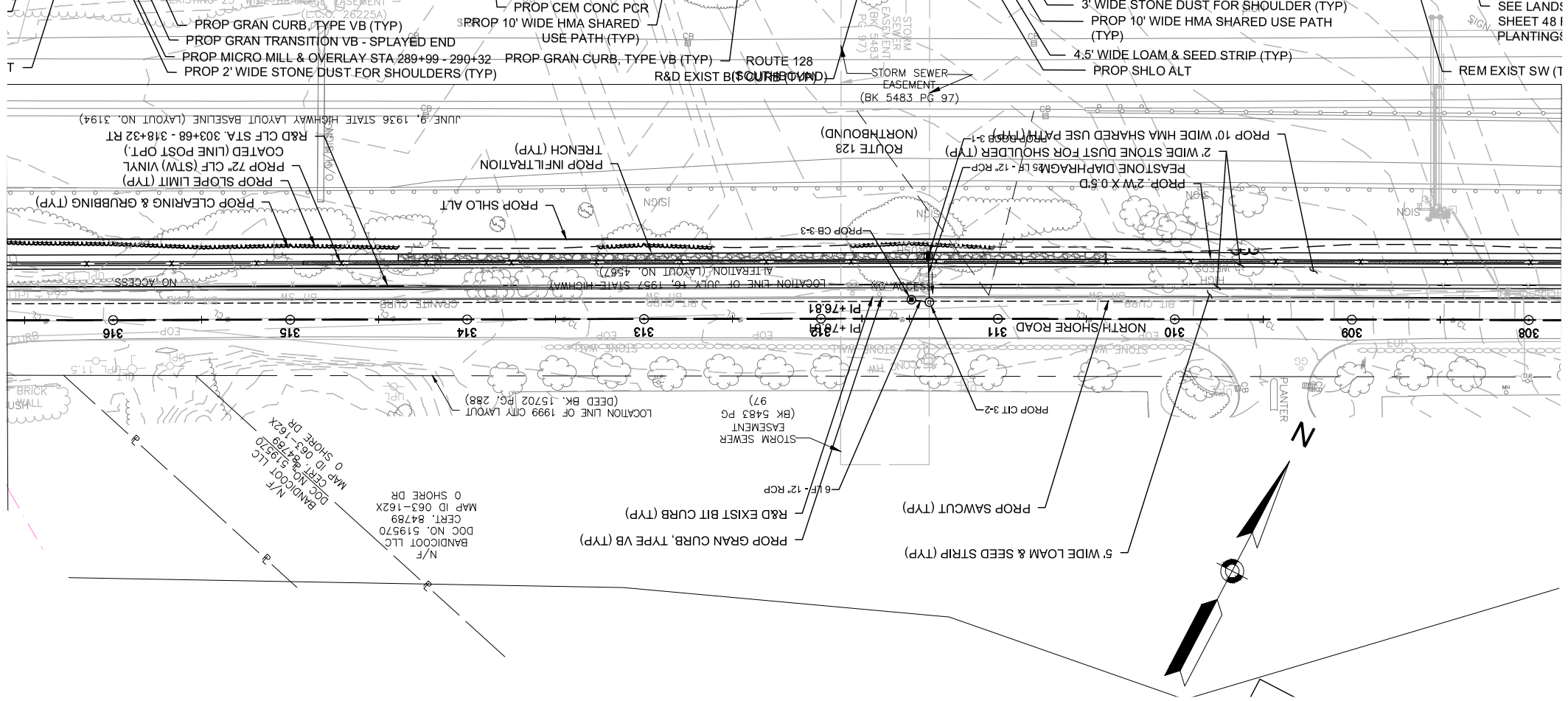
BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

SCALE IN FEET
1" = 40'
40 0 40 80



WQC/ACOE IMPACTS PLAN SHEET 3 OF 8			
PROJECT FILE NO. 609211			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	8

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

A00830 - 56

Proposal No. 609211-132091

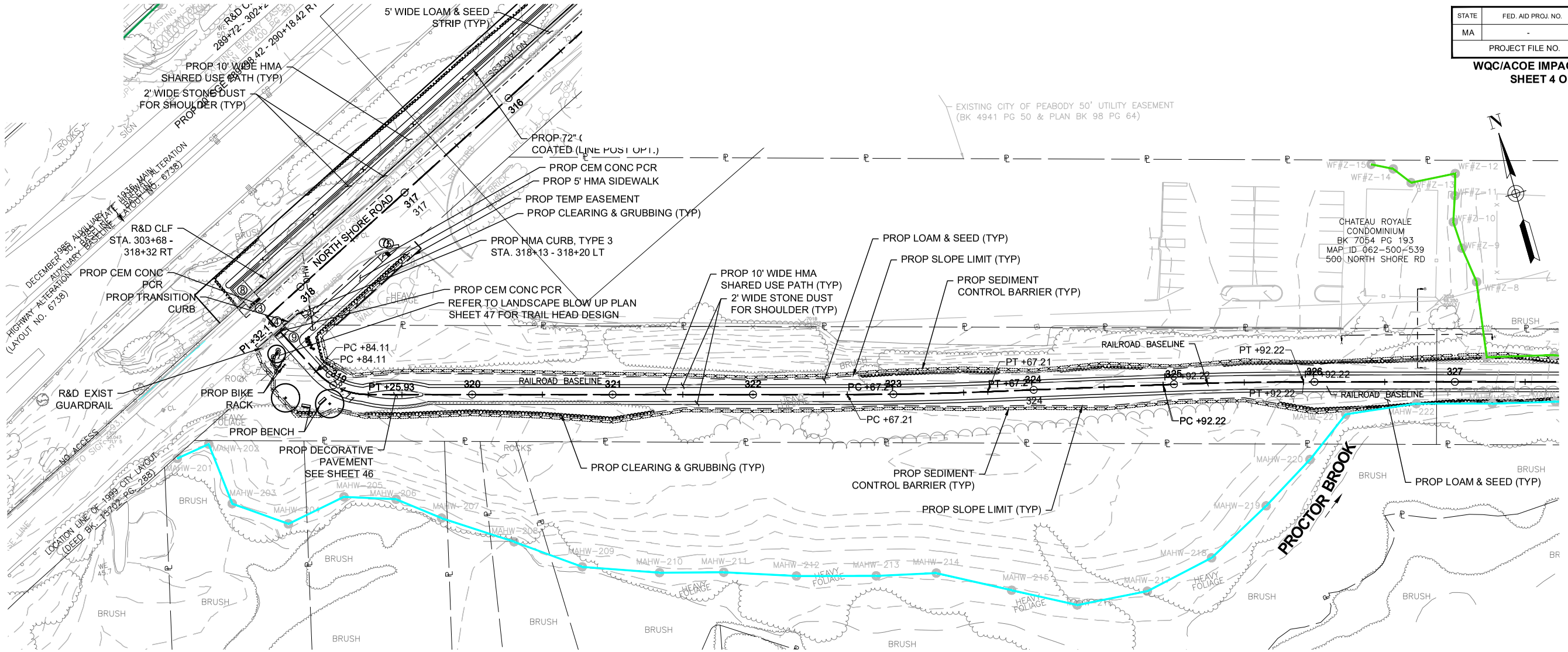
Proposal No. 609211-132091

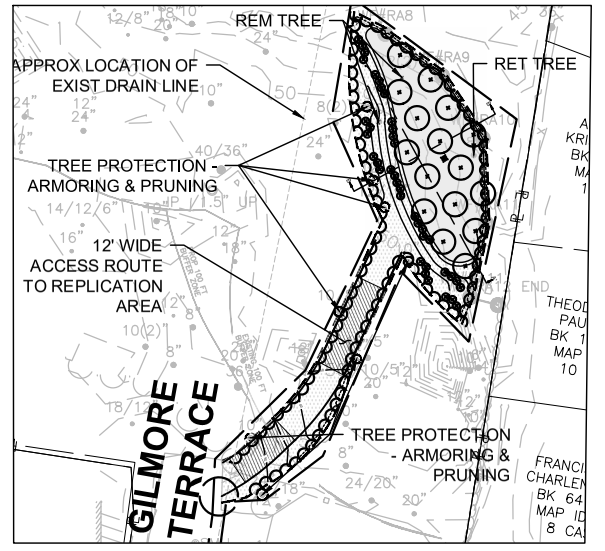
A00830 - 57

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 4 OF 8





INSET A - WETLAND REPLICATION AREA

- PERMANENT VW IMPACT AREA
- TEMPORARY VW IMPACT AREA
- PERMANENT LUW/WOTUS IMPACT AREA
- TEMPORARY LUW/WOTUS IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- BANK (INTERMITTENT STREAM)
- DITCH
- PERMANENT STREAM/BANK IMPACT
- TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 40'

WQC/ACOE PLAN SHEET 20 OF 63, REVISED 07/03/2024

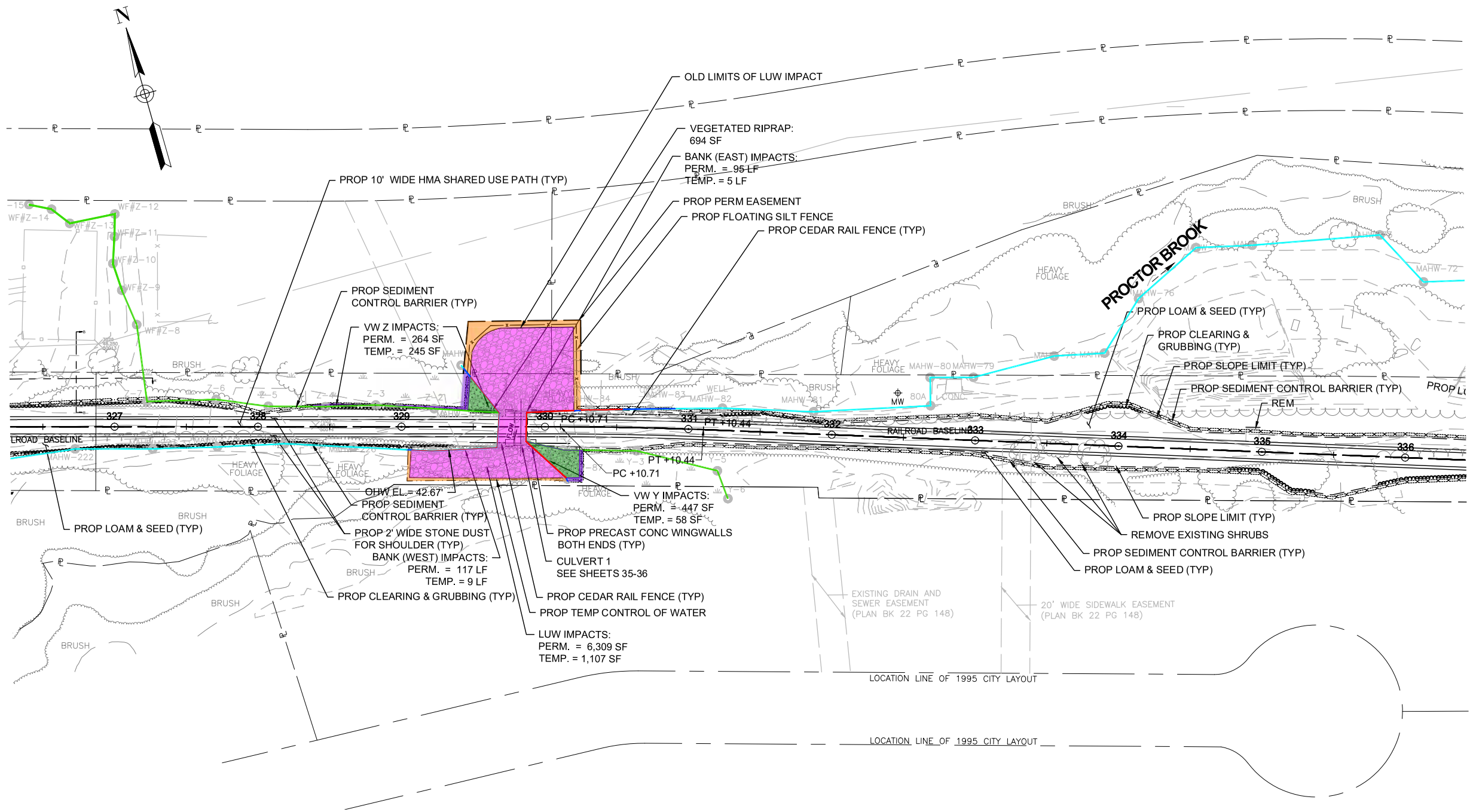
Proposal No. 609211-132091

A00830 - 58

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 5 OF 8



PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 40'

WQC/ACOE PLAN SHEET 21 OF 63, REVISED 07/03/2024

PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

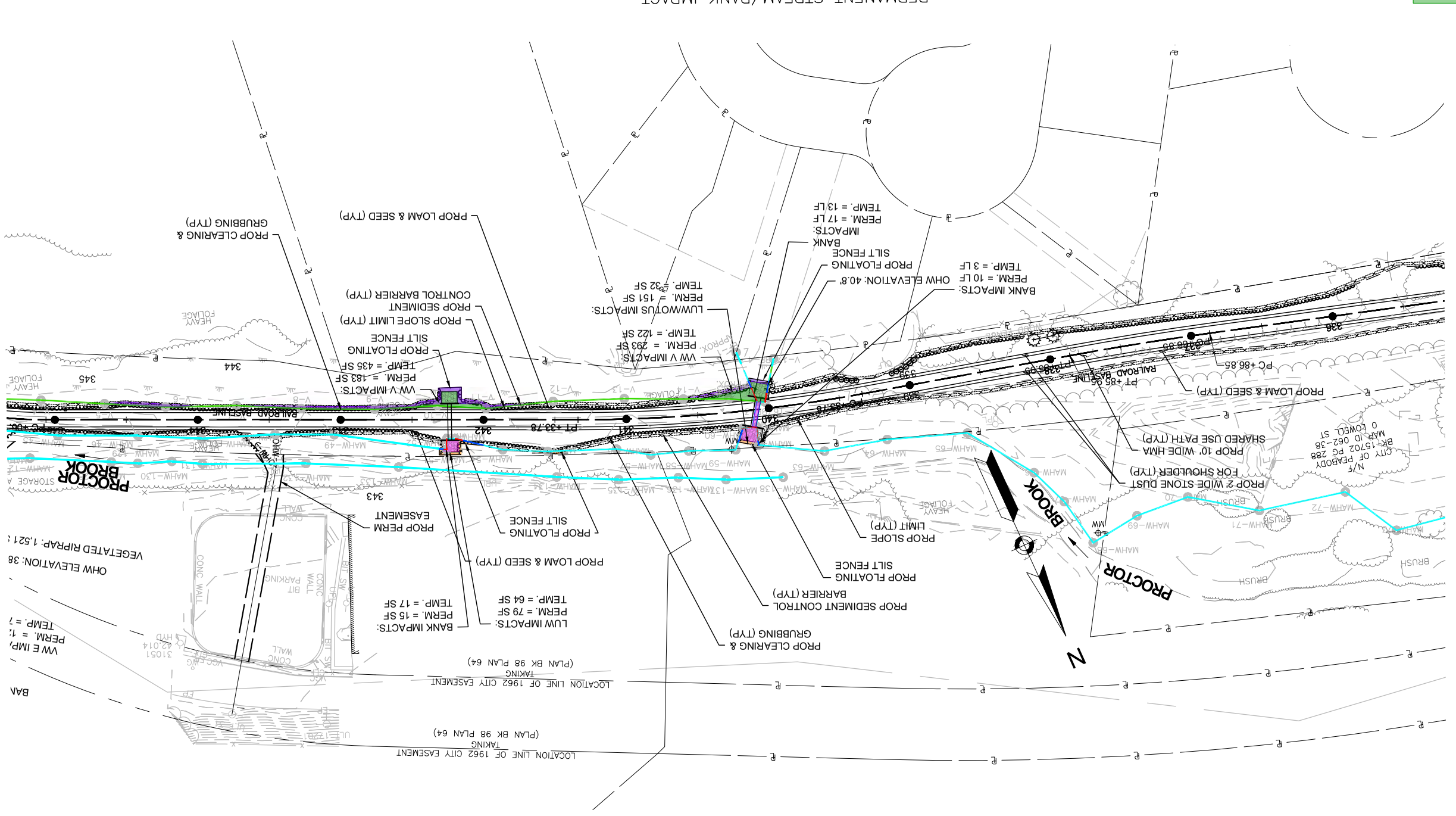
BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT


PROCTOR BROOK
PROCTOR BROOK
N
RAILROAD BASELINE
PC +86.85
PT +85.85
PROP LOAM & SEED (TYP)
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP 2' WIDE STONE DUST FOR SHOULDER (TYP)
N/F CITY OF PEABODY BK- 15702 PG 288 MAP ID 062-38 0 LOWELL ST
PROP SLOPE LIMIT (TYP)
PROP FLOATING SILT FENCE
PROP SEDIMENT CONTROL BARRIER (TYP)
PROP CLEARING & GRUBBING (TYP)
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
PROP LOAM & SEED (TYP)
PROP FLOATING SILT FENCE
PROP PERM EASEMENT
PROP CLEARING & GRUBBING (TYP)
PROP SEDIMENT CONTROL BARRIER (TYP)
PROP SLOPE LIMIT (TYP)
PROP SEDIMENT
PROP FLOATING SILT FENCE
VW V IMPACTS: PERM. = 435 SF TEMP. = 183 SF
VW V IMPACTS: PERM. = 293 SF TEMP. = 122 SF
LUW/WOTUS IMPACTS: PERM. = 151 SF TEMP. = 32 SF
OHW ELEVATION: 40.8'
BANK IMPACTS: PERM. = 10 LF TEMP. = 3 LF
BANK IMPACTS: PERM. = 17 LF TEMP. = 13 LF
LUW IMPACTS: PERM. = 79 SF TEMP. = 64 SF
BANK IMPACTS: PERM. = 15 SF TEMP. = 17 SF
PT +33.78
343
344
345
346
347
348
349
336
338
340
342
MAHW-49
MAHW-59
MAHW-63
MAHW-65
MAHW-69
MAHW-71
MAHW-72
MAHW-73
MAHW-130
MAHW-132
MAHW-136
MAHW-138
MAHW-139
MAHW-140
MAHW-141
MAHW-142
MAHW-143
MAHW-144
MAHW-145
MAHW-146
MAHW-147
MAHW-148
MAHW-149
MAHW-150
MAHW-151
MAHW-152
MAHW-153
MAHW-154
MAHW-155
MAHW-156
MAHW-157
MAHW-158
MAHW-159
MAHW-160
MAHW-161
MAHW-162
MAHW-163
MAHW-164
MAHW-165
MAHW-166
MAHW-167
MAHW-168
MAHW-169
MAHW-170
MAHW-171
MAHW-172
MAHW-173
MAHW-174
MAHW-175
MAHW-176
MAHW-177

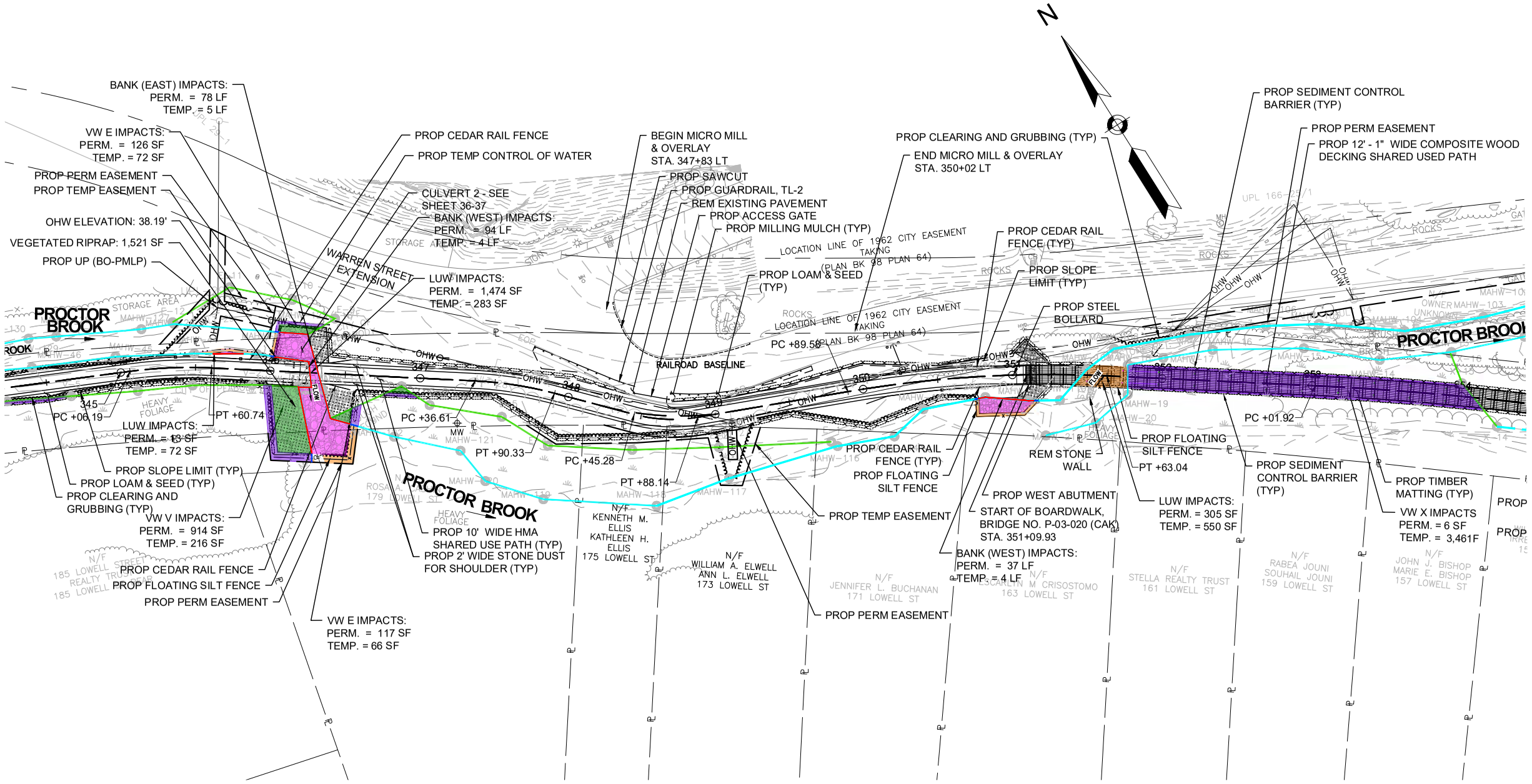
Proposal No. 609211-132091

A00830 - 60

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	8
PROJECT FILE NO.	609211		

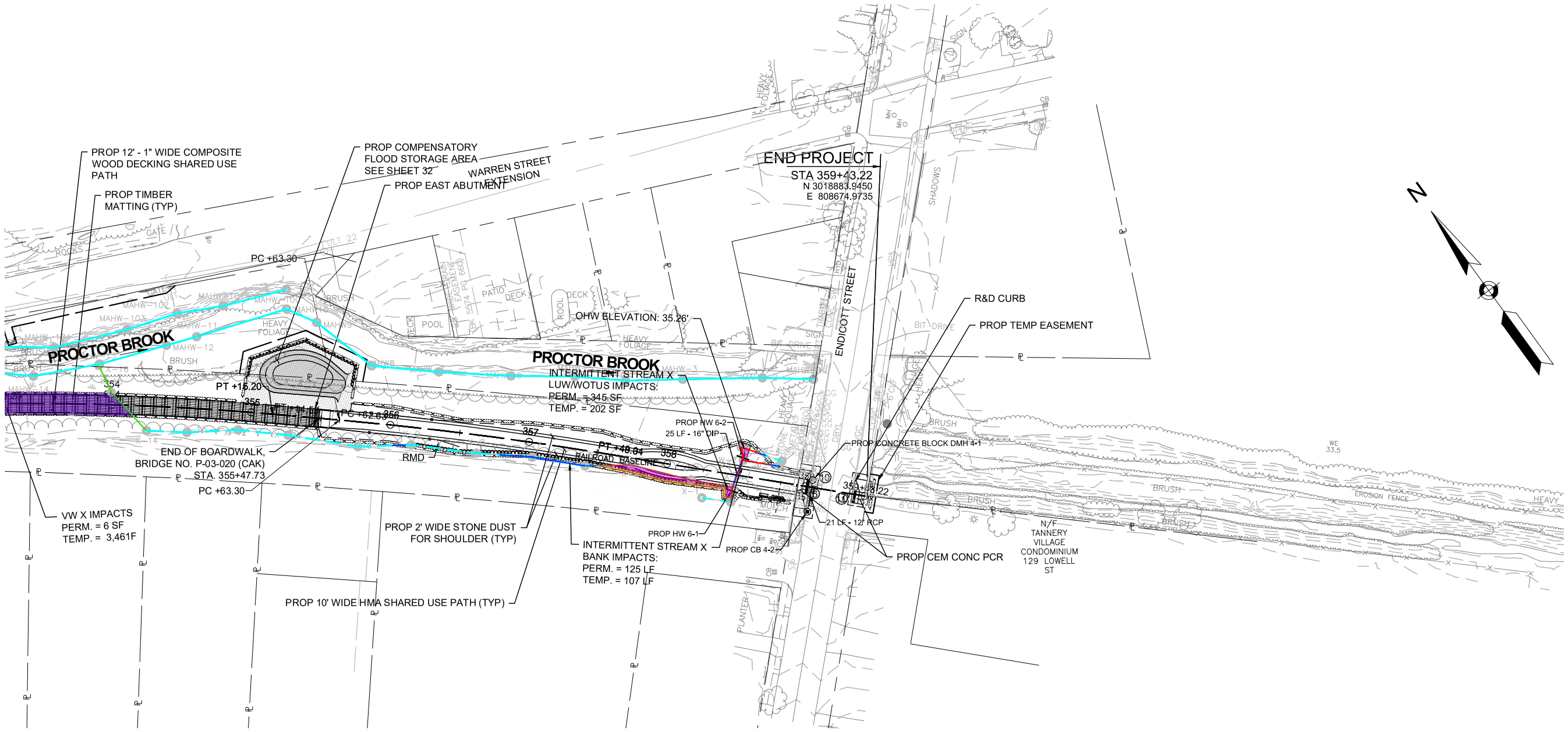
WQC/ACOE IMPACTS PLAN
SHEET 7 OF 8


BANK (EAST) IMPACTS:
PERM. = 78 LF
TEMP. = 5 LF
VW E IMPACTS:
PERM. = 126 SF
TEMP. = 72 SF
PROP PERM EASEMENT
PROP TEMP EASEMENT
OHW ELEVATION: 38.19'
VEGETATED RIPRAP: 1,521 SF
PROP UP (BO-PMLP)
PROP CEDAR RAIL FENCE
PROP TEMP CONTROL OF WATER
CULVERT 2 - SEE SHEET 36-37
BANK (WEST) IMPACTS:
PERM. = 94 LF
TEMP. = 4 LF
LUW IMPACTS:
PERM. = 1,474 SF
TEMP. = 283 SF
WARREN STREET EXTENSION
BEGIN MICRO MILL & OVERLAY STA. 347+83 LT
PROP SAWCUT
PROP GUARDRAIL, TL-2
REM EXISTING PAVEMENT
PROP ACCESS GATE
PROP MILLING MULCH (TYP)
PROP LOAM & SEED (TYP)
LOCATION LINE OF 1962 CITY EASEMENT TAKING (PLAN BK 98 PLAN 64)
PROP CLEARING AND GRUBBING (TYP)
END MICRO MILL & OVERLAY STA. 350+02 LT
PROP CEDAR RAIL FENCE (TYP)
PROP SLOPE LIMIT (TYP)
PROP STEEL BOLLARD
PROP SEDIMENT CONTROL BARRIER (TYP)
PROP PERM EASEMENT
PROP 12' - 1" WIDE COMPOSITE WOOD DECKING SHARED USED PATH
PROCTOR BROOK
RAILROAD BASELINE
PC +06.19
PT +60.74
PC +36.61
PT +90.33
PC +45.28
PT +88.14
PC +89.56
PC +01.92
PT +63.04
LUW IMPACTS:
PERM. = 13 SF
TEMP. = 72 SF
PROP SLOPE LIMIT (TYP)
PROP LOAM & SEED (TYP)
PROP CLEARING AND GRUBBING (TYP)
VW V IMPACTS:
PERM. = 914 SF
TEMP. = 216 SF
PROP CEDAR RAIL FENCE
PROP FLOATING SILT FENCE
PROP PERM EASEMENT
VW E IMPACTS:
PERM. = 117 SF
TEMP. = 66 SF
PROP 10' WIDE HMA SHARED USE PATH (TYP)
PROP 2' WIDE STONE DUST FOR SHOULDER (TYP)
PROP CEDAR RAIL FENCE (TYP)
PROP FLOATING SILT FENCE
PROP TEMP EASEMENT
PROP PERM EASEMENT
REM STONE WALL
PROP FLOATING SILT FENCE
PROP WEST ABUTMENT
START OF BOARDWALK, BRIDGE NO. P-03-020 (CAK) STA. 351+09.93
BANK (WEST) IMPACTS:
PERM. = 37 LF
TEMP. = 4 LF
LUW IMPACTS:
PERM. = 305 SF
TEMP. = 550 SF
PROP SEDIMENT CONTROL BARRIER (TYP)
PROP TIMBER MATTING (TYP)
VW X IMPACTS
PERM. = 6 SF
TEMP. = 3,461F
N/F KENNETH M. ELLIS KATHLEEN H. ELLIS 175 LOWELL ST
N/F WILLIAM A. ELWELL ANN L. ELWELL 173 LOWELL ST
N/F JENNIFER L. BUCHANAN 171 LOWELL ST
N/F ESCARLEN M. CRISOSTOMO 163 LOWELL ST
N/F STELLA REALTY TRUST 161 LOWELL ST
N/F RABEA JOUNI SOUHAIL JOUNI 159 LOWELL ST
N/F JOHN J. BISHOP MARIE E. BISHOP 157 LOWELL ST
N/F 185 LOWELL STREET REALTY TRUST 185 LOWELL ST
N/F 179 LOWELL ST
HEAVY FOLIAGE
STORAGE AREA
ROCKS
OWNER MAHW-103
UNKNOWN
MAHW-116
MAHW-117
MAHW-118
MAHW-119
MAHW-120
MAHW-121
MAHW-122
MAHW-123
MAHW-124
MAHW-125
MAHW-126
MAHW-127
MAHW-128
MAHW-129
MAHW-130
MAHW-131
MAHW-132
MAHW-133
MAHW-134
MAHW-135
MAHW-136
MAHW-137
MAHW-138
MAHW-139
MAHW-140
MAHW-141
MAHW-142
MAHW-143
MAHW-144
MAHW-145
MAHW-146
MAHW-147
MAHW-148
MAHW-149
MAHW-150
MAHW-151
MAHW-152
MAHW-153
MAHW-154
MAHW-155

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 8 OF 8



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

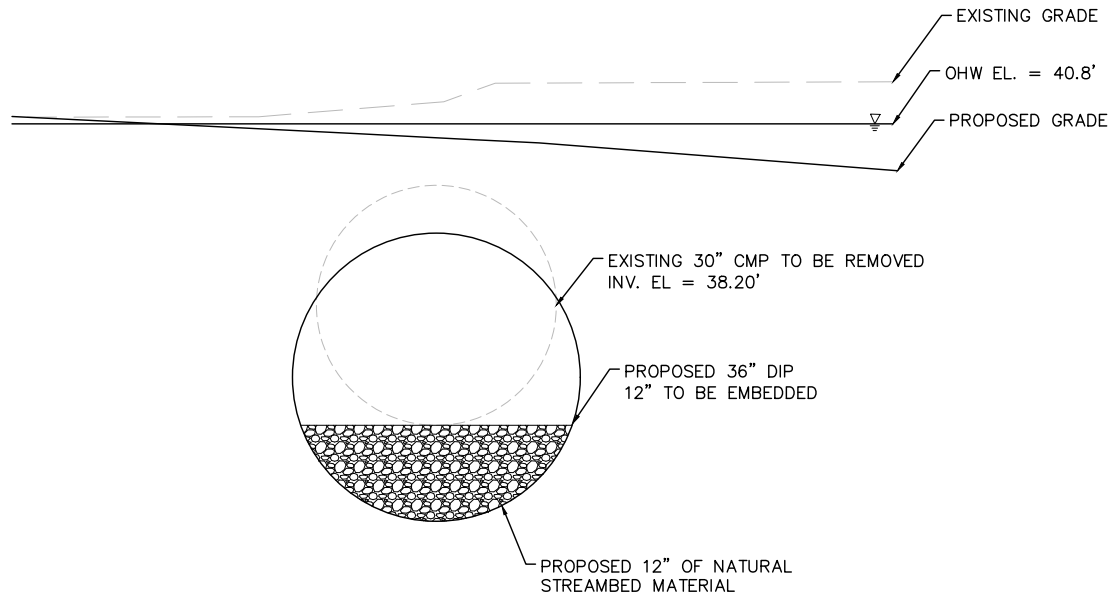
40 0 40 80
SCALE IN FEET
1" = 40'

WQC/ACOE PLAN SHEET 24 OF 63, REVISED 07/03/2024

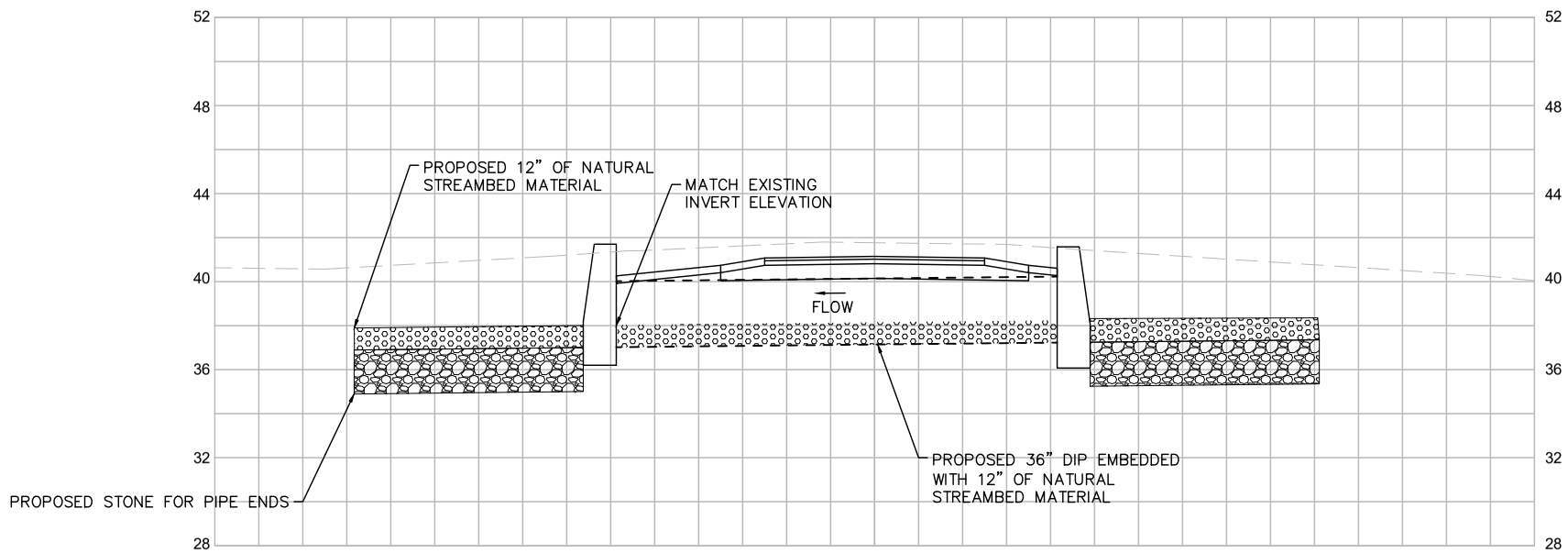
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609211		

CULVERT CROSS SECTION

CULVERT AT STATION 340+10



HOR. SCALE IN FEET
1 0 1 2
1 0 1 2
VER. SCALE IN FEET



HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

SUPPLEMENTAL WQC/ACOE PLAN SHEET 64

Proposal No. 609211-132091

A00830 - 62

36 IN STA 340+10 CULVERT_RECOVER.DWG Plotted on 5-Jul-2024 12:38 PM

HIGHWAY GUARD DETAILS

STA. 347+72 LT - STA. 348+07 LT TANGENT END TREATMENT
STA. 348+07 LT - STA. 348+32 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 348+32 LT - STA. 348+41 LT TRAILING ANCHORAGE
STA. 348+70 LT - STA. 349+11 LT TANGENT END TREATMENT
STA. 349+11 LT - STA. 349+61 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 349+61 LT - STA. 347+70 LT TRAILING ANCHORAGE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

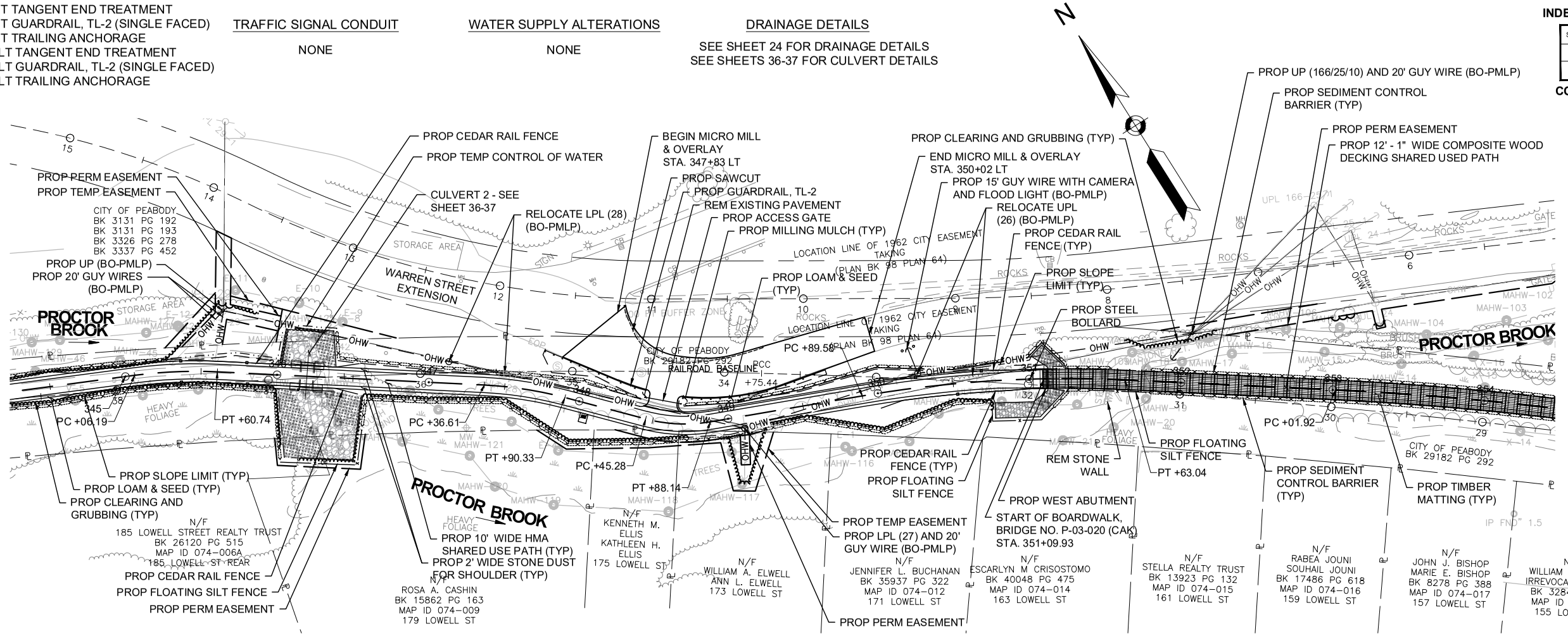
SEE SHEET 24 FOR DRAINAGE DETAILS
SEE SHEETS 36-37 FOR CULVERT DETAILS

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

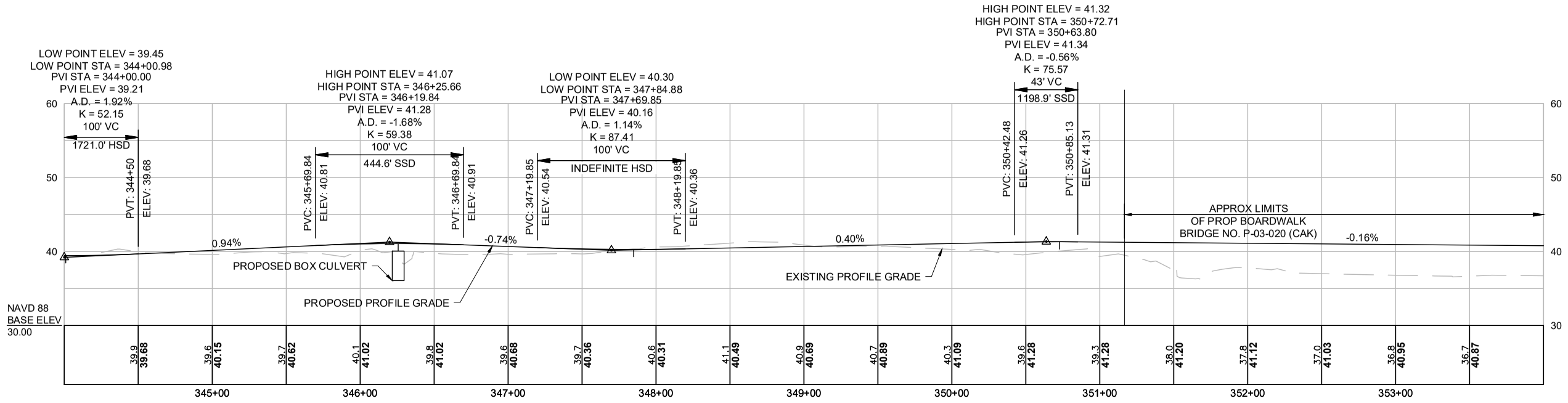
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	143
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 7

Plotted on 3-Jul-2024 11:46 AM
SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG



PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
40 0 40 80
VER. SCALE IN FEET
8 0 8 16

WQC/ACOE PLAN SHEET 15 OF 63, REVISED 07/03/2024

HYDRAULIC AND SCOUR ANALYSIS
SUMMARY REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Prepared for

Massachusetts Department of Transportation

November 2023

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for Proctor Brook along the Independence Greenway Extension. The proposed bikeway crosses Proctor Brook at three (3) locations. The Hydraulic Report submitted to MassDOT in February 2021 described the proposed bridge located approximated 800' west of Endicott Street. This study evaluates the hydraulic performance of the existing and proposed conditions for the remaining project area upstream of this proposed bridge, including the two (2) crossing locations that weren't discussed in the previous report.

This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at brook crossing sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the brook; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations.

This project involves the construction of two (2) new culverts that will cross over Proctor Brook in the City of Peabody, Massachusetts. There were previous culvert structures that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the culverts, and the culvert structures have been washed away over time. The purpose of this report is to present the results of a study conducted for the subject culvert sites to evaluate the hydraulic performance of the proposed structures for these crossings.

The scope of this investigation consists of a review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.45 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any

improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 8-span structure will be approximately 60'-0" long with an out-to-out width of 12'-0" and will provide a clear width of 11'-0" to accommodate two 5-0" wide travel lanes, one in each direction.

2.1 Existing Conditions

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject locations are within NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

Refer to Figure 1 for a locus map of the project area.

The remnants of two (2) culverts remain in the channel. There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the culverts are currently wooded and includes Bordering Vegetated Wetlands.

The existing culverts were studied during FEMA's 1978 FIS study. At the time of the study the culverts had not been washed out and were functioning as hydraulic connections to convey Proctor Brook under the railroad bed. More detailed description of the culverts are as follows:

Culvert at Station 329+85

This culvert is located at cross section H of the FEMA FIS study. The existing culvert is a 25' long double 42" barrel RCP culvert. The culvert hasn't been maintained and the railbed above the culvert has been washed away. The culvert piping has remained in place. Remnants of granite guidebanks remain at the upstream entrance to the culvert and remnants of a granite headwall remain on the downstream end of the culvert.

Culvert at Station 346+20

This culvert is located at cross section F of the FEMA FIS study. Review of the FEMA's HEC-2 hydraulic model indicates that the culvert was originally a 6'-5" box culvert. Due to a lack of maintenance along the abandoned railroad bed, the culvert has collapsed, and the remnants remain in the channel.

2.2 Proposed Conditions

Although the culvert crossings have failed to varying degrees, the horizontal alignment of Proctor Brook has remained. The culverts are being replaced at the same locations as the original structures in order to maintain the alignment of Proctor Brook at these crossings. The channel elevation will remain although some sediment will be removed to facilitate construction.

Both of the culverts will be replaced with 8'x4' concrete box culverts. The bottom 1' of each culvert will be filled with streambed material to provide a more natural wildlife habitat. This hydraulic study examines the impact of providing an 8'x3' hydraulic opening at both of these crossings.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 20 Stream Stability at Highway Structures, Fourth Edition, April 2012.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 14 Hydraulic Design of Energy Dissipators for Culverts and Channels, Third Edition, July 2006.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 19, 2021.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- Federal Highway Administration: Hydraulic Toolbox 5.1.4.0 Computer Program

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the culverts have been analyzed to ensure that existing flood elevations will not increase underproposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Figure 3 shows the project location in the flood insurance rate map.

In this hydraulic and scour summary report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. As further described in the Stormwater Report prepared for this project, the peak flow rates have been adjusted to account for the proposed increase in impervious area. Table 4.1 also presents the proposed flow projections for the project area.

Table 4.1 – Summary of Discharges

Description	Alternative	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River and Proctor Brook Upstream of Goldthwait Brook	FEMA FIS	240	285	360	420	610
	Proposed Conditions	243	290	366	428	618

4.2 Hydraulic Analysis

Green used a combination of the topographical survey and the proposed design of the brook crossings to create a proposed conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA.

Table 4.2 shows a comparison between the results of the HEC-2 data received from FEMA and Green's proposed model.

Table 4.2 – Comparison of FEMA and Proposed Base Flood Elevations (BFE - referenced to NAVD88) at several cross sections near the Proposed Structures

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Published Data* (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
34	-	-	46.50	
33	-	-	46.33	
32	-	-	46.33	
31	H	46.89	46.33	-0.56
30	-	-	46.23	
29.5	Culvert at Sta 329+85			
29.4	-	-	42.54	
29.3	-	-	42.44	
28	-	-	42.57	
27	G	42.50	42.50	0.00
26.5	-	-	42.00	
26	F	41.96	41.39	-0.57
25	-		41.40	
24.5	Culvert at Sta 346+20			
24.4	-		40.74	
24.3	-		40.12	
23	-		40.28	
22	E	40.84	40.24	-0.6
21.7	-		40.11	
21.6	-		40.11	
21.5	Bridge			
21.4			39.90	
21.35	-		39.75	
21.3	-		39.80	

21.2	-		39.66	
19	-		39.66	
18	D	39.60	39.60	0.00

Adjusted datum to NAVD 88

As shown in Table 4.2, Proctor Brook will not have an increase in the Water Surface Elevation (WSEL) for the FEMA Base Flood Elevation.

Attachment A includes the 1977 HEC-2 model input/output report received from FEMA Headquarters. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed Independence Greenway Extension boardwalkover Proctor Brook with the new crossing culverts.

Table 4.3 a– Summary of Hydraulic Performance at Culvert at Sta 329+85

AEP [%]	Existing			Proposed		
	Peak Flow (CFS)	WSEL (FT) Sta. 31 FEMA Sta. H	Velocity* (FT/S) (Max. at Bridge)	Peak Flow (CFS)	WSEL (FT) Sta. 31 FEMA Sta. H	Velocity* (FT/S) (Max. at Bridge)
10%	240	44.16	0.41	243	45.01	10.09
4%	285	44.52	0.44	290	45.90	11.26
2%	360	44.97	0.50	366	46.17	11.46
1%	420	45.21	0.55	428	46.33	11.56
0.2%	610	45.70	0.71	618	46.55	11.08

Table 4.3 b– Summary of Hydraulic Performance at Culvert at Sta 346+20

AEP [%]	Existing			Proposed		
	Peak Flow (CFS)	WSEL (FT) Sta. 26 FEMA Sta. F	Velocity* (FT/S) (Max. at Bridge)	Peak Flow (CFS)	WSEL (FT) Sta. 26 FEMA Sta. F	Velocity* (FT/S) (Max. at Bridge)
10%	240	40.41	3.31	243	40.86	5.80
4%	285	40.71	3.58	290	41.03	5.68
2%	360	41.17	3.93	366	41.25	5.62
1%	420	41.53	4.11	428	41.39	5.57
0.2%	610	42.29	4.75	618	41.77	4.70

In Table 4.3a and Table 4.3b, the hydraulic performance of the culverts at station 329+85 and Sta 346+20 is depicted. The velocities and elevations shown in the tables for existing conditions were obtained from the model developed on HEC-RAS by Green. This model was created using survey data and did not account for functioning culverts. The velocities and water surface elevations are anticipated to increase with the restoration of the culverts.

4.3 Scour Safety/Stability Analyses

We calculated the scour hole dimensions (length, width, and depth) using the Hydraulic Engineering Circular

(HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 5:

"Estimating Scour at Culvert Outlets" and using equation 5.1 for cohesionless soils shown below:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g}(R_c^{2.5})}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta}$$

The equations are based on tests that were conducted to determine the maximum scour for the given condition and therefore represent what might be termed worst case scour geometries.

We utilized the flows with the highest exit velocities for analyzing the scour hole dimensions of each culvert. No scour potential under current conditions was assessed, as one of the structures has washed away and based on evidence, there are no indications of vertical or horizontal instability.

Soil samples were taken at points within the brook, upstream of the culverts and the banks of the brook. These samples were analyzed, and the results are included in Attachment C. The grain size (D_x) was estimated for each soil sample. The D_x results of the samples were used in the scour analysis.

The results of the scour analyses are shown on Table 4.3.

Table 4.3 – Summary of Calculated Scour at Proposed Culverts

Alternative	Return Frequency	Scour Hole Depth (Feet)	Scour Hole Width (Feet)	Scour Hole Length (Feet)	Scour Hole Volume (Cubic Feet)	Location of Maximum Scour (Feet)
Sta 329+85	Peak Velocity Flow (100-year)	5.89	32.00	57.82	8,133.98	23.13
Sta 346+20	Peak Velocity Flow (100-year)	4.69	23.64	44.11	3,527.78	17.65

Scour Countermeasures

The scour/stability analyses were performed using Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 10: "Riprap Basins and Aprons" and using equation 10.4 shown below:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

Table 4.4 displays dimensions for riprap apron at the proposed culverts.

Table 4.4 – Summary of Scour Countermeasure Design at Proposed Culverts

Alternative	Riprap Size D_{50} (Inches)	Riprap Class	Riprap Apron Length (Feet)	Riprap Apron Depth (Feet)	Riprap Apron Width (Feet)
Sta 329+85	12	3	57.82	3.0	34
Sta 346+20	12	3	44.11	3.0	31

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The HEC-RAS model under proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile, and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.
B. The natural stream bed will result in a scour depth at culvert at Station 329+85 of 5.89' during peak velocity flow.
C. The natural stream bed will result in a scour depth at culvert at Station 340+26 of 4.69' during peak velocity flow.
D. The dimensions calculated represent worst-case scour geometries, and consideration of site and environmental constraints were considered when designing the riprap apron.
E. Riprap Countermeasures are proposed to mitigate against the risk of scour. The proposed riprap size has been chosen to exceed the minimum size calculated but readily available MassDOT specified material. Depth of riprap apron is sized in accordance with HEC-23 methodology for chosen riprap material.
F. By placing riprap revetment at the ends of the culvert, it is anticipated that the scour depth will be negligible.

Table 5.1a – Hydraulic Data for Culvert at Sta 329+85

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	2.31 SQUARE MILES
DESIGN FLOOD DISCHARGE:	243 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	11.56 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	45.01 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	428 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	46.33 FEET, NAVD 88

DESIGN SCOUR DATA (Peak Velocity Flow)	
DESIGN SCOUR FLOOD DISCHARGE:	277 CUBIC FEET PER SECOND
DESIGN FLOOD SCOUR DEPTH	5.89 FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

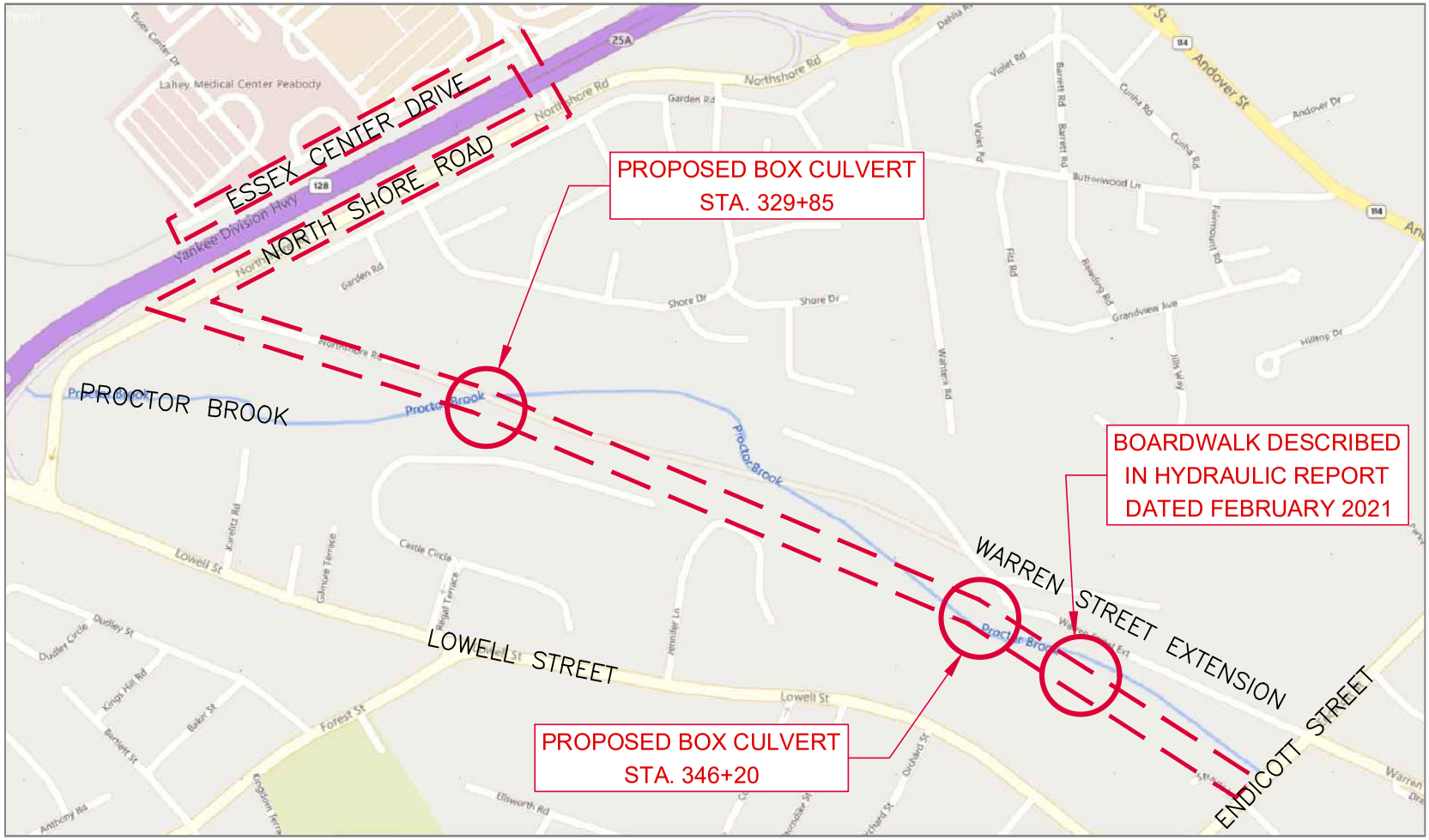
Table 5.1b – Hydraulic Data for Culvert at Sta 346+20

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	2.48 SQUARE MILES
DESIGN FLOOD DISCHARGE:	243 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	5.80 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	40.86 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	428 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	41.39 FEET, NAVD 88

DESIGN SCOUR DATA (Peak Velocity Flow)	
DESIGN SCOUR FLOOD DISCHARGE:	134 CUBIC FEET PER SECOND
DESIGN FLOOD SCOUR DEPTH	4.69 FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

FIGURES

FIGURE 1



LEGEND:

Project Limits

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS TEWKSBURY, MASSACHUSETTS

MASSDOT
PEABODY BIKEWAY EXTENSION
NORTH SHORE MALL TO ENDICOTT STREET
PEABODY, MA

CULVERT LOCATION LOCUS MAP
NOT TO SCALE

Proposal No. 609211-132091

A00830 - 75

F:\Projects\2013\13033\13033.10X--Weymouth Bridge St\Survey\Research\Utilities\Utility Request\Locus Map.dwg

SCALE IN FEET
250' 0 250' 500'
1" = 250'

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.: 17118.0XX
DATE: NOVEMBER, 2023
DESIGNED BY: N/A
DRAWN BY: JRM
CHECKED BY: SS

PROJECT TITLE:
PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:
FIGURE 2 – CROSS SECTIONS LOCATIONS

NAD 88
N

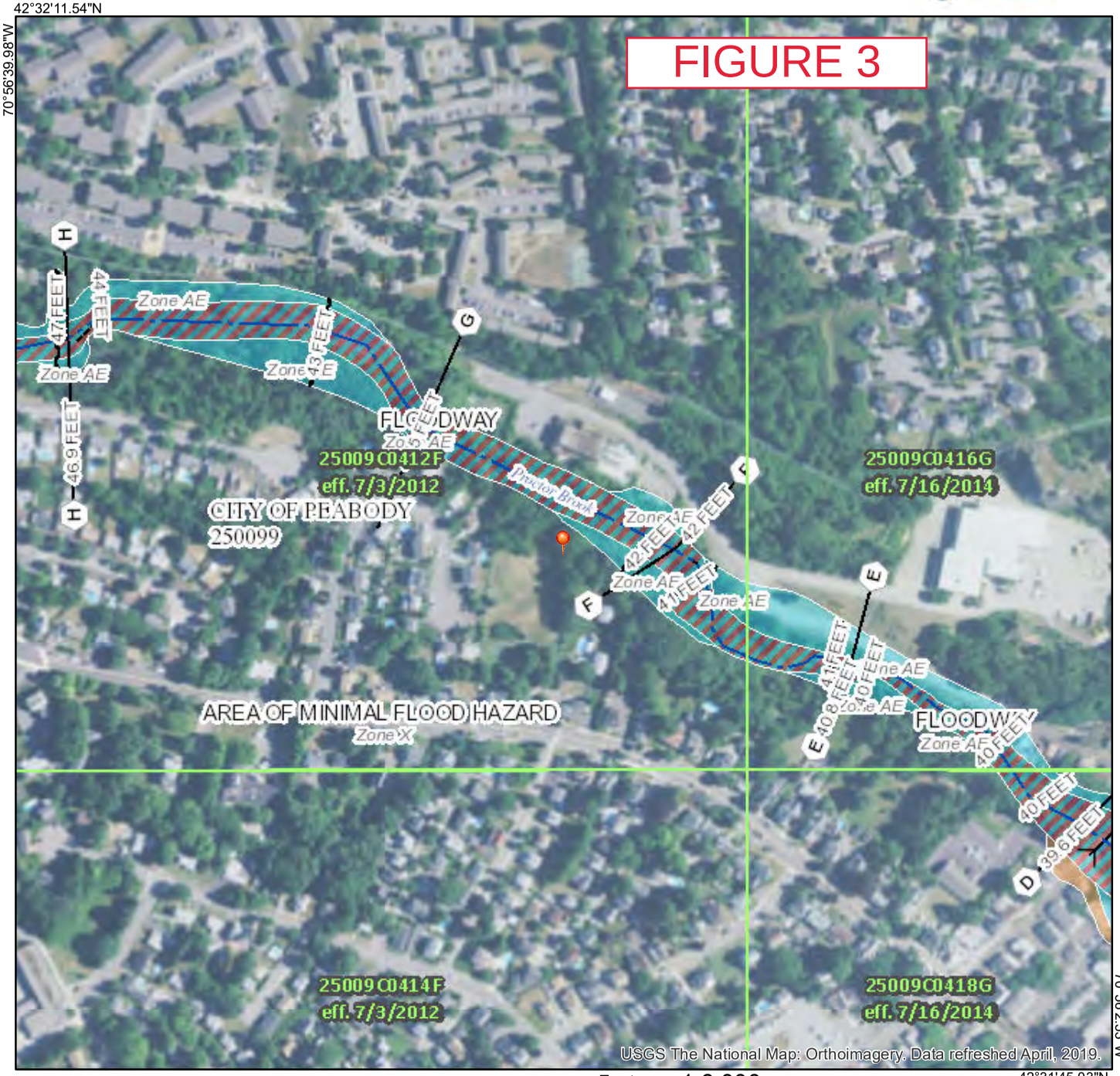
National Flood Hazard Layer FIRMette

FEMA

42°32'11.54"N

70°56'39.98"W

FIGURE 3



42°31'45.03"N

70°56'2.53"W

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- **SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- **OTHER AREAS OF FLOOD HAZARD**
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- **OTHER AREAS**
  - NO SCREEN — Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- **GENERAL STRUCTURES**
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- **OTHER FEATURES**
  - 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
  - Coastal Transect
  - Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- **MAP PANELS**
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/24/2019 at 9:07:12 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00830 - 77

ATTACHMENT A: 1977 HEC-2 MODEL INPUT/RESULTS

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

B.W. FINAL

70'

```
**********************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**********************************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1  ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
        0.        2.         0.         0.  0.0               0.0        0.0         0.     9.200      0.0
J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
    1.000        0.0     -1.000        0.0        0.0        0.0        0.0        0.0        0.0        0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
     38.000     1.000      2.000      3.000     40.000     41.000     42.000     53.000     21.000      4.000

     22.000    54.000     34.000        0.0     38.000      1.000     39.000     50.000     61.000     51.000

     26.000    43.000     13.000     14.000     15.000     27.000     28.000        0.0        0.0        0.0
QT    9.000   640.000    970.000   1140.000   1620.000   1140.000   1140.000   1140.000   1140.000   1140.000
NC    0.080     0.060      0.040      0.100      0.300        0.0        0.0        0.0        0.0        0.0
ET      0.0   900.000   1100.000        0.0        0.0        0.0        0.0        0.0      2.100        0.0

X1    0.002    17.000    992.500   1005.500        0.0        0.0        0.0        0.0        0.0        0.0
GR   20.000   625.000     15.000    650.000     10.000    760.000     11.200    949.000     11.200    964.000
GR   10.800   979.500      5.400    992.500      4.200   1000.000      4.600   1005.500      5.300   1008.000
GR    8.300  1011.000      8.700   1025.000      8.700   1040.000      8.700   1055.000      9.500   1082.000
GR   10.000  1140.000     40.000   1140.100        0.0        0.0        0.0        0.0        0.0        0.0
NC    0.075     0.060      0.040      0.100      0.300        0.0        0.0        0.0        0.0        0.0
ET      0.0   900.000   1100.000        0.0        0.0        0.0        0.0        0.0      2.100        0.0

X1    0.056    12.000    994.000   1006.000    340.000    285.000    285.000        0.0        0.0        0.0
GR   20.000   570.000     15.000    630.000     10.000    730.000     10.000    905.000      5.000    980.000
GR    4.800   994.000      4.600   1000.000      4.800   1006.000      5.000   1010.000     10.200   1035.000
GR   10.500  1090.000     40.000   1090.100        0.0        0.0        0.0        0.0        0.0        0.0
NC    0.050     0.050      0.040      0.100      0.300        0.0        0.0        0.0        0.0        0.0
ET      0.0   900.000   1100.000        0.0        0.0        0.0        0.0        0.0      2.100        0.0

X1    0.056    10.000    994.000   1006.000      1.000      1.000      1.000        0.0        0.0        0.0
GR   40.000   950.000     10.000    950.100      5.000    980.000      4.800    994.000      4.600   1000.000
GR    4.800  1006.000      5.000   1010.000     10.200   1035.000     10.500   1090.000     40.000   1090.100
NC    0.040     0.045      0.040      0.300      0.500        0.0        0.0        0.0        0.0        0.0
ET      0.0   900.000   1100.000        0.0        0.0        0.0        0.0        0.0      2.100        0.0

X1    0.069    15.000    985.700   1014.700     70.000     70.000     69.000        0.0        0.0        0.0
```

Proposal No. 609211-132091

A00830 - 79

ET	0.0	805.000	1040.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.020	11.000	805.000	1040.000	227.000	180.000	185.000	0.0	0.0	0.0
GR	50.000	595.000	45.000	695.000	38.000	804.900	32.400	805.000	31.400	1000.000
GR	32.400	1040.000	35.000	1065.000	35.000	1110.000	40.000	1155.000	45.000	1235.000
GR	50.000	1800.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.0	0.0	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	900.000	1100.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.099	10.000	980.000	1030.000	465.000	417.000	417.000	0.0	0.0	0.0
GR	50.000	635.000	45.000	720.000	32.100	980.000	31.100	1000.000	32.100	1030.000
GR	35.000	1070.000	35.000	1100.000	40.000	1120.000	45.000	1260.000	50.000	1350.000
NC	0.0	0.0	0.045	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	871.000	1138.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.108	18.000	995.000	1005.500	50.000	60.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	35.600	35.600	0.0
GR	50.000	635.000	45.000	720.000	39.400	900.000	38.900	925.000	38.100	950.000
GR	37.500	975.000	37.100	994.900	32.500	995.000	31.300	1000.000	31.300	1005.500
GR	31.300	1005.600	32.700	1025.000	34.400	1050.000	35.300	1075.000	35.600	1100.000
GR	40.000	1130.000	45.000	1265.000	50.000	1365.000	0.0	0.0	0.0	0.0
SB	0.0	1.560	2.800	0.0	10.500	0.0	41.100	0.0	31.400	31.300
ET	0.0	871.000	1138.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.118	0.0	0.0	0.0	51.000	51.000	51.000	0.0	0.100	0.0
X2	0.0	0.0	1.000	35.600	35.400	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	37.300	35.400	0.0
BT	9.000	975.000	37.600	0.0	994.900	37.300	0.0	995.000	37.300	35.600
BT	1000.000	37.200	35.500	1005.500	37.300	35.400	1005.600	37.300	0.0	1025.000
BT	36.600	0.0	1050.000	36.000	0.0	1075.000	35.400	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	950.000	1100.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.127	13.000	995.000	1005.000	50.000	60.000	50.000	0.0	0.0	0.0
GR	50.000	720.000	45.000	810.000	38.300	992.000	38.300	992.900	34.200	993.000
GR	32.500	995.000	31.900	1000.000	32.600	1005.000	36.300	1012.000	37.100	1050.000
GR	40.000	1105.000	45.000	1245.000	50.000	1350.000	0.0	0.0	0.0	0.0
NC	0.070	0.070	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	990.000	1015.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.254	11.000	996.000	1006.000	670.000	670.000	670.000	0.0	0.0	0.0
GR	50.000	935.000	45.000	990.000	40.000	990.000	39.100	993.000	39.100	995.900
GR	36.800	996.000	35.900	1000.000	35.900	1006.000	40.000	1012.000	45.000	1100.000
GR	50.000	1150.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.025	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	985.000	1020.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.263	13.000	996.000	1006.000	50.000	50.000	50.000	0.0	0.0	0.0
GR	60.000	860.000	45.000	945.000	40.000	985.000	39.100	993.000	39.100	995.900
GR	36.600	996.000	35.700	1000.000	35.600	1006.000	38.900	1006.100	38.900	1009.000
GR	40.000	1015.000	45.000	1085.000	50.000	1130.000	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.025	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1020.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.267	0.0	0.0	0.0	19.000	19.000	19.000	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	975.000	1035.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.276	12.000	994.000	1006.000	50.000	50.000	50.000	0.0	0.0	0.0

Proposal No. 609211-132091

A00830 - 80

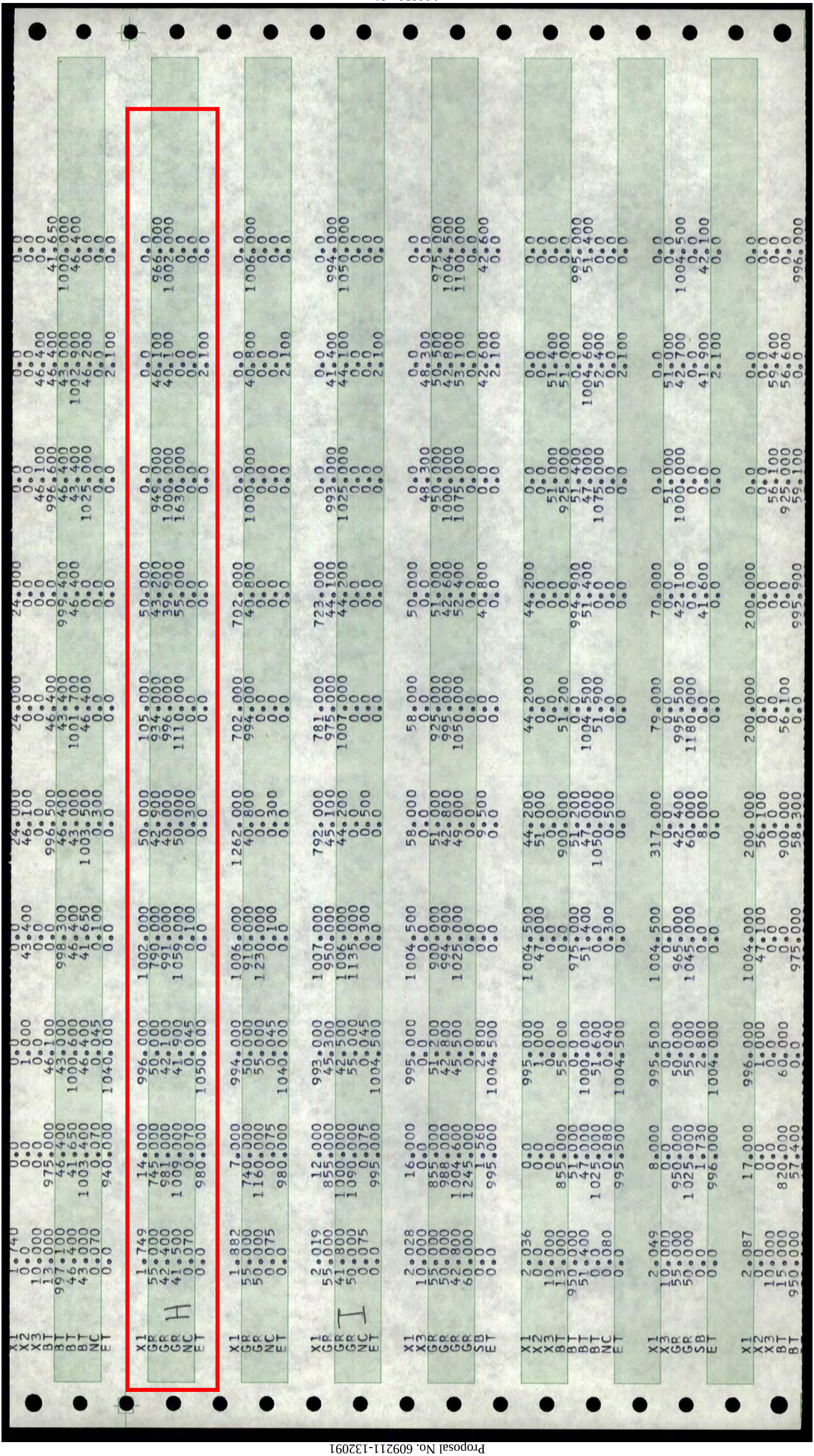
GR	30.000	870.000	45.200	950.000	40.300	964.000	40.200	974.000	40.100	984.000
GR	36.600	994.000	35.900	1000.000	36.500	1006.000	36.900	1011.000	37.600	1041.000
GR	45.000	1070.000	50.000	1110.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	930.000	1030.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.380	12.000	996.500	1003.500	550.000	650.000	549.000	0.0	0.0	0.0
GR	55.000	680.000	50.000	700.000	45.000	830.000	48.800	868.000	37.200	938.500
GR	37.100	1000.000	37.200	1003.500	40.000	1045.000	40.000	1110.000	45.000	1155.000
GR	50.000	1170.000	55.000	1180.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.070	0.075	0.050	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	967.000	1168.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.389	15.000	996.800	1003.200	50.000	50.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	38.900	38.900	0.0
GR	55.000	850.000	50.000	860.000	45.000	930.000	41.100	975.000	35.300	996.700
GR	35.200	996.800	35.700	1000.000	36.300	1003.200	36.300	1003.300	41.200	1025.000
GR	40.900	1080.000	40.900	1160.000	45.000	1200.000	50.000	1210.000	55.000	1220.000
SB	0.0	1.560	2.800	0.0	6.400	0.0	22.700	0.0	35.700	35.700
ET	0.0	956.000	1178.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.393	0.0	0.0	0.0	18.500	18.500	18.500	0.0	0.0	0.0
X2	0.0	0.0	1.000	39.300	41.100	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	41.100	41.200	0.0
BT	7.000	975.000	41.100	0.0	996.700	41.200	0.0	996.800	41.200	39.300
BT	1000.000	41.200	39.300	1003.200	41.200	39.300	1003.300	41.200	0.0	1025.000
BT	41.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	990.000	1090.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.402	16.000	994.000	1006.000	85.000	50.000	50.000	0.0	0.0	0.0
GR	55.000	865.000	50.000	885.000	45.000	960.000	41.000	970.000	38.500	980.000
GR	38.600	993.000	36.700	994.000	36.900	1000.000	37.300	1006.000	40.500	1014.000
GR	41.100	1023.000	40.900	1075.000	40.900	1140.000	45.000	1195.000	50.000	1205.000
GR	55.000	1215.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1080.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.542	15.000	997.000	1004.000	740.000	790.000	739.000	0.0	0.0	0.0
GR	55.000	780.000	50.000	795.000	45.200	960.000	42.200	970.000	40.900	980.000
GR	40.300	994.000	38.900	997.000	39.000	1000.000	39.100	1004.000	40.500	1005.000
GR	40.700	1030.000	41.100	1050.000	50.000	1175.000	50.000	1540.000	55.000	1570.000
NC	0.070	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	935.000	1035.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.726	8.000	996.500	1003.500	972.000	972.000	972.000	0.0	0.0	0.0
GR	55.000	810.000	50.000	845.000	40.200	996.500	40.100	1000.000	40.200	1003.500
GR	46.000	1050.000	50.000	1280.000	55.000	1765.000	0.0	0.0	0.0	0.0
NC	0.065	0.065	0.045	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	982.000	1017.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.735	19.000	996.500	1003.500	30.000	30.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	43.400	43.400	0.0
GR	55.000	745.000	50.000	885.000	46.100	975.000	43.000	994.500	42.000	996.500
GR	41.650	996.600	40.300	997.100	39.900	998.300	40.300	999.400	41.650	1000.000
GR	40.300	1000.600	39.900	1001.700	40.300	1002.900	41.650	1003.400	42.000	1003.500
GR	43.000	1005.500	46.200	1025.000	50.000	1255.000	55.000	1740.000	0.0	0.0
SB	0.0	1.560	2.800	0.0	6.700	0.0	18.200	0.0	39.900	39.900
ET	0.0	940.000	1111.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0

E

F

G

Proposal No. 609211-132091



SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.02	996.00	35.45	1006.00	1018.47	73.95
1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	210.71
1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

D

E

F

Proposal No. 609211-132091

A00830 - 83

Proposal No. 609211-132091

A00830 - 84

	SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
G	1.542	42.40	0.0	42.47	0.0	0.0	38.90	969.31	997.00	99.03	1004.00	1068.35	55.08
	1.542	43.01	0.0	43.08	0.0	0.0	38.90	967.31	997.00	109.50	1004.00	1076.80	87.37
	1.542	43.28	0.0	43.35	0.0	0.0	38.90	966.41	997.00	114.18	1004.00	1080.59	104.35
	1.542	44.02	0.0	44.09	0.0	0.0	38.90	963.95	997.00	127.00	1004.00	1090.95	159.05
	1.726	43.86	0.0	43.90	0.0	0.0	40.10	939.96	996.50	92.86	1003.50	1032.82	70.24
	1.726	44.45	0.0	44.51	0.0	0.0	40.10	930.82	996.50	106.75	1003.50	1037.56	100.41
	1.726	44.71	0.0	44.77	0.0	0.0	40.10	926.89	996.50	112.71	1003.50	1039.60	115.47
	1.726	45.41	0.0	45.48	0.0	0.0	40.10	916.11	996.50	129.08	1003.50	1045.19	163.74
*	1.735	43.94	43.94	44.88	0.0	0.0	39.90	988.61	996.50	22.60	1003.50	1011.21	15.83
*	1.735	44.67	44.67	45.64	0.0	0.0	39.90	983.97	996.50	31.72	1003.50	1015.70	25.16
*	1.735	44.94	44.94	45.94	0.0	0.0	39.90	982.27	996.50	35.08	1003.50	1017.35	29.57
*	1.735	45.59	45.59	46.69	0.0	0.0	39.90	978.21	996.50	43.08	1003.50	1021.28	42.48
	1.740	46.70	0.0	46.75	46.10	43.40	39.90	961.25	996.50	93.76	1003.50	1055.01	76.86
	1.740	47.35	0.0	47.41	46.10	43.40	39.90	946.04	996.50	148.87	1003.50	1094.91	111.85
	1.740	47.61	0.0	47.67	46.10	43.40	39.90	940.06	996.50	170.52	1003.50	1110.58	129.89
	1.740	48.32	0.0	48.37	46.10	43.40	39.90	923.80	996.50	229.44	1003.50	1153.24	194.12
H	1.749	46.76	0.0	46.77	0.0	0.0	39.90	855.65	996.00	233.97	1002.00	1089.62	413.41
	1.749	47.43	0.0	47.43	0.0	0.0	39.90	842.21	996.00	251.58	1002.00	1093.79	534.17
	1.749	47.69	0.0	47.69	0.0	0.0	39.90	836.95	996.00	258.47	1002.00	1095.42	586.16
	1.749	48.39	0.0	48.39	0.0	0.0	39.90	822.75	996.00	277.08	1002.00	1099.83	740.34
	1.882	46.80	0.0	46.81	0.0	0.0	40.80	939.19	994.00	167.28	1006.00	1106.48	283.97
	1.882	47.48	0.0	47.49	0.0	0.0	40.80	933.01	994.00	184.79	1006.00	1117.81	367.00
	1.882	47.75	0.0	47.75	0.0	0.0	40.80	930.58	994.00	191.68	1006.00	1122.26	403.31
	1.882	48.47	0.0	48.48	0.0	0.0	40.80	924.01	994.00	210.29	1006.00	1134.31	512.35
I	2.019	46.89	0.0	46.91	0.0	0.0	41.40	934.39	993.00	134.55	1007.00	1068.94	136.65
	2.019	47.59	0.0	47.62	0.0	0.0	41.40	927.52	993.00	146.17	1007.00	1073.69	198.05
	2.019	47.87	0.0	47.90	0.0	0.0	41.40	924.80	993.00	150.78	1007.00	1075.58	225.75
	2.019	48.62	0.0	48.65	0.0	0.0	41.40	917.45	993.00	163.22	1007.00	1080.67	310.20
	2.028	46.63	0.0	47.27	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	27.95
	2.028	47.07	0.0	48.24	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	32.86
	2.028	47.19	0.0	48.69	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	34.13
	2.028	48.55	0.0	48.81	0.0	0.0	42.60	989.39	995.00	57.41	1004.50	1046.79	121.45
	2.036	46.90	0.0	47.46	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	30.96
	2.036	48.23	0.0	48.96	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	46.35
	2.036	48.98	0.0	49.75	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	55.57
	2.036	51.68	0.0	51.73	51.00	47.00	42.60	894.32	995.00	175.38	1004.50	1069.70	335.37
	2.049	47.37	0.0	47.80	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	42.29
	2.049	48.71	0.0	49.32	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	58.97
	2.049	49.44	0.0	50.10	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	68.29
	2.049	51.70	0.0	51.80	0.0	0.0	42.10	959.89	995.50	71.92	1004.50	1031.81	295.82
	2.087	47.87	0.0	48.26	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	46.38
	2.087	50.27	0.0	50.73	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	72.87
	2.087	51.73	0.0	52.17	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	89.33
	2.087	56.80	0.0	56.82	56.10	47.10	41.90	835.94	996.00	168.06	1004.00	1004.00	804.85

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

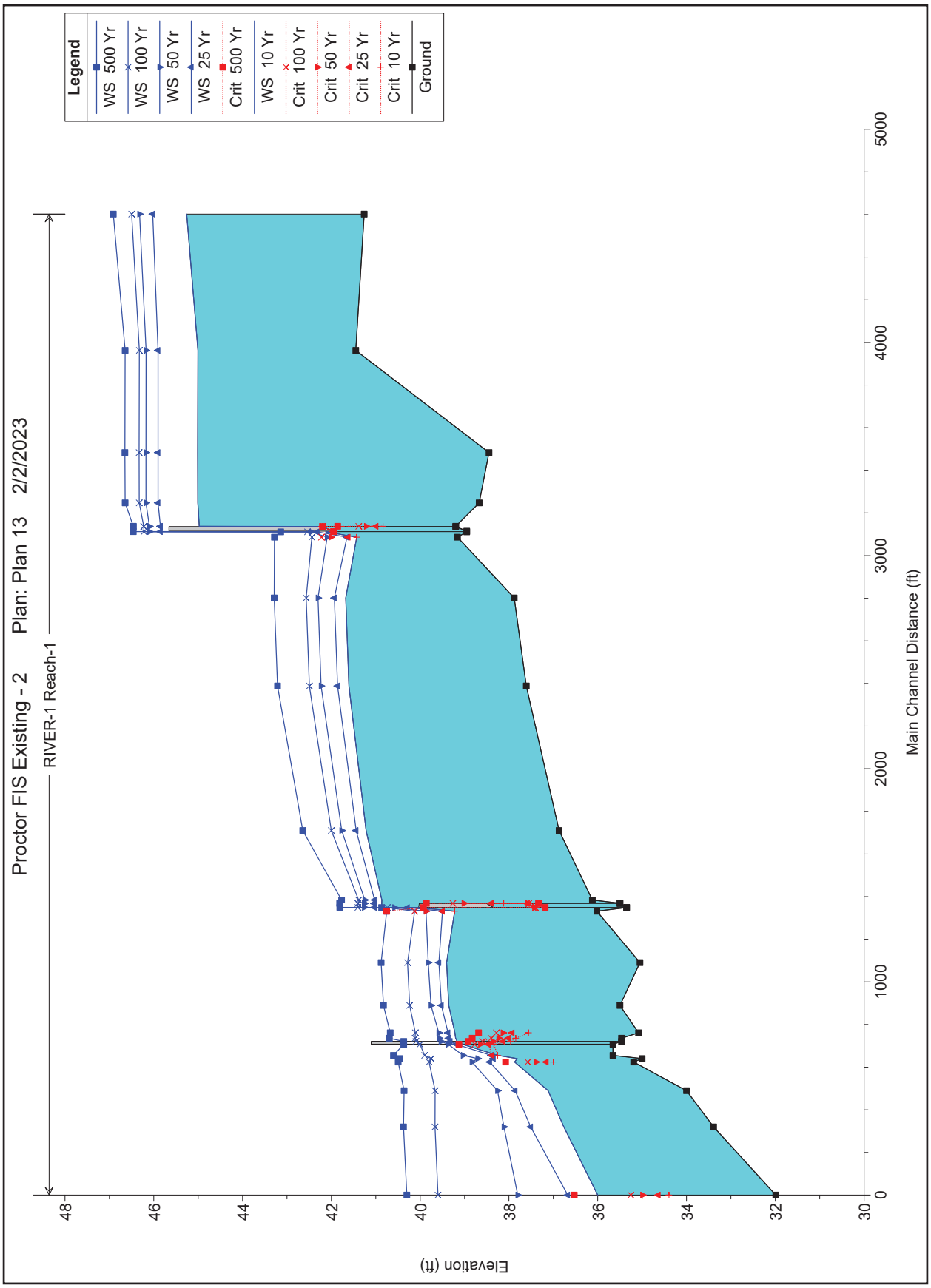
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	34	10 Yr	242.26	41.26	45.26		45.43	0.001879	3.47	97.63	84.71	0.37
Reach-1	34	25 Yr	289.42	41.26	46.02		46.12	0.000911	2.85	165.79	93.11	0.27
Reach-1	34	50 Yr	365.72	41.26	46.32		46.44	0.001017	3.17	193.87	96.36	0.29
Reach-1	34	100 Yr	427.56	41.26	46.50		46.64	0.001136	3.46	211.21	98.32	0.30
Reach-1	34	500 Yr	618.49	41.26	46.91		47.12	0.001543	4.30	252.72	102.84	0.36
Reach-1	33	10 Yr	242.26	41.45	45.01		45.02	0.000267	1.46	319.60	148.08	0.15
Reach-1	33	25 Yr	289.42	41.45	45.90		45.92	0.000140	1.26	461.53	168.49	0.11
Reach-1	33	50 Yr	365.72	41.45	46.17		46.19	0.000173	1.46	508.09	174.67	0.12
Reach-1	33	100 Yr	427.56	41.45	46.33		46.35	0.000206	1.63	534.97	178.14	0.14
Reach-1	33	500 Yr	618.49	41.45	46.64		46.68	0.000327	2.15	592.88	185.39	0.17
Reach-1	32	10 Yr	242.26	38.45	45.01		45.01	0.000006	0.29	871.30	219.19	0.02
Reach-1	32	25 Yr	289.42	38.45	45.90		45.91	0.000005	0.29	1075.76	237.72	0.02
Reach-1	32	50 Yr	365.72	38.45	46.18		46.18	0.000006	0.35	1141.15	243.35	0.03
Reach-1	32	100 Yr	427.56	38.45	46.33		46.33	0.000008	0.39	1178.58	246.52	0.03
Reach-1	32	500 Yr	618.49	38.45	46.65		46.65	0.000014	0.54	1258.64	253.15	0.04
Reach-1	31	10 Yr	242.26	38.67	45.01		45.01	0.000007	0.33	957.81	294.77	0.03
Reach-1	31	25 Yr	289.42	38.67	45.90		45.90	0.000006	0.32	1257.05	373.59	0.02
Reach-1	31	50 Yr	365.72	38.67	46.17		46.18	0.000007	0.39	1361.68	397.48	0.03
Reach-1	31	100 Yr	427.56	38.67	46.33		46.33	0.000009	0.44	1423.28	410.90	0.03
Reach-1	31	500 Yr	618.49	38.67	46.65		46.65	0.000016	0.60	1558.78	438.97	0.04
Reach-1	30	10 Yr	242.26	39.20	44.97	40.84	45.00	0.000123	1.46	233.94	97.19	0.11
Reach-1	30	25 Yr	289.42	39.20	45.85	40.99	45.89	0.000147	1.77	286.00	116.47	0.12
Reach-1	30	50 Yr	365.72	39.20	46.10	41.21	46.16	0.000205	2.14	320.35	168.44	0.15
Reach-1	30	100 Yr	427.56	39.20	46.23	41.38	46.30	0.000261	2.45	344.37	203.35	0.17
Reach-1	30	500 Yr	618.49	39.20	46.46	41.86	46.60	0.000470	3.36	399.49	268.61	0.22
Reach-1	29.5		Culvert									
Reach-1	29.4	10 Yr	242.26	38.95	42.13		42.35	0.002509	3.78	65.97	34.07	0.42
Reach-1	29.4	25 Yr	289.42	38.95	42.32		42.59	0.002777	4.17	71.88	36.81	0.45
Reach-1	29.4	50 Yr	365.72	38.95	42.45		42.84	0.003728	5.00	76.15	38.79	0.53
Reach-1	29.4	100 Yr	427.56	38.95	42.54		43.03	0.004604	5.67	78.75	39.99	0.59
Reach-1	29.4	500 Yr	618.49	38.95	43.14		43.83	0.005019	6.72	97.41	48.63	0.64
Reach-1	29.3	10 Yr	242.26	39.16	41.43	41.43	42.09	0.016855	6.51	37.23	28.61	1.01
Reach-1	29.3	25 Yr	289.42	39.16	41.65	41.62	42.33	0.015409	6.60	43.87	30.87	0.98
Reach-1	29.3	50 Yr	365.72	39.16	42.09	42.01	42.65	0.009391	6.09	75.57	104.97	0.79
Reach-1	29.3	100 Yr	427.56	39.16	42.44	42.22	42.87	0.006204	5.55	119.41	149.42	0.66
Reach-1	29.3	500 Yr	618.49	39.16	43.28		43.51	0.002697	4.55	291.00	258.02	0.46
Reach-1	28	10 Yr	242.26	37.88	41.68		41.69	0.000194	1.04	274.93	163.88	0.12
Reach-1	28	25 Yr	289.42	37.88	41.93		41.95	0.000190	1.11	316.93	165.79	0.12
Reach-1	28	50 Yr	365.72	37.88	42.30		42.32	0.000186	1.20	378.73	168.29	0.12
Reach-1	28	100 Yr	427.56	37.88	42.57		42.59	0.000186	1.27	423.89	170.10	0.12
Reach-1	28	500 Yr	618.49	37.88	43.29		43.32	0.000187	1.45	547.98	174.95	0.13
Reach-1	27	10 Yr	242.26	37.61	41.61		41.62	0.000162	0.94	262.98	122.78	0.11
Reach-1	27	25 Yr	289.42	37.61	41.86		41.88	0.000162	1.01	294.64	125.36	0.11
Reach-1	27	50 Yr	365.72	37.61	42.23		42.25	0.000164	1.11	341.70	129.09	0.11
Reach-1	27	100 Yr	427.56	37.61	42.50		42.52	0.000166	1.18	376.39	131.78	0.12
Reach-1	27	500 Yr	618.49	37.61	43.21		43.24	0.000174	1.39	473.33	138.92	0.12
Reach-1	26.5	10 Yr	242.26	36.87	41.22		41.36	0.001442	3.06	87.17	51.16	0.33
Reach-1	26.5	25 Yr	289.42	36.87	41.44		41.61	0.001540	3.33	99.43	57.56	0.34
Reach-1	26.5	50 Yr	365.72	36.87	41.77		41.97	0.001663	3.72	119.82	68.30	0.36
Reach-1	26.5	100 Yr	427.56	36.87	42.00		42.23	0.001747	3.99	136.75	77.37	0.38
Reach-1	26.5	500 Yr	618.49	36.87	42.64		42.94	0.001857	4.60	194.69	102.52	0.40
Reach-1	26	10 Yr	242.26	36.12	40.86		40.99	0.000887	2.90	97.10	48.82	0.26
Reach-1	26	25 Yr	289.42	36.12	41.03		41.19	0.001086	3.30	105.58	55.12	0.29
Reach-1	26	50 Yr	365.72	36.12	41.25		41.47	0.001415	3.90	118.63	63.60	0.33
Reach-1	26	100 Yr	427.56	36.12	41.39		41.67	0.001704	4.38	127.82	68.95	0.37
Reach-1	26	500 Yr	618.49	36.12	41.77		42.22	0.002529	5.64	157.16	83.79	0.45
Reach-1	25	10 Yr	242.26	35.50	40.87	38.12	40.96	0.000715	2.55	119.60	72.16	0.23
Reach-1	25	25 Yr	289.42	35.50	41.03	38.40	41.15	0.000858	2.88	132.11	78.29	0.26
Reach-1	25	50 Yr	365.72	35.50	41.26	39.01	41.42	0.001087	3.37	150.74	86.62	0.29
Reach-1	25	100 Yr	427.56	35.50	41.40	39.26	41.60	0.001287	3.75	163.64	91.94	0.32
Reach-1	25	500 Yr	618.49	35.50	41.81	39.86	42.11	0.001818	4.73	204.06	106.93	0.39
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	242.26	35.35	40.06		40.30	0.001760	3.99	66.19	24.87	0.36
Reach-1	24.4	25 Yr	289.42	35.35	40.29		40.59	0.002068	4.50	72.65	32.38	0.39

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	24.4	50 Yr	365.72	35.35	40.57		40.99	0.002586	5.26	83.66	44.02	0.44
Reach-1	24.4	100 Yr	427.56	35.35	40.74		41.26	0.003065	5.87	91.57	50.78	0.48
Reach-1	24.4	500 Yr	618.49	35.35	40.87	39.93	41.86	0.005758	8.19	98.31	55.89	0.66
Reach-1	24.3	10 Yr	242.26	36.02	39.22	39.22	40.06	0.016648	7.32	33.08	20.10	1.01
Reach-1	24.3	25 Yr	289.42	36.02	39.50	39.50	40.36	0.014524	7.45	40.48	30.70	0.96
Reach-1	24.3	50 Yr	365.72	36.02	39.87	39.87	40.76	0.012248	7.69	54.77	45.79	0.91
Reach-1	24.3	100 Yr	427.56	36.02	40.12	40.12	41.04	0.011122	7.88	67.75	55.44	0.88
Reach-1	24.3	500 Yr	618.49	36.02	40.75	40.75	41.73	0.009372	8.41	110.23	79.19	0.84
Reach-1	23	10 Yr	242.26	35.05	39.40		39.41	0.000052	0.66	401.39	156.58	0.07
Reach-1	23	25 Yr	289.42	35.05	39.58		39.58	0.000062	0.75	428.63	158.87	0.07
Reach-1	23	50 Yr	365.72	35.05	39.82		39.83	0.000078	0.88	467.37	161.12	0.08
Reach-1	23	100 Yr	427.56	35.05	40.28		40.30	0.000069	0.90	543.40	165.46	0.08
Reach-1	23	500 Yr	618.49	35.05	40.88		40.90	0.000089	1.12	643.56	171.00	0.09
Reach-1	22	10 Yr	242.26	35.50	39.36		39.38	0.000658	1.33	183.03	138.19	0.20
Reach-1	22	25 Yr	289.42	35.50	39.52		39.55	0.000646	1.41	206.41	141.44	0.20
Reach-1	22	50 Yr	365.72	35.50	39.76		39.79	0.000649	1.54	240.00	145.98	0.21
Reach-1	22	100 Yr	427.56	35.50	40.24		40.27	0.000400	1.39	312.34	155.31	0.17
Reach-1	22	500 Yr	618.49	35.50	40.83		40.86	0.000381	1.56	407.24	166.76	0.17
Reach-1	21.7	10 Yr	242.26	35.08	39.22	37.56	39.28	0.000955	1.98	122.64	69.81	0.25
Reach-1	21.7	25 Yr	289.42	35.08	39.37	37.93	39.45	0.001049	2.19	133.79	75.72	0.27
Reach-1	21.7	50 Yr	365.72	35.08	39.58	38.13	39.68	0.001203	2.50	150.44	83.77	0.29
Reach-1	21.7	100 Yr	427.56	35.08	40.11	38.28	40.19	0.000788	2.33	200.47	104.22	0.25
Reach-1	21.7	500 Yr	618.49	35.08	40.67	38.68	40.79	0.000846	2.73	262.26	114.10	0.26
Reach-1	21.6	10 Yr	242.26	35.46	39.20	37.85	39.24	0.001125	1.61	151.05	126.87	0.26
Reach-1	21.6	25 Yr	289.42	35.46	39.36	38.01	39.40	0.001123	1.70	171.47	134.62	0.26
Reach-1	21.6	50 Yr	365.72	35.46	39.57	38.23	39.62	0.001149	1.83	201.40	145.23	0.27
Reach-1	21.6	100 Yr	427.56	35.46	40.11	38.40	40.15	0.000579	1.53	287.30	168.00	0.20
Reach-1	21.6	500 Yr	618.49	35.46	40.69	38.83	40.74	0.000482	1.67	387.91	179.91	0.19
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	242.26	35.66	38.25	38.25	38.69	0.018701	5.36	49.29	69.69	1.00
Reach-1	21.4	25 Yr	289.42	35.66	38.40	38.38	38.84	0.015829	5.45	59.82	75.85	0.94
Reach-1	21.4	50 Yr	365.72	35.66	39.03		39.26	0.004572	4.02	116.63	102.92	0.55
Reach-1	21.4	100 Yr	427.56	35.66	39.90		40.01	0.001307	2.84	221.82	139.83	0.31
Reach-1	21.4	500 Yr	618.49	35.66	40.60		40.71	0.001041	2.98	325.78	155.54	0.29
Reach-1	21.35	10 Yr	242.26	35.00	37.81		38.18	0.004617	4.84	50.10	20.60	0.55
Reach-1	21.35	25 Yr	289.42	35.00	38.35		38.69	0.003646	4.71	61.40	21.66	0.49
Reach-1	21.35	50 Yr	365.72	35.00	38.70		39.14	0.004131	5.29	69.16	22.36	0.53
Reach-1	21.35	100 Yr	427.56	35.00	39.75		39.95	0.003457	3.54	120.75	67.51	0.47
Reach-1	21.35	500 Yr	618.49	35.00	40.46		40.66	0.002652	3.59	172.05	77.22	0.42
Reach-1	21.3	10 Yr	242.26	35.19	37.87	37.00	38.07	0.003009	3.56	68.12	35.00	0.45
Reach-1	21.3	25 Yr	289.42	35.19	38.43	37.16	38.60	0.002006	3.27	88.47	37.88	0.38
Reach-1	21.3	50 Yr	365.72	35.19	38.83	37.39	39.02	0.001886	3.47	118.41	103.01	0.37
Reach-1	21.3	100 Yr	427.56	35.19	39.80	37.57	39.90	0.000750	2.69	226.91	122.06	0.25
Reach-1	21.3	500 Yr	618.49	35.19	40.49	38.08	40.61	0.000756	3.03	316.67	135.81	0.26
Reach-1	21.2	10 Yr	242.26	34.00	37.12		37.53	0.005100	5.16	46.99	19.03	0.58
Reach-1	21.2	25 Yr	289.42	34.00	37.86		38.18	0.004995	4.54	63.78	31.80	0.56
Reach-1	21.2	50 Yr	365.72	34.00	38.26		38.59	0.005840	4.64	78.83	43.52	0.61
Reach-1	21.2	100 Yr	427.56	34.00	39.66		39.77	0.001224	2.63	167.44	82.49	0.30
Reach-1	21.2	500 Yr	618.49	34.00	40.36		40.49	0.001111	2.91	231.71	101.78	0.29
Reach-1	19	10 Yr	242.26	33.39	36.76		36.91	0.002162	3.10	78.03	37.25	0.38
Reach-1	19	25 Yr	289.42	33.39	37.51		37.59	0.002064	2.22	130.62	103.19	0.35
Reach-1	19	50 Yr	365.72	33.39	38.11		38.17	0.000996	1.85	197.34	117.88	0.25
Reach-1	19	100 Yr	427.56	33.39	39.66		39.68	0.000173	1.04	409.41	155.64	0.11
Reach-1	19	500 Yr	618.49	33.39	40.37		40.40	0.000181	1.18	525.96	172.92	0.12
Reach-1	18	10 Yr	242.26	31.99	36.00	34.40	36.21	0.002151	3.71	65.28	23.13	0.39
Reach-1	18	25 Yr	289.42	31.99	36.68	34.63	36.84	0.002605	3.25	93.05	65.81	0.41
Reach-1	18	50 Yr	365.72	31.99	37.80	34.99	37.88	0.000776	2.41	195.57	116.43	0.24
Reach-1	18	100 Yr	427.56	31.99	39.60	35.26	39.63	0.000159	1.49	478.02	197.41	0.12
Reach-1	18	500 Yr	618.49	31.99	40.30	36.53	40.34	0.000184	1.75	627.24	228.91	0.13

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Reach-1	29.5 Culvert #1	10 Yr	45.00	44.97	45.15	45.00	45.67	242.26		2.85	10.09	10.09
Reach-1	29.5 Culvert #1	25 Yr	45.89	45.85	45.92	45.89	45.67	270.18	19.24	3.53	11.26	11.26
Reach-1	29.5 Culvert #1	50 Yr	46.16	46.10	46.16	46.16	45.67	274.98	90.74	3.64	11.46	11.46
Reach-1	29.5 Culvert #1	100 Yr	46.30	46.23	46.28	46.30	45.67	277.33	150.23	3.69	11.56	11.56
Reach-1	29.5 Culvert #1	500 Yr	46.61	46.46	46.58	46.61	45.67	266.02	352.47	3.32	11.08	11.08
Reach-1	24.5 Culvert #1	10 Yr	40.97	40.87	40.58	40.97	40.06	139.22	103.04	0.81	5.80	5.80
Reach-1	24.5 Culvert #1	25 Yr	41.16	41.03	40.83	41.16	40.06	136.42	153.00	0.75	5.68	5.68
Reach-1	24.5 Culvert #1	50 Yr	41.43	41.26	41.12	41.43	40.06	134.93	230.79	0.68	5.62	5.62
Reach-1	24.5 Culvert #1	100 Yr	41.61	41.40	41.32	41.61	40.06	133.78	293.78	0.66	5.57	5.57
Reach-1	24.5 Culvert #1	500 Yr	42.11	41.81	41.88	42.11	40.06	112.70	505.79	0.94	4.70	4.70


Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
Crit 500 Yr
WS 10 Yr
Crit 100 Yr
Crit 50 Yr
Crit 25 Yr
Crit 10 Yr
Ground
Proctor FIS Existing - 2 Plan: Plan 13 2/2/2023
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
48
46
44
42
40
38
36
34
32
30
0
1000
2000
3000
4000
5000

ATTACHMENT C: GEOTECHNICAL ANALYSIS RESULTS

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

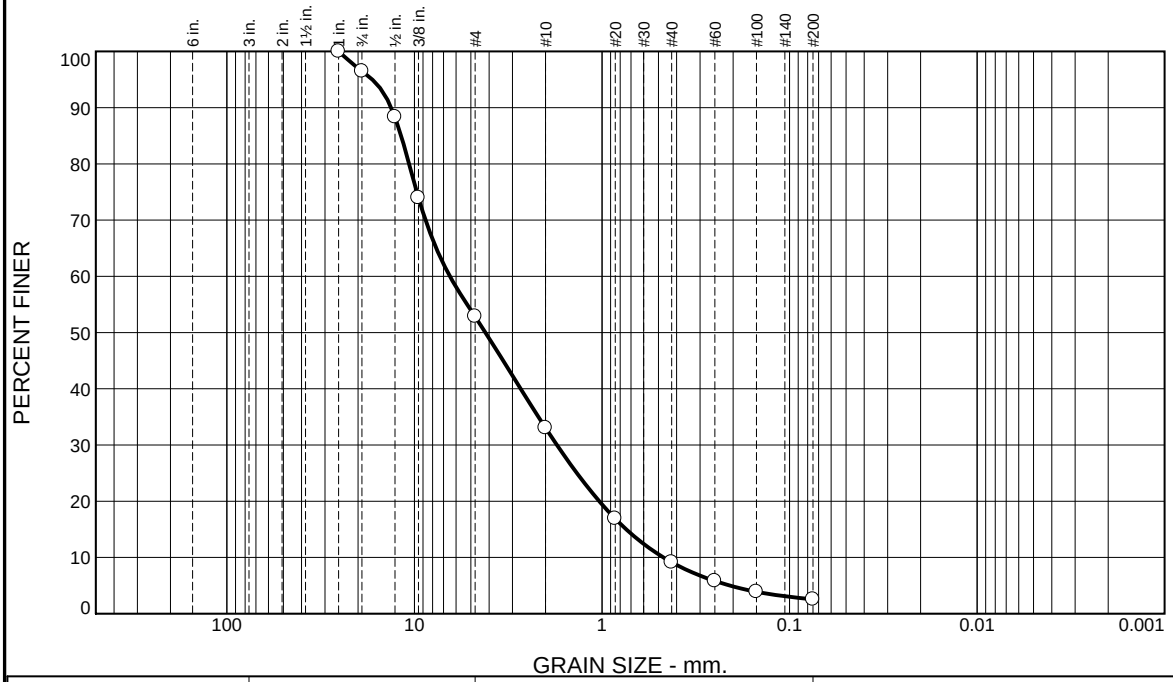
LABORATORY TESTING DATA SHEET

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f c Gravel, little Silt

Reviewed By _____ *01.14.2019*

Proposal No. 609211-132091
A00830 - 91

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	43.7	19.8	23.9	6.6	2.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.5		
0.5"	88.3		
0.375"	74.0		
#4	52.8		
#10	33.0		
#20	16.9		
#40	9.1		
#60	5.8		
#100	3.9		
#200	2.5		

* (no specification provided)

Material Description

Brown f-c SAND and fine GRAVEL, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 13.2913 D_{85}= 11.7790 D_{60}= 6.4677
D_{50}= 4.1824 D_{30}= 1.7381 D_{15}= 0.7425
D_{10}= 0.4702 C_u= 13.75 C_c= 0.99

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 7

Thielsch Engineering Inc.

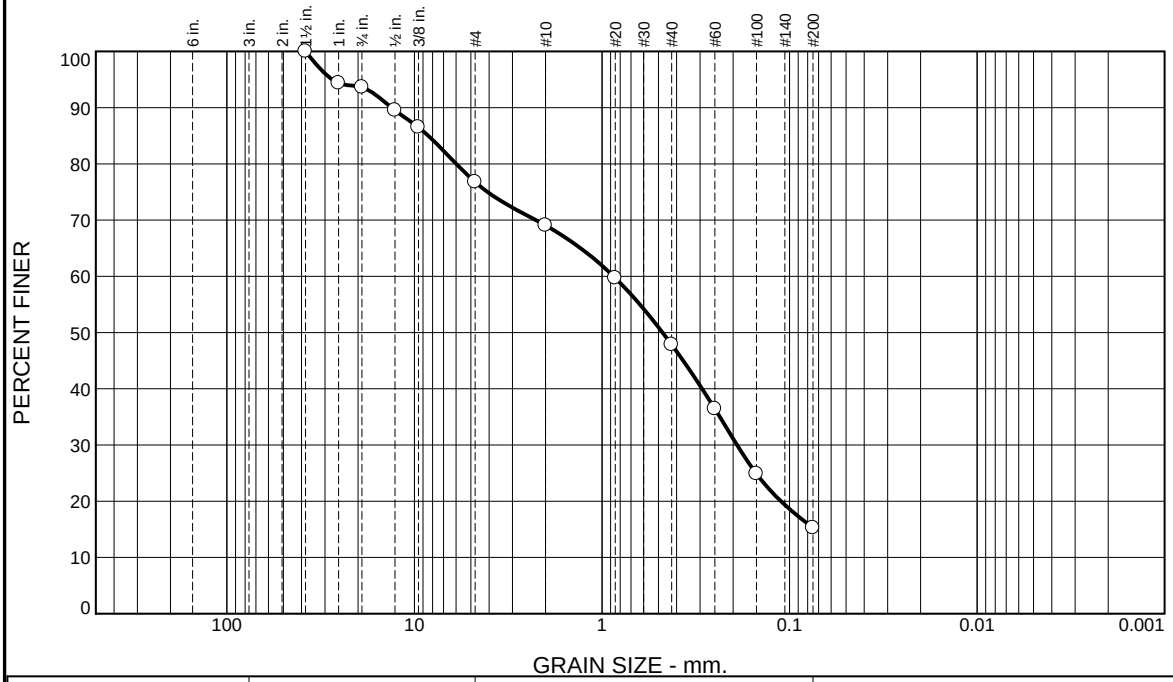
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.4	16.8	7.7	21.3	32.5	15.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	94.4		
0.75"	93.6		
0.5"	89.5		
0.375"	86.5		
#4	76.8		
#10	69.1		
#20	59.7		
#40	47.8		
#60	36.4		
#100	24.9		
#200	15.3		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 13.2491 D_{85}= 8.4302 D_{60}= 0.8673
D_{50}= 0.4754 D_{30}= 0.1904 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 8

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-8

ATTACHMENT D: SCOUR/STABILITY ANALYSES

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

U.S. Department of Transportation
Federal Highway Administration

Hydraulic Engineering Circular No. 14 - Estimating Scour at Culvert Outlets

5.1 COHESIONLESS SOILS

The general expression for determining scour geometry in a cohesionless soil at the culvert outlet is:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Input:

Q (cfs)	277
Slope	0.042
Time (min)	30
Dia (ft)	5.97
R_c *(ft)*	1.49
g (ft/s^2)	32.2
D_{84}	11.779
D_{16}	0.7425
σ	3.98

Output:

Depth, h_s *(ft)*	5.89
Width, W_s *(ft)*	32.00
Length, L_s *(ft)*	57.82
Volume, V_s (ft^3)	8133.98
Location of maximum scour ($L_m = 0.4L_s$) *(ft)*	23.13

Table 5.1. Coefficients for Culvert Outlet Scour in Cohesionless Soils

	α	β	θ
Depth, h_S	2.27	0.39	0.06
Width, W_S	6.94	0.53	0.08
Length, L_S	17.10	0.47	0.10
Volume, V_S	127.08	1.24	0.18

Table 5.2. Coefficient C_h for Outlets above the Bed

H_d[1]	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
1	1.22	1.51	0.73	1.28
2	1.26	1.54	0.73	1.47
4	1.34	1.66	0.73	1.55

[1] H_d is the height above bed in pipe diameters.

Table 5.3. Coefficient C_s for Culvert Slope

Slope %	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
2	1.03	1.28	1.17	1.30
5	1.08	1.28	1.17	1.30
>7	1.12	1.28	1.17	1.30

*Soil data taken from Geotechnical Report prepared by Gza GeoEnvironmental, Inc. on April 19, 2021.

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

U.S. Department of Transportation
Federal Highway Administration

Hydraulic Engineering Circular No. 14 - Estimating Scour at Culvert Outlets

5.1 COHESIONLESS SOILS

The general expression for determining scour geometry in a cohesionless soil at the culvert outlet is:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g}(R_c^{2.5})}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Input:

Q (cfs)	134
Slope	0.008
Time (min)	30
Dia (ft)	5.53
R_c *(ft)*	1.38
g *(ft/s²)*	32.2
D_{84}	8.4302
D_{16}	0.75
σ	3.35

Output:

Depth, h_s *(ft)*	4.69
Width, W_s *(ft)*	23.64
Length, L_s *(ft)*	44.11
Volume, V_s *(ft³)*	3527.78
Location of maximum scour ($L_m = 0.4L_s$) *(ft)*	17.65

Table 5.1. Coefficients for Culvert Outlet Scour in Cohesionless Soils

	α	β	θ
Depth, h_S	2.27	0.39	0.06
Width, W_S	6.94	0.53	0.08
Length, L_S	17.10	0.47	0.10
Volume, V_S	127.08	1.24	0.18

Table 5.2. Coefficient C_h for Outlets above the Bed

H_d[1]	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
1	1.22	1.51	0.73	1.28
2	1.26	1.54	0.73	1.47
4	1.34	1.66	0.73	1.55

[1] H_d is the height above bed in pipe diameters.

Table 5.3. Coefficient C_s for Culvert Slope

Slope %	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
2	1.03	1.28	1.17	1.30
5	1.08	1.28	1.17	1.30
>7	1.12	1.28	1.17	1.30

*Soil data taken from Geotechnical Report prepared by Gza GeoEnvironmental, Inc. on April 19, 2021.

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft		
g=	32.2	ft/s^2		
Q=	277	cfs		
TW=	0.9	ft		
D_{50}=	0.61	ft		
	7.36	in		
	186.90	mm	Use Class 3	Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length=	4.00	x	5.97
	24	ft	
Apron Depth=	3.30	x	0.61
	2.0	ft	
Apron Width=	34	ft	
(Figure 10.4)			

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft	
g=	32.2	ft/s^2	
Q=	134	cfs	
TW=	1	ft	
D_{50}=	0.21	ft	
	2.51	in	
	63.88	mm	Use Class 3 Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length= 4.00 x 5.97 = 24 ft

Apron Depth= 3.50 x 0.21 = 1 ft

Apron Width= 34 ft (Figure 10.4)

HYDRAULIC AND SCOUR REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Bridge No. TBD

Prepared for

massDOT Massachusetts Department of Transportation Highway Division

Massachusetts Department of Transportation

February 2021

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1
1.1 Purpose 1
1.2 Scope of Work 1
2.0 PROJECT DESCRIPTION 1
2.1 Existing Conditions 1
2.2 Proposed Conditions 2
3.0 DATA COLLECTION 2
4.0 ENGINEERING METHODS 3
4.1 Hydrologic Analysis 3
4.2 Duplicate Effective Analysis 4
4.3 Hydraulic Analysis 4
4.4 Scour Safety/Stability Analyses 6
5.0 CONCLUSIONS 9
6.0 REFERENCES 10
6.1 Federal Emergency Management Agency, Flood Insurance Study, Essex County, Massachusetts, July 19, 2018. 10
6.2 Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976. 10
6.3 Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019 10

TABLES

Table 4.1 – Summary of Discharges from 2018 Essex County FIS 3
Table 4.2 – Summary of Duplicate Effective Analysis 4
Table 4.3 – Comparison of FEMA, Existing and Proposed Base Flood Elevations (BFE - referenced to NAVD 88) at several cross sections near the Bridge 5
Table 4.4 – Summary of Hydraulic Performance at the Bridge 6
Table 4.5 – Summary of Calculated Scour at Bridge 7
Table 4.6 – Abutment Scour Depths at Bridge 8
Table 5.1 – Hydraulic Data 9

FIGURES

Figure 1: Locus Map
Figure 2: Existing Conditions
Figure 3: Drainage Area
Figure 4: FEMA Flood Insurance Rate Map - Peabody, MA
Figure 5: Cross-Section Locations Plan
Figure 6: Independence Greenway Extension - Elevation View

ATTACHMENTS

ATTACHMENT A: EXISTING CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS
ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS
ATTACHMENT C: 1977 HEC-2 MODEL INPUT/OUTPUT 1977 HEC-2 MODEL INPUT/OUTPUT AND RESULTANT HEC-RAS SUMMARY TABLE AND PLOT
ATTACHMENT D: SCOUR/STABILITY ANALYSES

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for the Independence Greenway Extension, Bridge No. TBD, a pedestrian bridge over the Proctor Brook in Peabody, Massachusetts. This study evaluates the hydraulic performance of the existing and proposed conditions. This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the bridge; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations. Lastly, Section 6 outlines the references.

This project involves the construction of a timber boardwalk on helical piles that will cross over Proctor Brook in the City of Peabody, Massachusetts. There was a previous bridge structure that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the bridge, and the bridge structure has been washed away over time. The purpose of this report is to present the results of a study conducted at the subject bridge site to evaluate the hydraulic performance of the proposed alternative for this crossing.

The scope of this investigation consisted of review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

2.1 Existing Conditions

A railroad, now abandoned, once crossed Proctor Brook in the city of Peabody, Essex County, Massachusetts (Figure 1).

Scattered blocks of granite in the channel and remnants of stone wingwalls are the only indication that a bridge had once been at this location (Figure 2). There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the bridge is currently wooded and includes Bordering Vegetated Wetlands.

Crossed Waterway at the Bridge Location

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject location is within a NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

2.2 Proposed Conditions

The design loading criteria will be pedestrian loading only. No vehicular access will be permitted on the trail, and bollards will be installed at roadway intersections and access points to prevent any vehicular access. The boardwalk will not be maintained in the winter for snow removal.

The proposed structure over the brook will be a 64'-0" long timber framed boardwalk with helical piles spaced 8'-0" center-to-center. The proposed boardwalk will have a 13'-0" out-to-out width and 12'-0" clear width to accommodate two (2) 5'-0" travel lanes and two (2) 1'-0" shoulders. 4" x 4" timber posts will be spaced 4'-0" apart with a top rail height of 3'-6" with timber pickets between each post. Top and bottom rails will be 2" x 4" timber boards. The proposed boardwalk will also consist of 8" x 1" timber planking or composite wood decking over 2" x 8" timber joists.

Within this present hydraulic study, the existing and proposed bridge waterway openings were evaluated for hydraulic adequacy and scour safety. More alternative bridge opening geometries will be evaluated at the request of the State Bridge Engineer.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019.
- Massachusetts Department of Transportation: LRFD Bridge Manual, January 2020 Revision.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 18 Evaluating Scour at Bridges, Fifth Edition, April 2012.

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the bridge have been analyzed to ensure that existing flood elevations will not increase under proposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Proctor Brook flows west to east in the vicinity of the crossing. Using the U.S. Geological Survey (USGS) Massachusetts StreamStats, the Proctor Brook's watershed basin area at the crossing site is estimated to be 2.5 square miles (Figure 3). Figure 4 shows the project location in the flood insurance rate map.

In this hydraulic and scour report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. The brook's drainage area at the Proctor Brook crossing was delineated using the USGS StreamStats Website. Refer to Figure 3 for drainage area at the bridge.

Table 4.1 – Summary of Discharges from 2018 Essex County FIS

Description	Drainage Area (mi^2)	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River and Proctor Brook Upstream of Goldthwait Brook	3.52	240	285	360	420	610

4.2 Duplicate Effective Analysis

The Duplicate Effective HEC-RAS Model was developed using the HEC-2 model obtained from FEMA. The HEC-2 inputs between FIS cross sections at river sta. 1.402 upstream of the bridge to river sta. 1.127 downstream of the bridge were imported into HEC-RAS. After making minor edits, Green was able to run the imported HEC-2 data in HEC-RAS. The duplicate effective model reproduced relatively close values that are less than 1 ft for the cross sections near the bridge when compared to the current effective Base Flood Elevation (BFE) profile. The variation in BFE is attributed to using different hydraulic programs. The summary of the WSEL's from FIS is presented in Table 4.2.

Table 4.2 – Summary of Duplicate Effective Analysis

River Station HEC-RAS/HEC-2	FIS Cross-Section	[1] Published Data* (FEET, NAVD)	[2] Duplicate Effective Model (FEET, NAVD)	[2] – [1]
26/1.402	F	41.96	41.33	-0.63
25/1.393	-	41.95	41.28	-0.67
24/1.389	-	40.97	41.12	0.15
23/1.380	-	40.99	41.14	0.15
22/1.276	E	40.84	40.97	0.13
21/1.267	-	39.85	40.46	0.61
21.5	Bridge			
20/1.263	-	39.65	39.85	0.20
19/1.254	-	39.40	39.20	-0.20
18/1.127	D	39.60	39.60	0.00

4.3 Hydraulic Analysis

Green used the topographical survey to create an existing conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA, and Green's existing and proposed conditions HEC-RAS models.

The HEC-RAS model parameters such as channel and overbank roughness coefficients (Manning's 'n'), ineffective flow areas, bank stations, and expansion and contraction coefficients were modified to reflect current conditions. Pertinent computational results of the existing and proposed conditions flood simulations performed for the subject bridge in this project hydraulic study are presented in Table 4.3. The table show a comparison between the results of Green's model using the HEC-2 data received from

FEMA, Green's existing model built with the recent topographic survey, and the proposed post construction model. Figure 5 shows the cross sections locations.

Table 4.3 – Comparison of FEMA, Existing and Proposed Base Flood Elevations (BFE - referenced to NAVD 88) at several cross sections near the Bridge

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Existing Condition Model (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
26	F	41.97	41.69	-0.28
25	-	41.97	41.69	-0.28
24.7	-	41.77	41.45	-0.32
24.6	-	41.73	41.46	-0.27
24.4	-	40.41	40.29	-0.12
24.3	-	40.09	40.06	-0.03
24	-	40.38	40.36	-0.02
23	-	40.32	40.29	-0.03
22	E	40.19	40.19	0.00
21.7	-	40.07	40.06	-0.01
21.6	-	40.10	40.10	0.00
21.5	Bridge			
21.4	-	39.89	39.84	-0.05
21.35	-	39.77	39.76	-0.01
21.3	-	39.86	39.85	-0.01
20	-	39.62	39.62	0.00
19	-	39.67	39.67	0.00
18	D	39.60	39.60	0.00

As shown in Tables 4.2 and 4.3, there are variations in the elevations obtained from the existing conditions Green's HEC-RAS model compared to the HEC-2 Imported HEC-RAS model, the FEMA FIS flood elevations. The variations in flood elevations can be explained and justified due to the following reasons:

- Different hydraulic programs were used, and the HEC-2 coding of the bridge is different than its coding in HEC-RAS.
- Ineffective areas were added and modified to ignore ineffective flow areas.
- More cross sections are added in the HEC-RAS model to depict the geometry of the channel and riverbed.
- Based on site observations, the manning (n) coefficients were adjusted to reflect actual conditions.

Because of the above, Green's HEC-RAS model under existing conditions was used as a design base to compare flood elevations under the proposed conditions.

Table 4.4 compares Hydraulic Performance at the Bridge under existing and proposed conditions. The peak head water elevations and the maximum velocity for each return event at the bridge location are shown in the table.

Table 4.4 – Summary of Hydraulic Performance at the Bridge

AEP [%]	Peak Flow (CFS)	Existing		Proposed	
		WSEL (FT) Sta. 22 FEMA Sta. E	Velocity* (FT/S) (Max. at Bridge)	WSEL (FT) Sta. 22 FEMA Sta. E	Velocity* (FT/S) (Max. at Bridge)
10%	240	39.25	5.90	39.33	5.97
4%	285	39.44	6.14	39.53	6.25
2%	360	39.73	6.58	39.82	6.59
1%	420	40.19	3.97	40.19	4.34
0.2%	610	40.95	3.83	40.88	5.01

As shown in Table 4.4, the proposed bridge will not have an increase in the Water Surface Elevation (WSEL) at the upstream face of the bridge for the FEMA Base Flood Elevation.

Note that the velocities decrease for the 100-year and 500-year storms as compared to the more frequent storms. The 100-year and 500-year storms are approaching a backwater condition as demonstrated by a flattening of the energy grade line.

The analysis also shows that the proposed bridge deck is above the 100-year flood elevation and the only components impacting the hydraulics are the western abutment and the piers.

Attachment A includes the output of Green's Existing Conditions HEC-RAS analysis for the Independence Greenway Extension over Proctor Brook. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed bridge scenario for a new Independence Greenway Extension boardwalk over Proctor Brook. Attachment C includes the 1977 HEC-2 model input/output report received from FEMA Headquarters.

4.4 Scour Safety/Stability Analyses

Scour potential at the crossing site under proposed conditions was analyzed using the guidelines set forth in Reference 4, Sections 1.3 and 3.2.9 and AASHTO LRFD Bridge Design Specifications, Sections 2.6.4.4.2 and 3.7.S. In accordance with Section 1.3.4 of Reference 4, we used the river's 25-year and 50-year floods as the scour design and scour check events, respectively, in this analysis. Scour potential under existing conditions was not analyzed because there is no existing structure in place. As said in section 2.1, scattered blocks of granite in the channel and remnants of stone wingwalls are the only indication that a bridge had once been at this location.

Peak 50-year flood discharge used in this analysis was taken from Table 4.1. The peak 25-year flood discharge (285 cfs) was interpolated from 10- and 50-year flood discharge rates presented in the same table and was used as the "Design Scour Event" in the scour analysis.

Soil samples were taken at points within the brook, upstream of the bridge and the banks of the brook. These samples were analyzed, and the results are included in Attachment D. The grain size (D50) was estimated for each soil sample. The D50 results of the samples varied widely from 0.51 to 2.78 mm from left of bank to right of bank, which were used in the scour analysis.

The scour/stability analyses for the 25- and 50-year floods were performed using the equations from FHWA Hydraulic Engineering Circular No. 18 (HEC-18), Evaluation Scour at Bridges. Calculations to determine scour potential were performed according to HEC-18 live-bed equation for the bridge types associated with existing and proposed conditions.

The local scour was calculated for the piers using the HEC-18 pier scour equations (HEC-18, equations 7.1 – 7.4). The variables are based on the results from the HEC-RAS model for the 25-year storm. The scour calculation was also performed for the 50-year design storm as a check. Pressure scour is not applicable at this bridge because the low chord is above the design storms being considered for these calculations.

The results of the scour analyses are shown on Table 4.5.

Table 4.5 – Summary of Calculated Scour at Bridge

Alternative	Return Frequency (year)	[1] Contraction Scour (Feet)	[2] Maximum Local Pier Scour (Feet)	[3]* Long Term Degradation (Feet)	[4] Abutment Scour (Feet)	[3] + [4] Design Total Abutment Scour (Feet)	[1] + [2] + [3] Design Total Pier Scour (Feet)
Existing Condition	Design 25-yr	n/a	n/a	n/a	n/a	n/a	n/a
	Check 50-yr	n/a	n/a	n/a	n/a	n/a	n/a
Proposed Condition	Design 25-yr	0.0	1.17	n/a	1.95	1.95	1.17
	Check 50-yr	0.0	1.22	n/a	2.28	2.28	1.22

*Long Term Degradation Calculations were not computed for this bridge

The HEC-RAS method uses the Froelich equation that has been identified by MassDOT as being too conservative in calculating scour at the abutments. Therefore, the abutment scour depths calculated in the HEC-RAS analysis should not be held for design purposes. Instead, the scour depths for the abutments were

computed using the NCHRP 24-40 Abutment Scour Approach in the FHWA HEC-18, Evaluating Scour at Bridges Section 8.6.3 and shown below.

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

The computed abutment scour depths using the above equation are listed below and should be used for design.

Table 4.6 – Abutment Scour Depths at Bridge

Alternative	Return Frequency (year)	Design Abutment Scour (Feet)	Design Pier Scour (Feet)
Existing Condition	Design 25-yr	n/a	n/a
	Check 50-yr	n/a	n/a
Proposed Condition	Design 25-yr	1.95	1.17
	Check 50-yr	2.28	1.22

Scour Countermeasures

The natural stream bed will result in a scour depth at the left abutment of 1.95' during the 25 year design storm. By placing riprap revetment around the abutment it is anticipated that the scour depth will be negligible as shown in Table 4.7. The proposed right abutment is located on the eastern end of the boardwalk and outside of the flow of the channel. For this reason scour protection is not needed at the right abutment.

The calculated contraction, and pier scour depths resulted in a value of less than 1.5 ft. For this reason, scour countermeasures are not required within the main channel, and are only required at the left abutment.

The scour countermeasure design at the left abutment were computed using HEC-23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition, Volume 2, Section 4, Design Guideline 14 and shown below.

Table 4.7 – Summary of Scour Countermeasure Design at Bridge Abutments

Alternative	Riprap Size D_{50} (Inches)	Riprap Size D_{100} (Inches)	Riprap Thickness (Feet)	Riprap Apron Extend from toe (Feet)	Riprap Extend along u/s and d/s face of the Embankment (Feet)	Vertical Extend up Abutment Slope (Feet)
Existing	n/a	n/a	n/a	n/a	n/a	n/a
Proposed (left abutment)	6	12	1	10	25	10
Proposed (right abutment)	n/a	n/a	n/a	n/a	n/a	n/a

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The project hydraulic model indicates that proposed replacement bridge will safely convey the 10-year design flood event.

B. To minimize the environmental impacts of the western approach on the adjacent wetlands, 1.5 ft of freeboard was maintained over the 10-year design flood event. Although this does not meet the recommended 2 feet of freeboard between the hydraulic design flood water surface elevation and the proposed superstructure low chord, we consider that 1.5 ft of freeboard will be appropriate because it is a recreational pedestrian bridge.

C. HEC-RAS models under existing and proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.

D. The natural stream bed will result in a scour depth at the abutment of 1.95' during the 25 year design storm. By placing riprap revetment around the abutment it is anticipated that the scour depth will be negligible.

E. The calculated contraction, and pier scour depths resulted in a value of less than 1.5ft. For that reason, scour countermeasures are only required at the left abutment for this bridge.

F. The information in Table 5.1 should be presented within the Hydraulic Data Tables in the General Notes of the Bridge Sketch Plans.

Table 5.1 – Hydraulic Data

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	3.52 SQUARE MILES
DESIGN FLOOD DISCHARGE:	240 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	5.97 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	39.33 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	420 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	40.19 FEET, NAVD 88

DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	25 YEAR
DESIGN FLOOD ABUTMENT SCOUR DEPTH	1.95 FEET
DESIGN FLOOD PIER SCOUR DEPTH	1.17 FEET
SCOUR CHECK FLOOD EVENT RETURN FREQUENCY:	50 YEAR
CHECK FLOOD ABUTMENT SCOUR DEPTH	2.28 FEET
CHECK FLOOD PIER SCOUR DEPTH	1.22FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

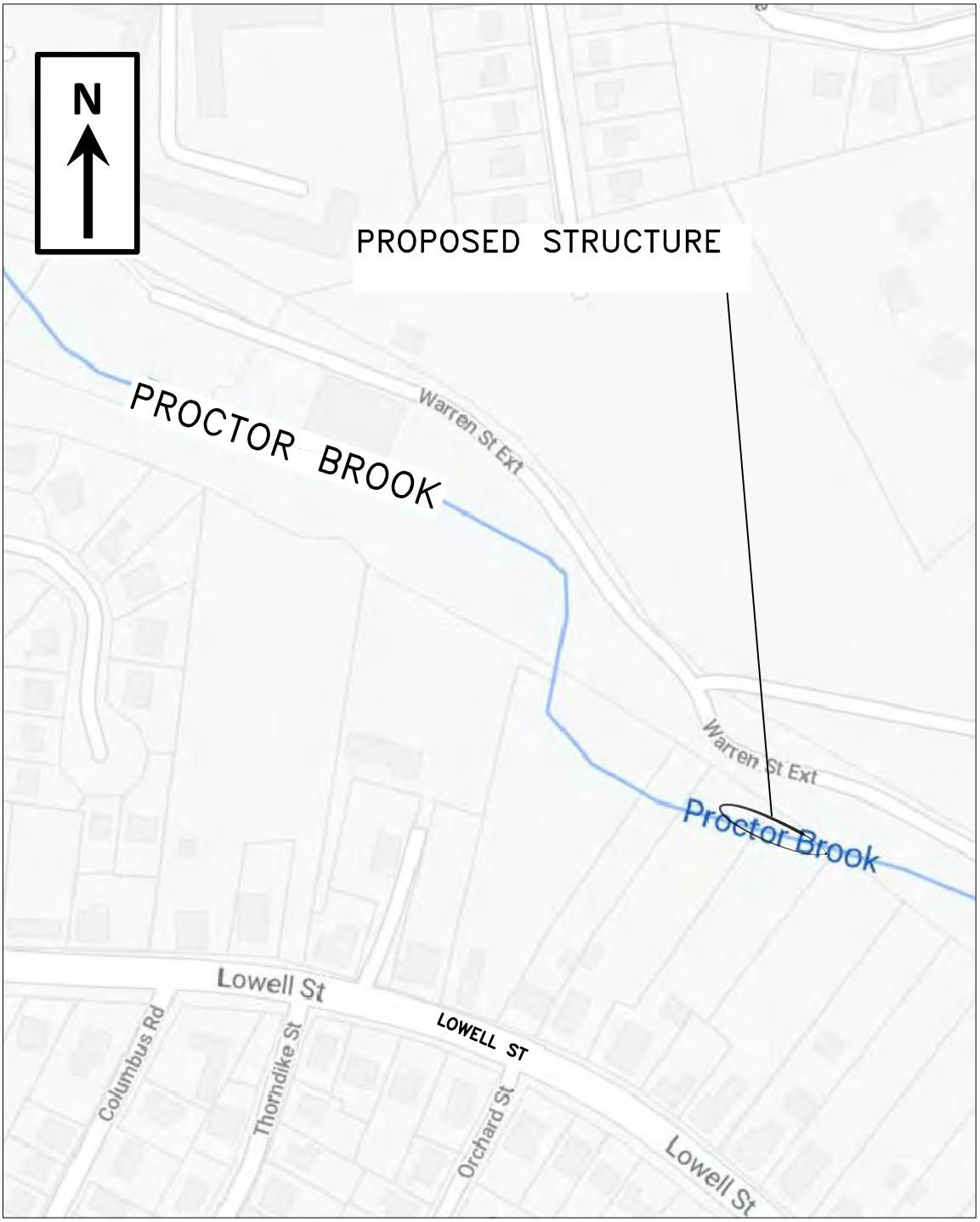
6.0 REFERENCES

6.1 Federal Emergency Management Agency, Flood Insurance Study, Essex County, Massachusetts, July 19, 2018.

6.2 Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.

6.3 Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019

FIGURES



GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

PROJECT TITLE:

PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:

FIGURE 1 – LOCUS MAP

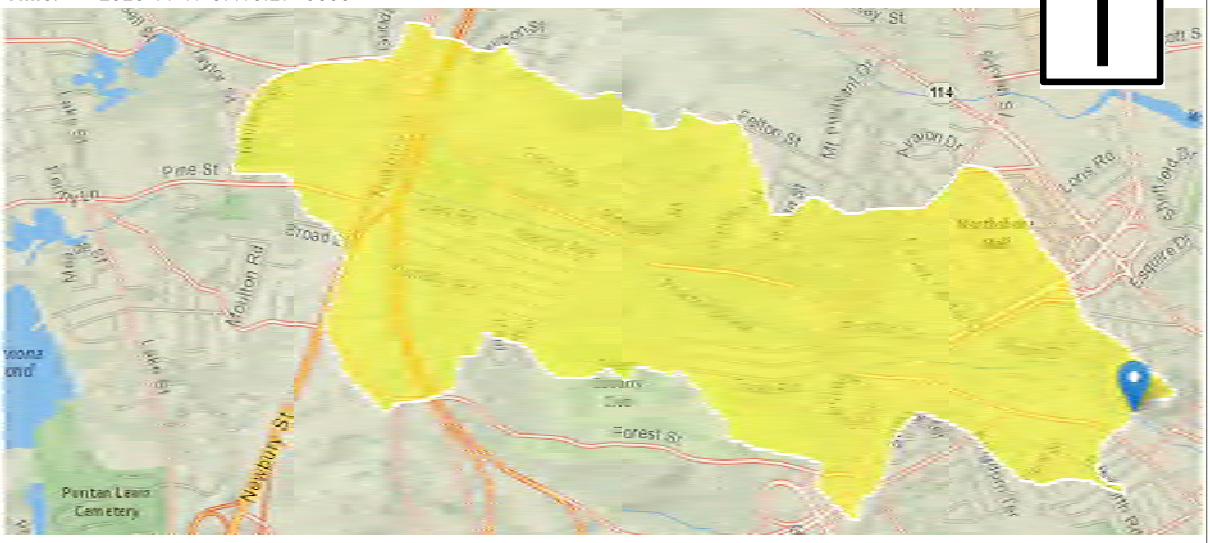
FIGURE 2A: REMNANTS IN CHANNEL

FIGURE 2B: ABANDONED ABUTMENT

GREEN INTERNATIONAL AFFILIATES, INC. *Civil and Structural Engineers*	PROJECT TITLE: PEABODY INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA
GREEN PROJ. NO.: 17118.0XX DATE: OCTOBER, 2020 DESIGNED BY: N/A DRAWN BY: JRM CHECKED BY: SS	DRAWING TITLE: FIGURE 2 – EXISTING CONDITIONS

StreamStats Report

Region ID: MA
Workspace ID: MA20201117121813254000
Clicked Point (Latitude, Longitude): 42.53191, -70.93625
Time: 2020-11-17 07:18:29 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.52	square miles

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

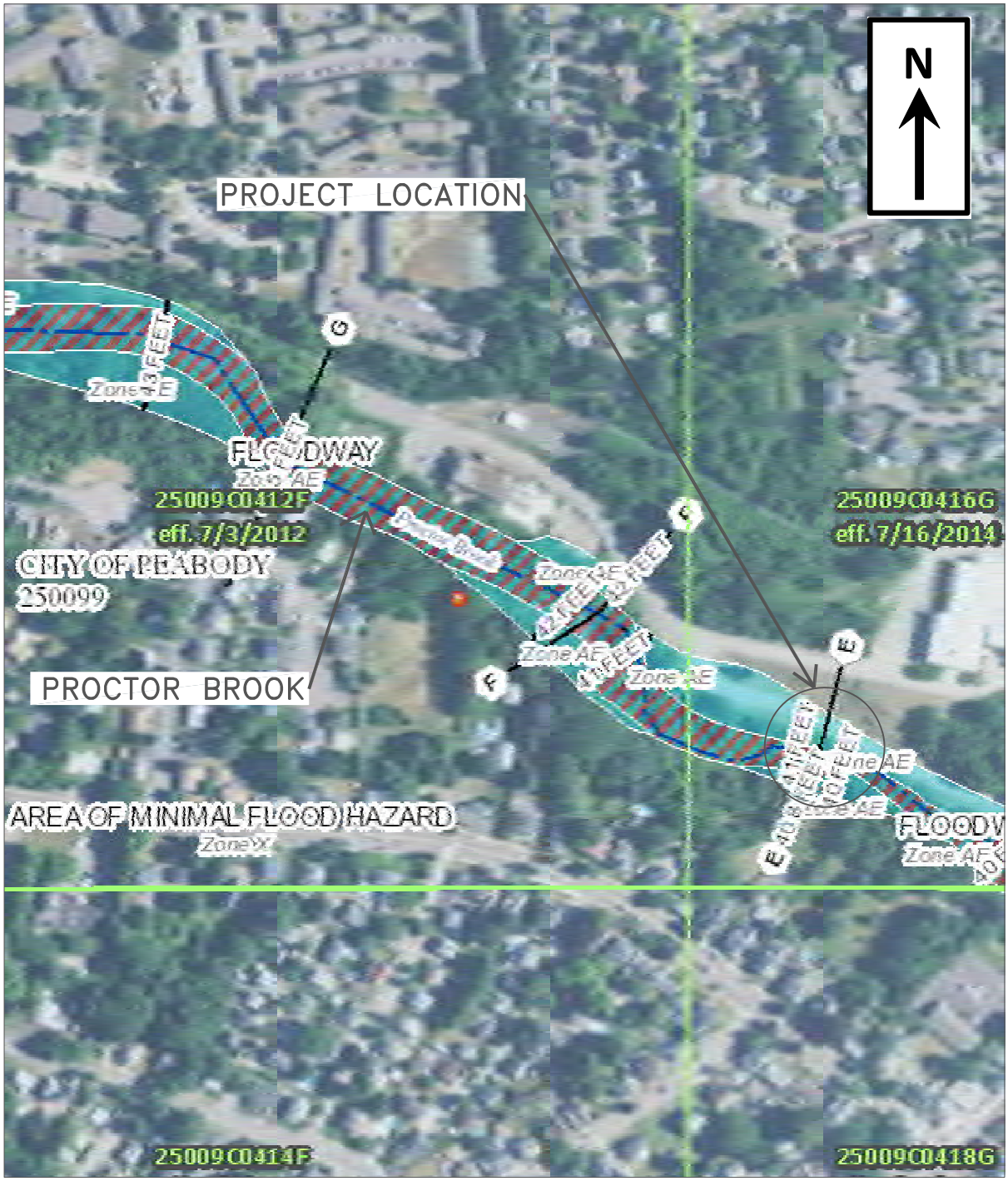
Application Version: 4.4.0

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

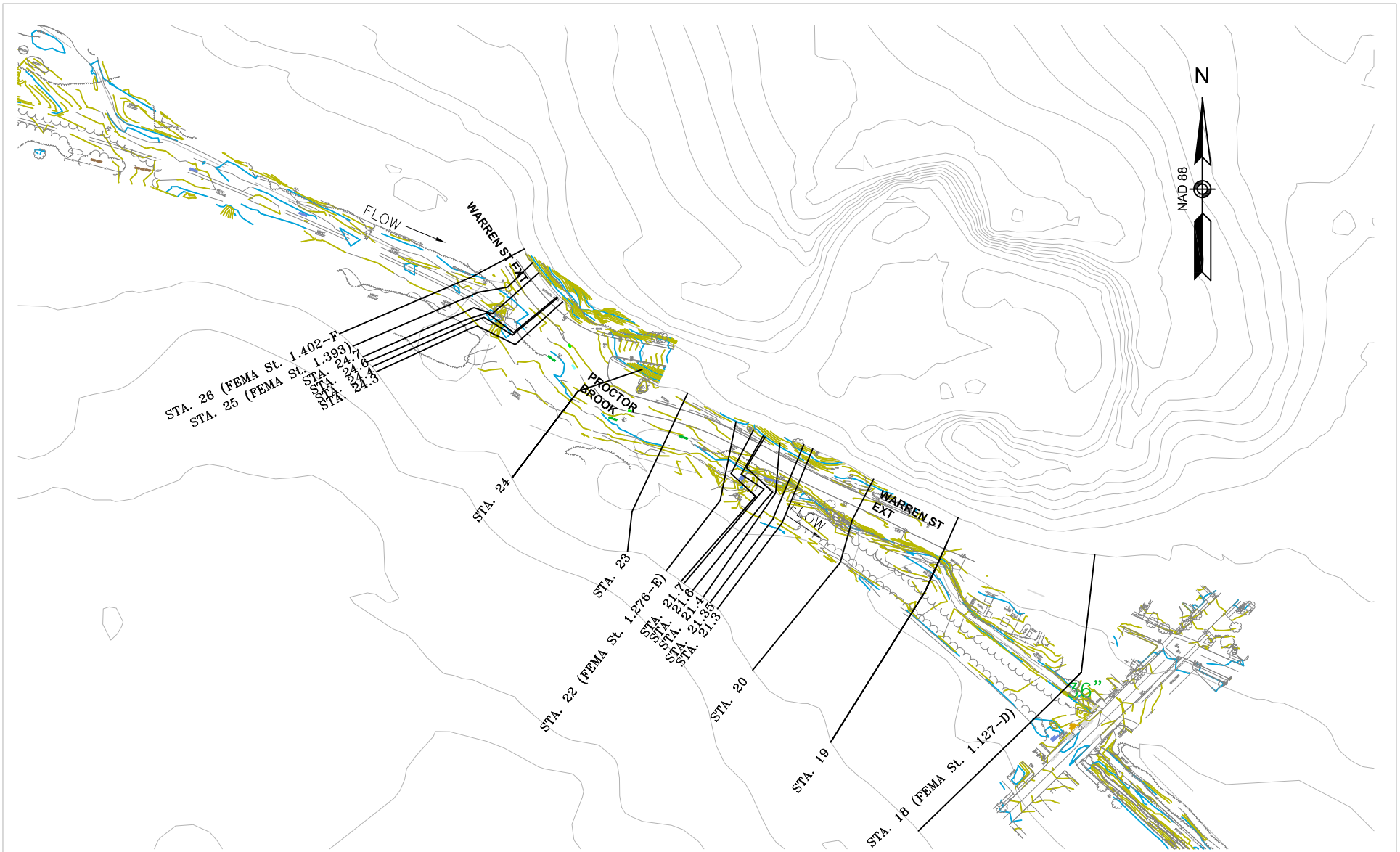
PROJECT TITLE:
PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:
FIGURE 3 – DRAINAGE AREA



GREEN INTERNATIONAL AFFILIATES, INC. *Civil and Structural Engineers*	PROJECT TITLE: PEABODY INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA
GREEN PROJ. NO.: 17118.0XX DATE: OCTOBER, 2020 DESIGNED BY: N/A DRAWN BY: JRM CHECKED BY: SS	DRAWING TITLE: FIGURE 4 – FLOOD INSURANCE RATE MAP

Proposal No. 609211-132091



SCALE IN FEET

250' 0 250' 500'

1" = 250'

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

PROJECT TITLE:

PEABODY

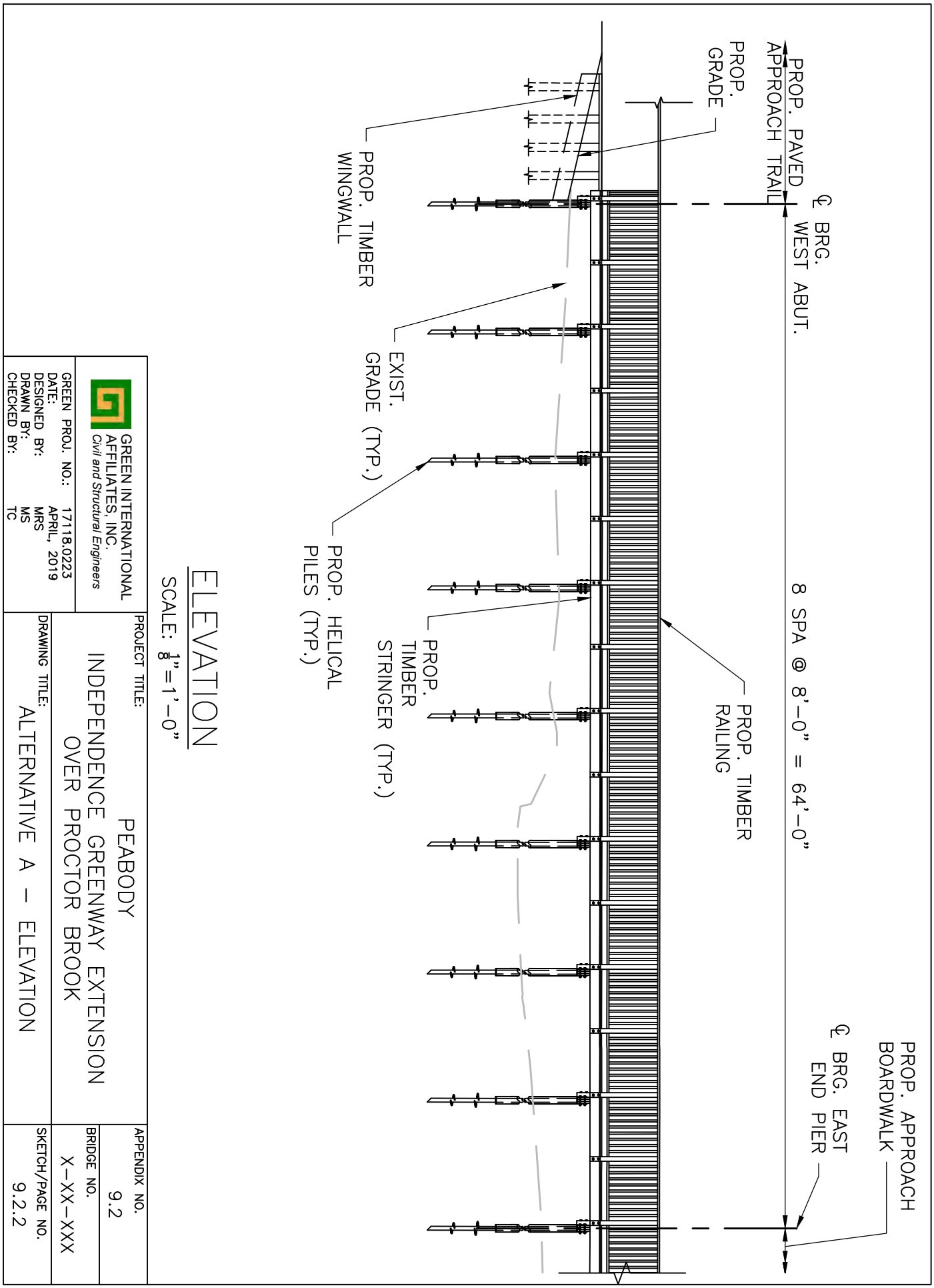
INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:

FIGURE 5 – CROSS SECTIONS LOCATIONS

A00830 - 117

FIGURE 6



ELEVATION

SCALE: $\frac{1}{8}$"=1'-0"

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.: 17118.0223
DATE: APRIL, 2019
DESIGNED BY: MRS
DRAWN BY: MS
CHECKED BY: TC

PROJECT TITLE:
PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK

DRAWING TITLE:
ALTERNATIVE A – ELEVATION

APPENDIX NO. 9.2
BRIDGE NO. X-XX-XXX
SKETCH/PAGE NO. 9.2.2

REFERENCES

REFERENCE 6.1

ESSEX COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

Volume 1 of 4

COMMUNITY NAME	COMMUNITY NUMBER
AMESBURY, CITY OF	250075
ANDOVER, TOWN OF	250076
BEVERLY, CITY OF	250077
BOXFORD, TOWN OF	250078
DANVERS, TOWN OF	250079
ESSEX. TOWN OF	250080
GEORGETOWN, TOWN OF	250081
GLOUCESTER, CITY OF	250082
GROVELAND, TOWN OF	250083
HAMILTON, TOWN OF	250084
HAVERHILL, CITY OF	250085
IPSWICH, TOWN OF	250086
LAWRENCE, CITY OF	250087
LYNN, CITY OF	250088
LYNNFILED, TOWN OF	250089
MANCHESTER BY THE SEA, TOWN OF	250090
MARBLEHEAD, TOWN OF	250091
MERRIMAC, TOWN OF	250092
METHUEN, CITY OF	250093
MIDDLETON, TOWN OF	250094
NAHANT, TOWN OF	250095
NEWBURY, TOWN OF	250096
NEWBURYPORT, CITY OF	250097
NORTH ANDOVER, TOWN OF	250098
PEABODY, CITY OF	250099
ROCKPORT, TOWN OF	250100
ROWLEY, TOWN OF	250101
SALEM, CITY OF	250102
SALISBURY, TOWN OF	250103
SAUGUS, TOWN OF	250104
SWAMPSCOTT, TOWN OF	250105
TOPSFIELD, TOWN OF	250106
WENHAM, TOWN OF	250107
WEST NEWBURY, TOWN OF	250108

REVISION DATE:
JULY 19, 2018

TABLE 6 – SUMMARY OF DISCHARGES-continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
unnamed Tributary downstream of Abandoned dam					
NORTH BEVERLY DRAINAGE DITCH					
Upstream of Boston and Maine Railroad embankment in	1.16	174	253	290	393
NORTH RIVER AND PROCTOR BROOK					
At Salem corporate Limits	9.96	640	990	1,140	1,620
Upstream of Strongwater Brook	8.86	580	880	1,030	1,470
Upstream of Goldthwaite Brook	3.52	240	360	420	610
Upstream of State Route 128	2.52	170	260	310	450
Upstream of Downing Road	2.10	150	240	280	420
150 feet upstream of Downing Road	1.48	140	220	260	380
Downstream of Albert Road	1.22	130	200	230	340
NORTH TRIBUTARY BROOK					
At Pikes Bridge Road	1.35	70	125	150	170
PARKERS RIVER(TOWN OF BOXFORD)					
At downstream Corporate Limits	3.60	170	270	325	460

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
NORTH RIVER								
A	2,212	80	325	3.5	10.0	10.0	11.0	1.0
B	2,841	70	345	3.3	12.4	12.4	12.5	0.1
C	3,326	60	270	3.8	13.6	13.6	14.0	0.4
PROCTOR BROOK								
D	8,152	150	440	1.0	39.6	39.6	39.7	0.1
E	8,939	60	245	1.7	40.8	40.8	40.8	0.0
F	9,604	100	255	1.6	42.0	42.0	42.0	0.0
G	10,344	100	265	1.6	42.5	42.5	42.8	0.3
H	11,436	100	515	0.8	46.9	46.9	46.9	0.0
I	12,862	60	260	1.6	47.1	47.1	47.3	0.2
J	13,306	45	300	1.0	51.4	51.4	52.1	0.7
K	13,712	60	570	0.5	51.5	51.5	52.2	0.7
L	14,404	60	360	0.9	54.9	54.9	55.4	0.5
M	14,837	50	235	1.3	55.1	55.1	55.5	0.4
N	15,808	90	325	0.9	55.2	55.2	55.6	0.4
O	17,778	90	215	1.3	57.1	57.1	57.8	0.7
P	19,626	100	255	1.1	61.4	61.4	61.4	0.0
Q	20,724	100	155	1.7	61.8	61.8	62.0	0.2
R	21,614	65	210	1.1	64.5	64.5	64.5	0.0
S	22,709	50	145	1.6	65.3	65.3	65.3	0.0

[1] FEET ABOVE GROVE STREET

TABLE 12

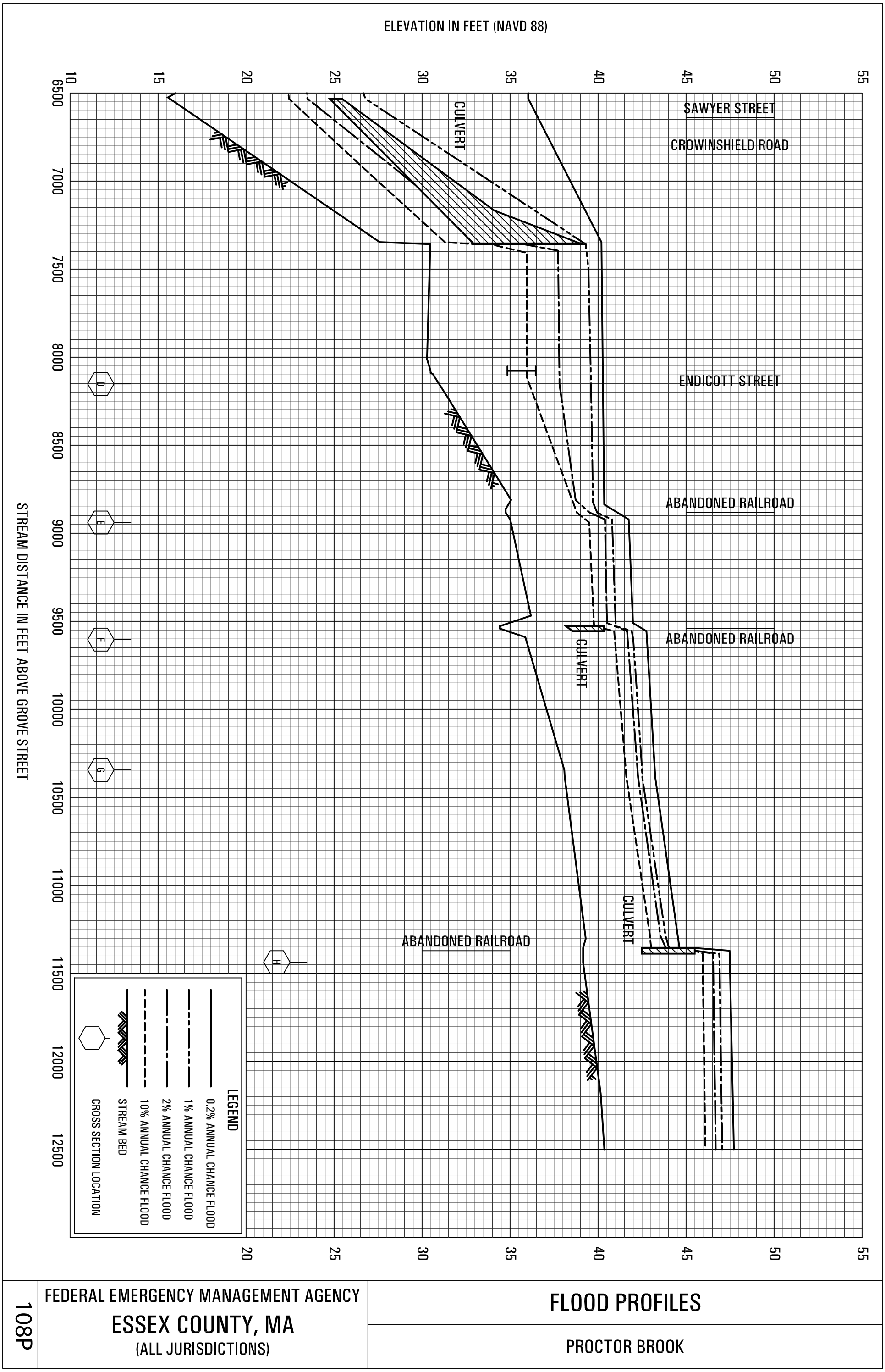
FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

NORTH RIVER AND PROCTOR BROOK

Proposal No. 609211-132091



108P

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA

(ALL JURISDICTIONS)

FLOOD PROFILES

PROCTOR BROOK

REFERENCE 6.2

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

B.W. FINAL

70'

```
**********************************************************************************************************
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**************************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1   ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
        0.        2.         0.         0.  0.0               0.0        0.0         0.      9.200      0.0
J2   NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
      1.000      0.0       -1.000      0.0        0.0        0.0        0.0        0.0        0.0        0.0
J3   VARIABLE CODES FOR SUMMARY PRINTOUT
       38.000     1.000      2.000      3.000     40.000     41.000     42.000     53.000     21.000     4.000

       22.000    54.000     34.000      0.0       38.000      1.000     39.000     50.000     61.000     51.000

       26.000    43.000     13.000     14.000     15.000     27.000     28.000      0.0        0.0        0.0
QT      9.000   640.000    970.000   1140.000   1620.000   1140.000   1140.000   1140.000   1140.000   1140.000
NC      0.080     0.060      0.040      0.100      0.300      0.0        0.0        0.0        0.0        0.0
ET      0.0     900.000   1100.000      0.0        0.0        0.0        0.0        0.0        2.100      0.0

X1      0.002    17.000    992.500   1005.500      0.0        0.0        0.0        0.0        0.0        0.0
GR     20.000   625.000     15.000    650.000     10.000    760.000    11.200    949.000    11.200    964.000
GR     10.800   979.500      5.400    992.500      4.200   1000.000     4.600   1005.500     5.300   1008.000
GR      8.300  1011.000      8.700   1025.000      8.700   1040.000     8.700   1055.000     9.500   1082.000
GR     10.000  1140.000     40.000   1140.100      0.0        0.0        0.0        0.0        0.0        0.0
NC      0.075     0.060      0.040      0.100      0.300      0.0        0.0        0.0        0.0        0.0
ET      0.0     900.000   1100.000      0.0        0.0        0.0        0.0        0.0        2.100      0.0

X1      0.056    12.000    994.000   1006.000    340.000    285.000    285.000      0.0        0.0        0.0
GR     20.000   570.000     15.000    630.000     10.000    730.000     10.000    905.000     5.000    980.000
GR      4.800   994.000      4.600   1000.000      4.800   1006.000      5.000   1010.000    10.200   1035.000
GR     10.500  1090.000     40.000   1090.100      0.0        0.0        0.0        0.0        0.0        0.0
NC      0.050     0.050      0.040      0.100      0.300      0.0        0.0        0.0        0.0        0.0
ET      0.0     900.000   1100.000      0.0        0.0        0.0        0.0        0.0        2.100      0.0

X1      0.056    10.000    994.000   1006.000      1.000      1.000      1.000      0.0        0.0        0.0
GR     40.000   950.000     10.000    950.100      5.000    980.000      4.800    994.000     4.600   1000.000
GR      4.800  1006.000      5.000   1010.000     10.200   1035.000     10.500   1090.000    40.000   1090.100
NC      0.040     0.045      0.040      0.300      0.500      0.0        0.0        0.0        0.0        0.0
ET      0.0     900.000   1100.000      0.0        0.0        0.0        0.0        0.0        2.100      0.0

X1      0.069    15.000    985.700   1014.700     70.000     70.000     69.000      0.0        0.0        0.0
```

Proposal No. 609211-132091

A00830 - 124

Proposal No. 609211-132091

THIS RUN EXECUTED 11/13/78 19.11.46

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**************************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SALEM CORPORATE LIMIT TO

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
A	0.002	9.20	8.94	10.03	0.0	0.0	4.20	983.35	992.50	88.52	1005.50	1071.87	79.06
	0.002	10.30	0.0	10.84	0.0	0.0	4.20	753.40	992.50	213.15	1005.50	1140.00	150.74
	0.002	10.80	0.0	11.19	0.0	0.0	4.20	742.40	992.50	304.10	1005.50	1140.00	206.11
	0.002	12.40	0.0	12.50	0.0	0.0	4.20	707.20	992.50	432.81	1005.50	1140.01	536.65
	0.056	10.44	0.0	10.48	0.0	0.0	4.60	721.20	994.00	357.83	1006.00	1079.03	280.90
	0.056	11.19	0.0	11.24	0.0	0.0	4.60	706.25	994.00	383.75	1006.00	1090.00	421.35
	0.056	11.50	0.0	11.54	0.0	0.0	4.60	700.06	994.00	389.94	1006.00	1090.00	492.98
	0.056	12.65	0.0	12.69	0.0	0.0	4.60	676.98	994.00	413.02	1006.00	1090.01	821.60
	0.056	10.42	0.0	10.49	0.0	0.0	4.60	950.10	994.00	125.65	1006.00	1075.75	268.06
	0.056	11.15	0.0	11.25	0.0	0.0	4.60	950.10	994.00	139.91	1006.00	1090.00	361.64
	0.056	11.45	0.0	11.56	0.0	0.0	4.60	950.10	994.00	139.91	1006.00	1090.00	405.70
	0.056	12.59	0.0	12.71	0.0	0.0	4.60	950.09	994.00	139.92	1006.00	1090.01	601.63
	0.069	10.43	0.0	10.58	0.0	0.0	4.30	940.10	985.70	126.47	1014.70	1066.57	208.38
	0.069	11.17	0.0	11.35	0.0	0.0	4.30	940.10	985.70	159.90	1014.70	1100.00	295.57
	0.069	11.48	0.0	11.67	0.0	0.0	4.30	940.10	985.70	159.91	1014.70	1100.00	341.11
	0.069	12.62	0.0	12.79	0.0	0.0	4.30	940.09	985.70	159.91	1014.70	1100.01	555.46
	0.079	11.10	0.0	11.30	10.30	8.90	4.50	986.50	986.60	73.50	1014.50	1060.00	205.15
	0.079	11.91	0.0	12.19	10.30	8.90	4.50	986.50	986.60	73.51	1014.50	1060.00	276.53
	0.079	12.25	0.0	12.57	10.30	8.90	4.50	986.50	986.60	73.51	1014.50	1060.01	310.45
	0.079	13.28	0.0	13.67	10.30	8.90	4.50	986.49	986.60	73.52	1014.50	1060.01	426.23
	0.088	11.18	0.0	11.37	0.0	0.0	5.50	984.00	984.00	86.10	1011.00	1070.10	148.24
	0.088	12.05	0.0	12.28	0.0	0.0	5.50	984.00	984.00	86.10	1011.00	1070.10	211.33
	0.088	12.40	0.0	12.67	0.0	0.0	5.50	983.98	984.00	86.12	1011.00	1070.10	255.50
	0.088	13.48	0.0	13.78	0.0	0.0	5.50	983.98	984.00	86.12	1011.00	1070.10	371.15
	0.106	11.34	0.0	11.59	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	136.73
	0.106	12.29	0.0	12.54	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	168.88
	0.106	12.69	0.0	12.94	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	173.18
	0.106	13.75	0.0	14.07	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	226.79
B	0.121	11.51	0.0	11.69	0.0	0.0	3.80	988.59	994.00	75.41	1006.00	1064.00	200.13
	0.121	12.44	0.0	12.67	0.0	0.0	3.80	988.59	994.00	75.42	1006.00	1064.01	282.47
	0.121	12.83	0.0	13.09	0.0	0.0	3.80	988.58	994.00	75.42	1006.00	1064.01	321.59
	0.121	13.91	0.0	14.24	0.0	0.0	3.80	988.58	994.00	75.43	1006.00	1064.01	443.21

A00830 - 125

SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
0.121	11.64	0.0	11.71	0.0	0.0	3.80	890.40	994.00	173.60	1006.00	1064.00	296.34
0.121	12.62	0.0	12.69	0.0	0.0	3.80	872.75	994.00	191.26	1006.00	1064.01	452.55
0.121	13.04	0.0	13.11	0.0	0.0	3.80	865.21	994.00	198.80	1006.00	1064.01	530.58
0.121	14.19	0.0	14.26	0.0	0.0	3.80	844.60	994.00	219.41	1006.00	1064.01	778.52
0.127	11.67	0.0	11.72	0.0	0.0	4.10	900.18	992.30	143.82	1007.80	1044.00	366.52
0.127	12.64	0.0	12.70	0.0	0.0	4.10	867.77	992.30	176.24	1007.80	1044.01	514.40
0.127	13.05	0.0	13.12	0.0	0.0	4.10	853.92	992.30	190.09	1007.80	1044.01	589.49
0.127	14.20	0.0	14.27	0.0	0.0	4.10	816.32	992.30	227.69	1007.80	1044.01	832.55
0.135	12.29	0.0	12.37	9.80	8.30	3.80	857.17	992.60	162.84	1007.40	1020.01	318.13
0.135	13.51	0.0	13.58	9.80	8.30	3.80	815.72	992.60	204.29	1007.40	1020.01	509.22
0.135	14.06	0.0	14.13	9.80	8.30	3.80	796.92	992.60	223.09	1007.40	1020.01	617.94
0.135	15.54	0.0	15.60	9.80	8.30	3.80	756.89	992.60	263.12	1007.40	1020.02	998.89
0.144	12.30	0.0	12.40	0.0	0.0	5.20	869.26	994.00	160.74	1006.00	1030.01	244.99
0.144	13.52	0.0	13.61	0.0	0.0	5.20	826.59	994.00	203.42	1006.00	1030.01	413.01
0.144	14.08	0.0	14.15	0.0	0.0	5.20	807.24	994.00	222.77	1006.00	1030.01	509.64
0.144	15.55	0.0	15.61	0.0	0.0	5.20	765.54	994.00	264.48	1006.00	1030.02	852.14
0.165	12.36	0.0	12.49	0.0	0.0	5.50	897.48	994.00	122.52	1006.00	1020.00	199.66
0.165	13.57	0.0	13.69	0.0	0.0	5.50	875.67	994.00	144.34	1006.00	1020.01	328.16
0.165	14.12	0.0	14.23	0.0	0.0	5.50	865.79	994.00	154.22	1006.00	1020.01	399.50
0.165	15.57	0.0	15.67	0.0	0.0	5.50	829.08	994.00	190.94	1006.00	1020.02	638.98
0.165	12.40	0.0	12.50	0.0	0.0	5.50	908.85	994.00	111.16	1006.00	1020.01	225.69
0.165	13.59	0.0	13.69	0.0	0.0	5.50	893.29	994.00	126.72	1006.00	1020.01	369.83
0.165	14.14	0.0	14.23	0.0	0.0	5.50	886.37	994.00	133.64	1006.00	1020.01	447.48
0.165	15.58	0.0	15.67	0.0	0.0	5.50	875.00	994.00	145.02	1006.00	1020.02	709.44
0.187	12.45	0.0	12.66	0.0	0.0	5.90	940.10	994.00	121.78	1006.00	1061.88	145.57
0.187	13.67	0.0	13.81	0.0	0.0	5.90	940.09	994.00	180.51	1006.00	1120.61	266.45
0.187	14.22	0.0	14.34	0.0	0.0	5.90	940.09	994.00	207.41	1006.00	1147.50	345.10
0.187	15.68	0.0	15.75	0.0	0.0	5.90	940.09	994.00	244.91	1006.00	1185.00	647.71
0.213	12.65	0.0	12.95	0.0	0.0	6.30	938.10	994.00	102.03	1006.00	1041.52	122.34
0.213	13.80	0.0	14.03	0.0	0.0	6.30	938.09	994.00	139.10	1006.00	1077.19	217.13
0.213	14.33	0.0	14.52	0.0	0.0	6.30	938.09	994.00	146.91	1006.00	1085.00	279.01
0.213	15.73	0.0	15.87	0.0	0.0	6.30	938.09	994.00	146.92	1006.00	1085.01	494.55
0.222	12.83	0.0	13.05	0.0	0.0	6.90	930.10	992.00	78.00	1008.00	1008.10	145.27
0.222	13.88	0.0	14.11	0.0	0.0	6.90	930.10	992.00	135.44	1008.00	1065.54	223.66
0.222	14.38	0.0	14.59	0.0	0.0	6.90	930.09	992.00	144.91	1008.00	1075.00	279.01
0.222	15.76	0.0	15.92	0.0	0.0	6.90	930.09	992.00	144.92	1008.00	1075.01	478.94
0.222	12.85	0.0	13.05	0.0	0.0	6.90	930.10	992.00	78.00	1008.00	1008.10	148.86
0.222	13.88	0.0	14.11	0.0	0.0	6.90	930.10	992.00	108.84	1008.00	1038.94	224.93
0.222	14.37	0.0	14.60	0.0	0.0	6.90	930.09	992.00	127.76	1008.00	1057.85	272.89
0.222	15.75	0.0	15.94	0.0	0.0	6.90	930.09	992.00	165.30	1008.00	1095.39	447.15
0.231	13.43	0.0	13.60	12.40	12.00	7.20	930.10	992.00	79.12	1008.00	1009.21	167.71
0.231	14.26	0.0	14.48	12.40	12.00	7.20	930.09	992.00	112.82	1008.00	1042.91	231.93
0.231	14.63	0.0	14.87	12.40	12.00	7.20	930.09	992.00	126.42	1008.00	1056.52	267.95
0.231	15.92	0.0	16.13	12.40	12.00	7.20	930.09	992.00	161.59	1008.00	1091.68	426.75

Proposal No. 609211-132091

A00830 - 126

Proposal No. 609211-132091

SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.02	996.00	35.45	1006.00	1018.47	73.95
1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	210.71
1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

A00830 - 127

REFERENCE 6.3

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

for

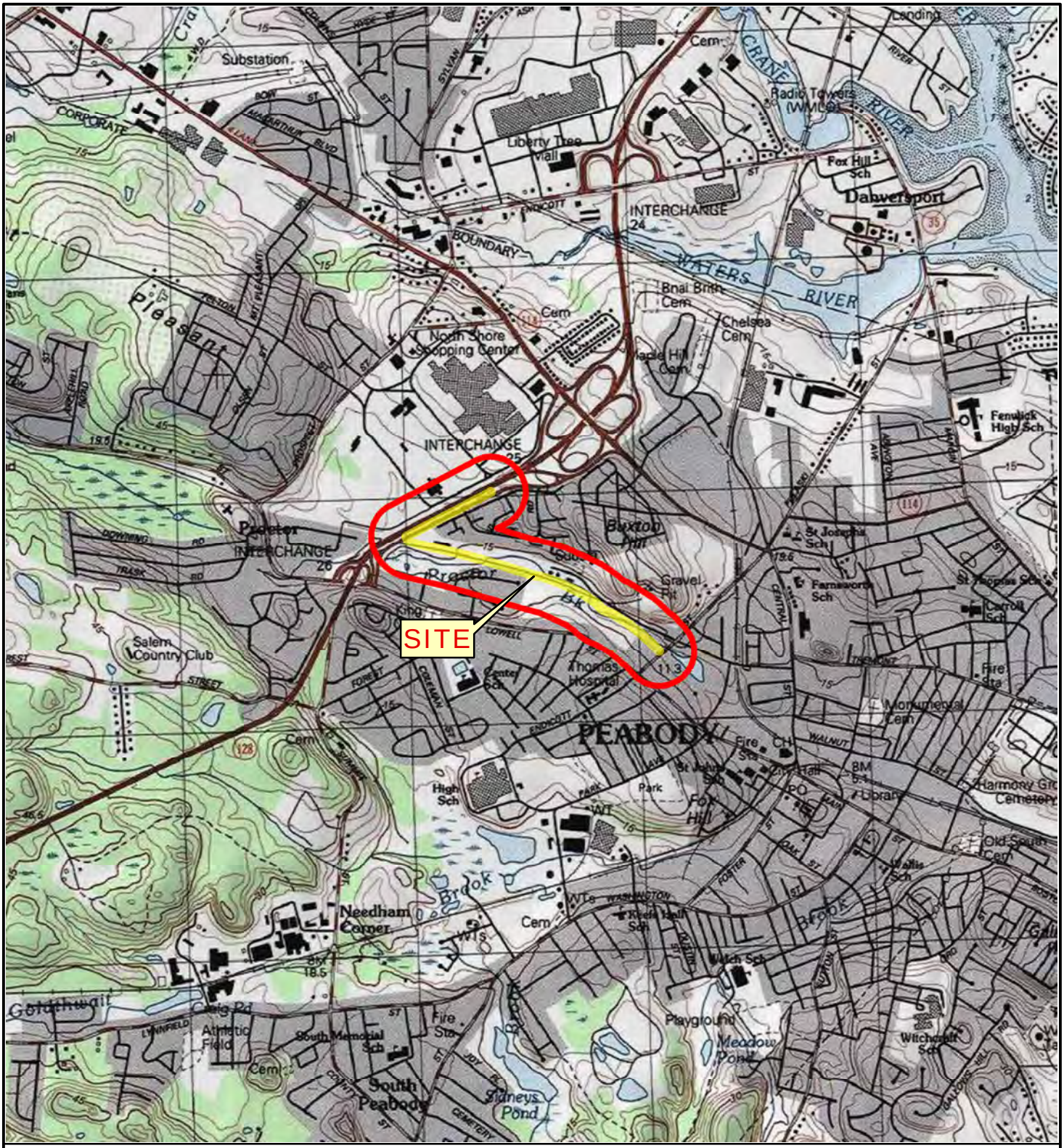
Proposed Peabody Bikeway – Phase II
Peabody, MA

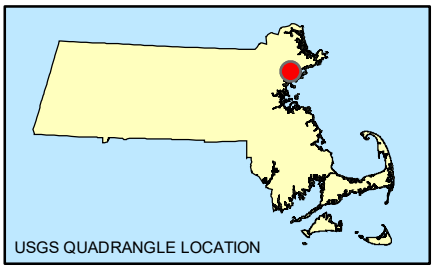
April 22, 2019
File No. 01.0174019.00

PREPARED FOR:
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue | Norwood, MA 02062

31 Offices Nationwide
www.gza.com





SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED SEPTEMBER 26, 2018 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

PROJ. MGR.: MPS
DESIGNED BY: ZSM
REVIEWED BY: TMK
OPERATOR: EMD

DATE: 01-30-2019

SITE LOCUS PLAN

JOB NO. 01.0174019.00

PEABODY BIKEWAY - PHASE II
PEABODY, MASSACHUSETTS

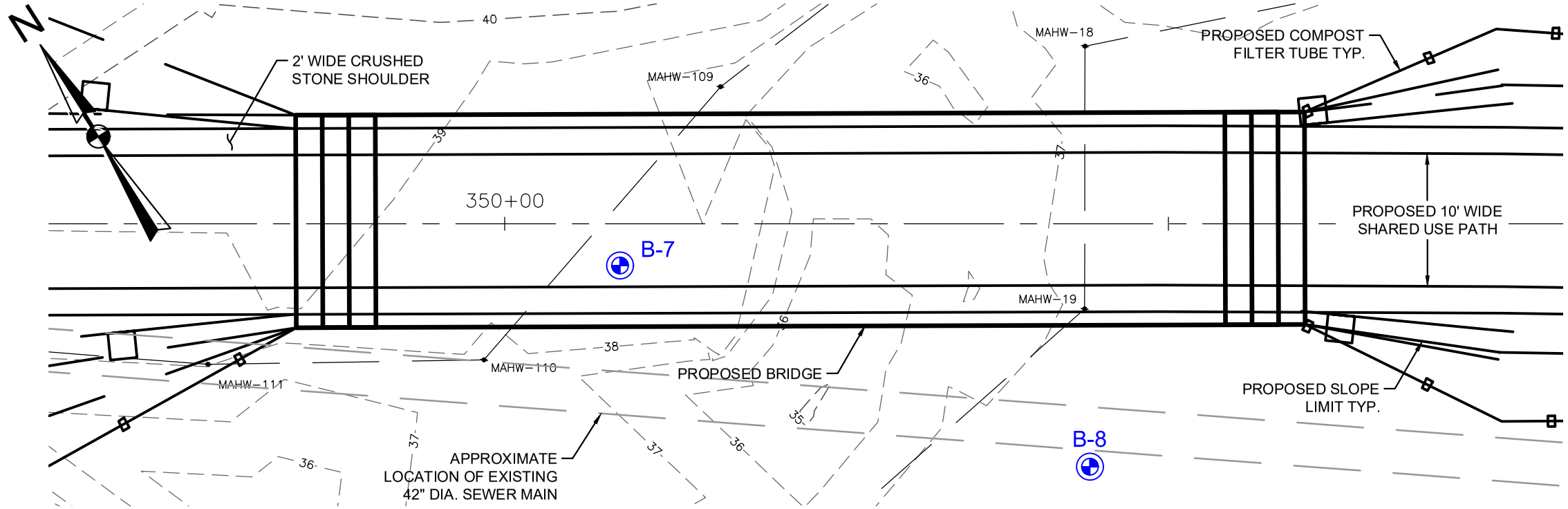
FIGURE NO. 1

© 2019 - GZA GeoEnvironmental, Inc., J:\170,000-179,999\174019\174019-00.MPS\Figures_GIS\174019_SiteLocus_PeabodyBikePath_FIG1.mxd, 1/30/2019, 10:43:13 AM, elaine.donohue

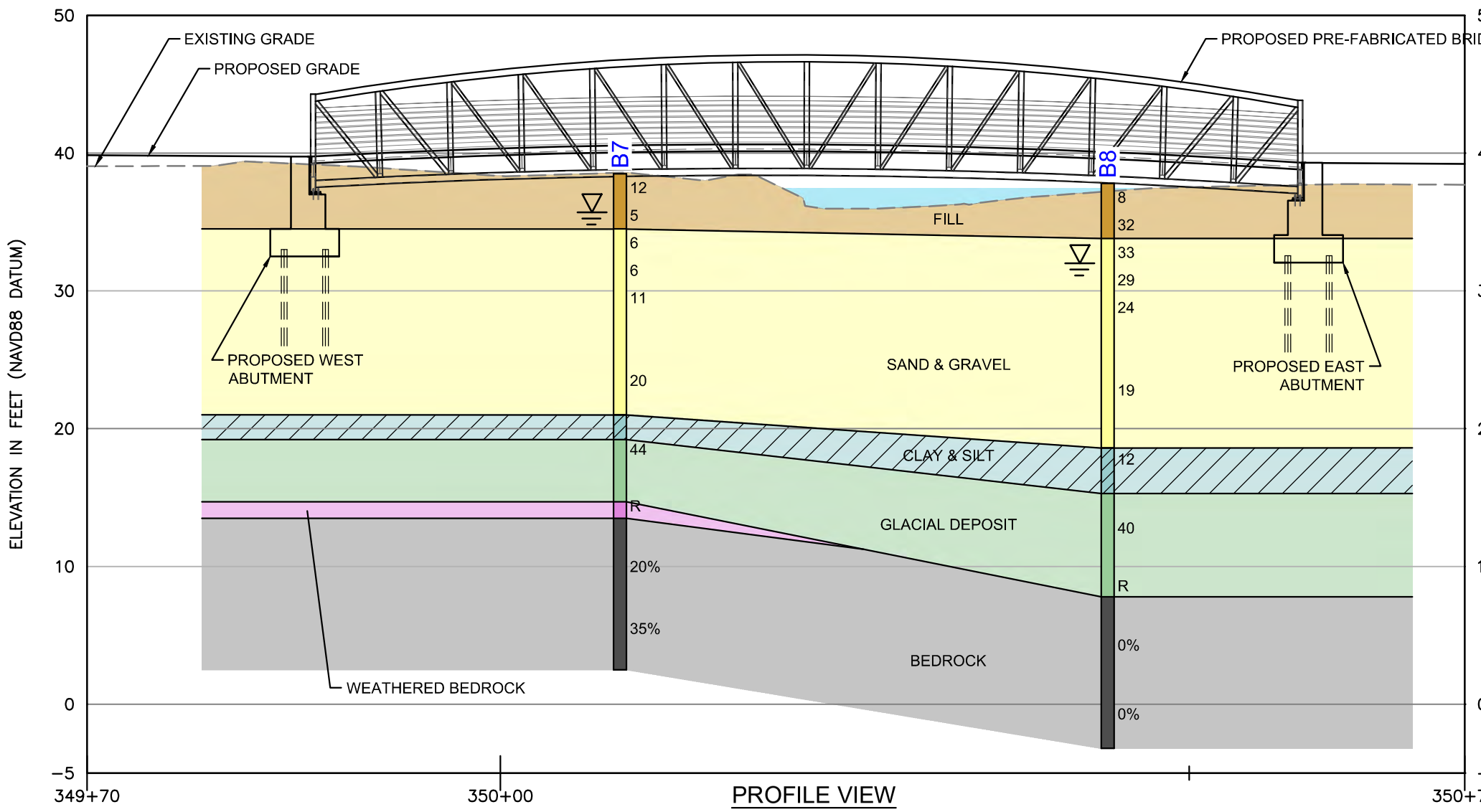
© 2019 – GZA GeoEnvironmental, Inc. GZA–\\gzanor\jobs\170,000–179,999\174019\174019–00.MPS\Figures–CAD\174019_BASE.dwg [PROF–FIG3] April 18, 2019 – 11:07am michael.smith

Proposal No. 609211-132091

A00830 - 130

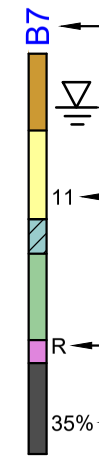


PLAN VIEW



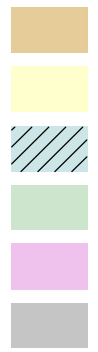
PROFILE VIEW

LEGEND



- B7 — BOREHOLE DESIGNATION
- INDICATES WATER LEVEL MEASURED IN BOREHOLE
- 11 — INDICATES STANDARD PENETRATION TEST (SPT) N-VALUE
- R — INDICATES REFUSAL
- 35% — INDICATES RQD VALUE

LITHOLOGY KEY



- FILL
- SAND & GRAVEL
- CLAY & SILT
- GLACIAL DEPOSIT
- WEATHERED BEDROCK
- BEDROCK

NOTES:

1. THE STRATIFICATION LINES SHOWN ON ARE BASED ON INTERPOLATIONS BETWEEN WIDELY SPACED EXPLORATION LOCATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.

VERTICAL SCALE IN FEET
0 5 10 20
0 5 10 20
HORIZONTAL SCALE IN FEET

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

PEABODY BIKE PATH - PHASE II
PEABODY, MASSACHUSETTS

EXPLORATION LOCATION PLAN & SUBSURFACE PROFILE

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: GREEN INTERNATIONAL AFFILIATES, INC. Civil and Structural Engineers	
PROJ MGR: MPS	REVIEWED BY: TMK	CHECKED BY: ABB	FIGURE 3
DESIGNED BY: ZSM	DRAWN BY: ADP	SCALE: AS SHOWN	
DATE: 02-06-2019	PROJECT NO. 01.0174019.00	REVISION NO.	

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

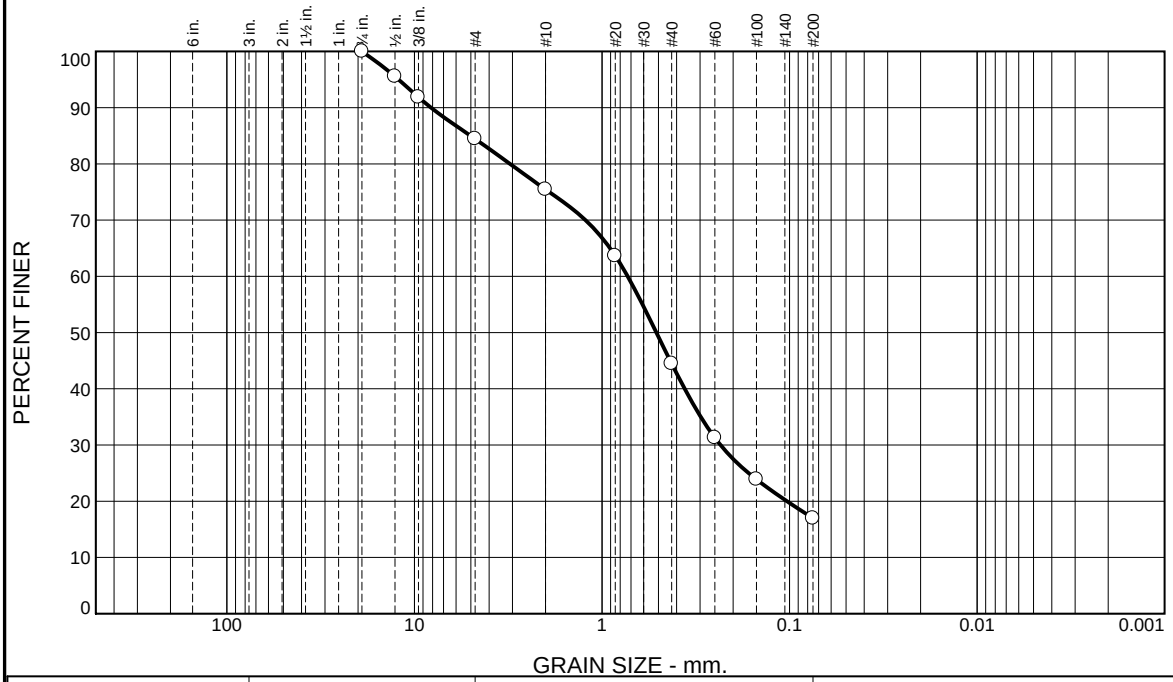
LABORATORY TESTING DATA SHEET

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f c Gravel, little Silt

Reviewed By _____ 01.14.2019

Proposal No. 609211-132091
A00830 - 131

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.6	8.9	31.0	27.5	17.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	95.6		
0.375"	91.9		
#4	84.4		
#10	75.5		
#20	63.6		
#40	44.5		
#60	31.3		
#100	23.9		
#200	17.0		

* (no specification provided)

Material Description

Brown f-c SAND, little Silt, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 8.1481 D_{85}= 5.0207 D_{60}= 0.7300
D_{50}= 0.5128 D_{30}= 0.2334 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 1

Thielsch Engineering Inc.

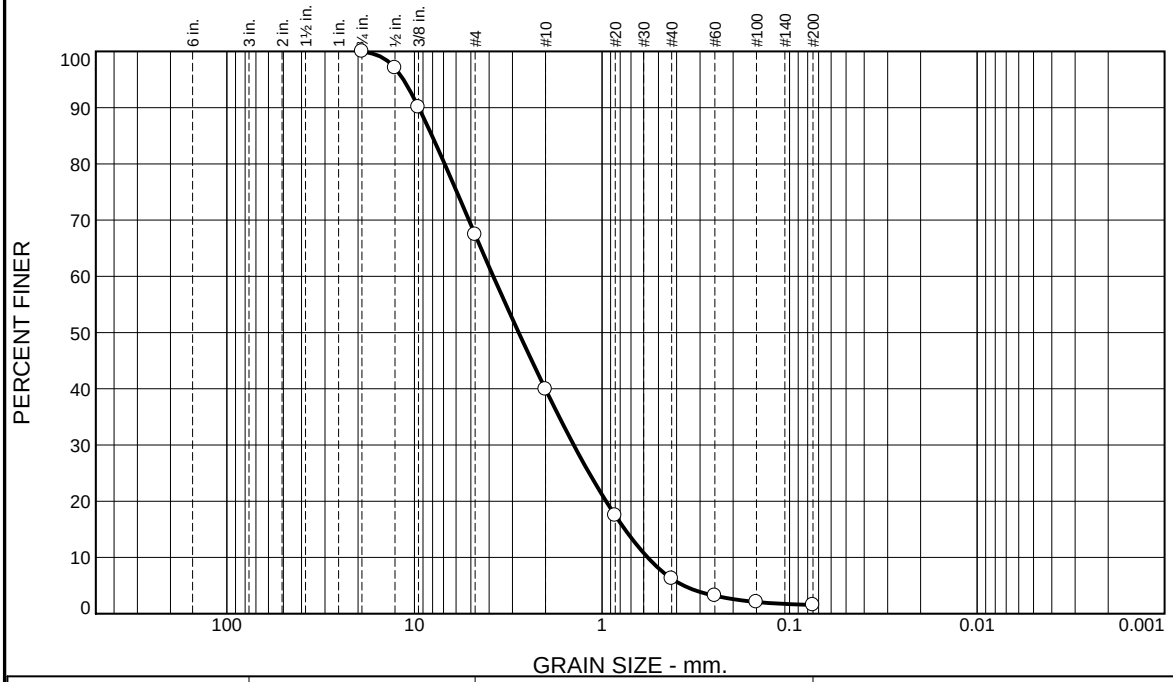
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	32.6	27.5	33.7	4.6	1.6	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.1		
0.375"	90.1		
#4	67.4		
#10	39.9		
#20	17.5		
#40	6.2		
#60	3.2		
#100	2.1		
#200	1.6		

* (no specification provided)

Material Description

Brown m-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 9.4954 D_{85}= 8.0567 D_{60}= 3.7970
D_{50}= 2.7818 D_{30}= 1.4137 D_{15}= 0.7552
D_{10}= 0.5709 C_u= 6.65 C_c= 0.92

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 2

Thielsch Engineering Inc.

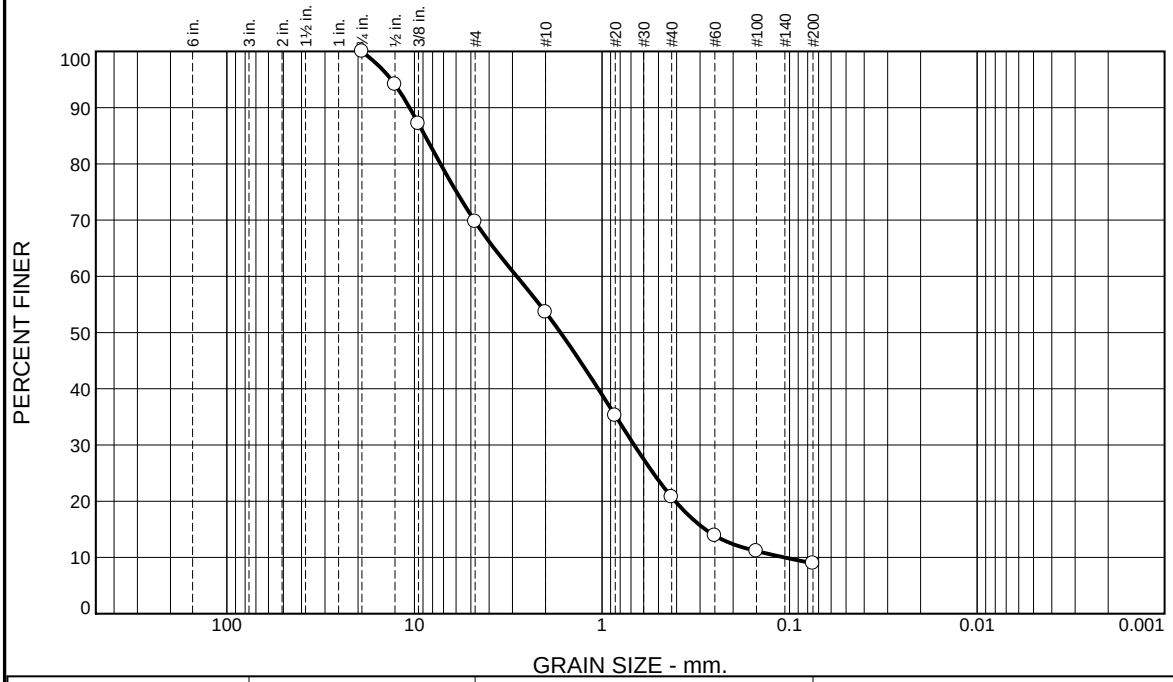
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.3	16.1	32.9	11.7	9.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.1		
0.375"	87.2		
#4	69.7		
#10	53.6		
#20	35.2		
#40	20.7		
#60	13.9		
#100	11.1		
#200	9.0		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 10.6243 D_{85}= 8.7796 D_{60}= 2.8502
D_{50}= 1.6634 D_{30}= 0.6736 D_{15}= 0.2815
D_{10}= 0.1064 C_u= 26.78 C_c= 1.50

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2'
Sample Number: Grab - 3

Date Sampled:

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-3

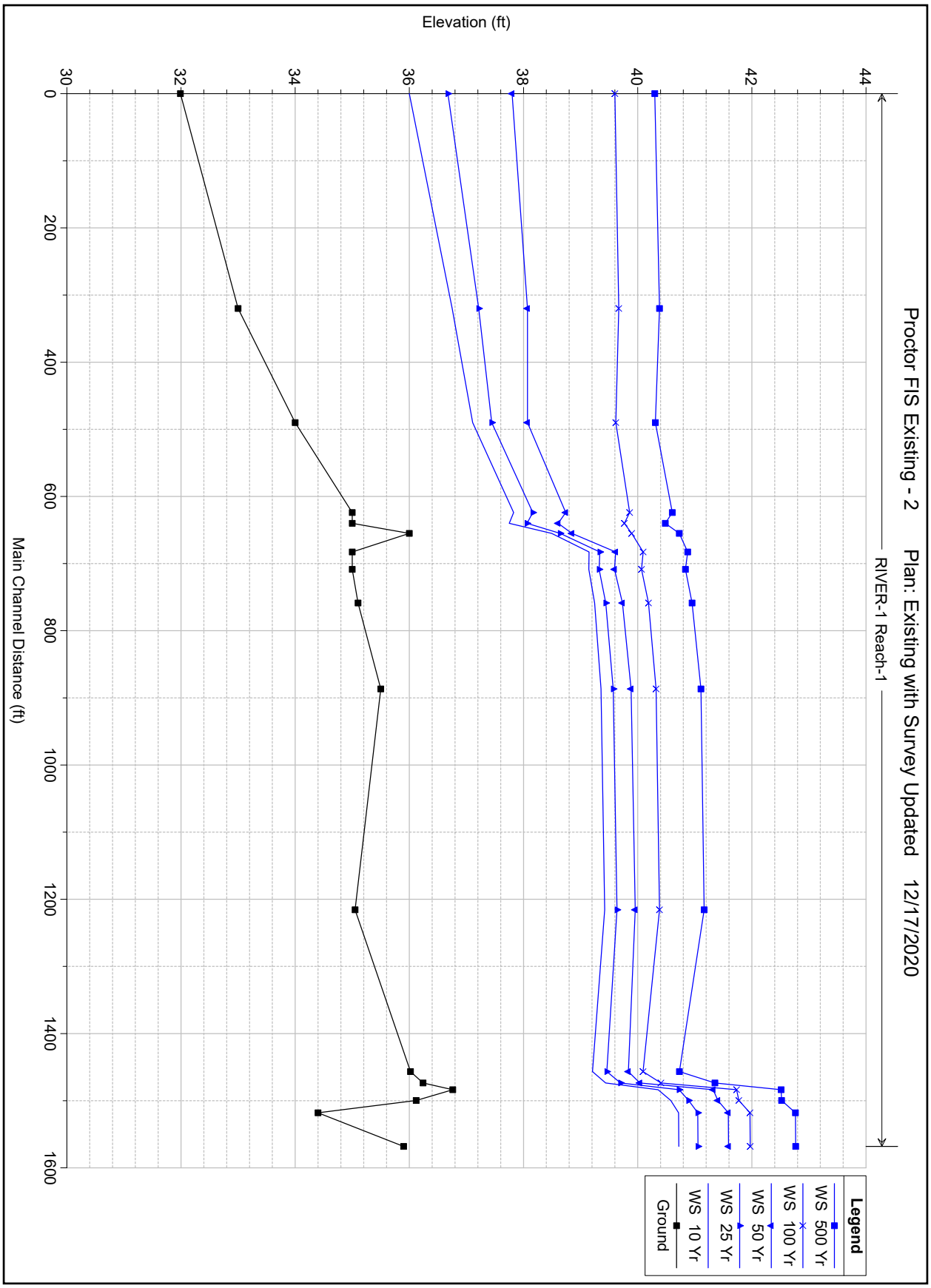
ATTACHMENT A: EXISTING CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: ExistingUpdated River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.72		40.76	0.000345	1.62	212.81	179.63	0.16
Reach-1	26	25 Yr	285.00	35.90	41.06		41.09	0.000304	1.63	274.13	184.98	0.16
Reach-1	26	50 Yr	360.00	35.90	41.59		41.62	0.000249	1.62	375.38	193.49	0.14
Reach-1	26	100 Yr	420.00	35.90	41.97		42.00	0.000223	1.63	449.95	199.53	0.14
Reach-1	26	500 Yr	610.00	35.90	42.77		42.80	0.000219	1.82	614.05	212.22	0.14
Reach-1	25	10 Yr	240.00	34.40	40.72	38.45	40.74	0.000198	1.33	247.94	195.81	0.13
Reach-1	25	25 Yr	285.00	34.40	41.05	38.87	41.08	0.000183	1.36	315.00	202.97	0.12
Reach-1	25	50 Yr	360.00	34.40	41.59	39.54	41.61	0.000159	1.38	426.73	214.37	0.12
Reach-1	25	100 Yr	420.00	34.40	41.97	40.04	41.99	0.000147	1.41	509.67	222.46	0.11
Reach-1	25	500 Yr	610.00	34.40	42.76	40.31	42.79	0.000151	1.58	693.76	239.43	0.12
Reach-1	24.7	10 Yr	240.00	36.12	40.58		40.72	0.001164	3.05	84.79	37.86	0.29
Reach-1	24.7	25 Yr	285.00	36.12	40.89		41.06	0.001198	3.29	98.56	49.96	0.30
Reach-1	24.7	50 Yr	360.00	36.12	41.40		41.59	0.001173	3.54	129.17	69.71	0.30
Reach-1	24.7	100 Yr	420.00	36.12	41.77		41.97	0.001139	3.69	157.46	83.92	0.30
Reach-1	24.7	500 Yr	610.00	36.12	42.52		42.77	0.001251	4.28	230.94	112.77	0.33
Reach-1	24.6	10 Yr	240.00	36.76	40.36		40.65	0.003713	4.36	62.54	53.45	0.51
Reach-1	24.6	25 Yr	285.00	36.76	40.72		41.00	0.002943	4.29	84.58	66.94	0.47
Reach-1	24.6	50 Yr	360.00	36.76	41.32		41.55	0.002035	4.10	131.16	88.97	0.40
Reach-1	24.6	100 Yr	420.00	36.76	41.73		41.94	0.001659	4.01	170.72	104.08	0.37
Reach-1	24.6	500 Yr	610.00	36.76	42.51		42.73	0.001470	4.30	263.12	132.83	0.36
Reach-1	24.4	10 Yr	240.00	36.24	39.44	39.44	40.39	0.014481	7.84	32.25	20.42	0.98
Reach-1	24.4	25 Yr	285.00	36.24	39.70	39.70	40.72	0.013342	8.17	37.83	22.30	0.96
Reach-1	24.4	50 Yr	360.00	36.24	40.04	40.04	41.22	0.013038	8.87	45.76	24.73	0.97
Reach-1	24.4	100 Yr	420.00	36.24	40.41	40.41	41.61	0.011172	8.97	56.92	37.26	0.92
Reach-1	24.4	500 Yr	610.00	36.24	41.35	41.35	42.44	0.007686	8.95	110.26	75.52	0.80
Reach-1	24.3	10 Yr	240.00	36.02	39.21	39.21	40.04	0.016759	7.32	32.78	20.02	1.01
Reach-1	24.3	25 Yr	285.00	36.02	39.46	39.46	40.33	0.015041	7.49	39.34	29.80	0.97
Reach-1	24.3	50 Yr	360.00	36.02	39.84	39.84	40.74	0.012474	7.70	53.40	44.65	0.91
Reach-1	24.3	100 Yr	420.00	36.02	40.09	40.09	41.01	0.011238	7.86	66.12	54.32	0.88
Reach-1	24.3	500 Yr	610.00	36.02	40.73	40.73	41.70	0.009424	8.39	108.29	78.26	0.84
Reach-1	24	10 Yr	240.00	35.05	39.42		39.43	0.000055	0.73	404.11	156.92	0.07
Reach-1	24	25 Yr	285.00	35.05	39.64		39.65	0.000062	0.81	438.33	159.44	0.07
Reach-1	24	50 Yr	360.00	35.05	39.96		39.97	0.000074	0.93	489.64	162.41	0.08
Reach-1	24	100 Yr	420.00	35.05	40.38		40.39	0.000070	0.97	559.57	166.36	0.08
Reach-1	24	500 Yr	610.00	35.05	41.16		41.18	0.000082	1.17	692.61	173.64	0.09
Reach-1	23	10 Yr	240.00	35.50	39.36		39.38	0.000644	1.31	183.22	138.22	0.20
Reach-1	23	25 Yr	285.00	35.50	39.57		39.60	0.000567	1.34	213.18	142.37	0.19
Reach-1	23	50 Yr	360.00	35.50	39.89		39.92	0.000499	1.40	258.96	148.48	0.18
Reach-1	23	100 Yr	420.00	35.50	40.32		40.35	0.000340	1.31	325.82	156.99	0.16
Reach-1	23	500 Yr	610.00	35.50	41.11		41.14	0.000265	1.38	455.05	173.76	0.14
Reach-1	22	10 Yr	240.00	35.10	39.25		39.30	0.000557	2.38	175.14	66.43	0.22
Reach-1	22	25 Yr	285.00	35.10	39.44		39.52	0.000667	2.70	189.13	81.36	0.24
Reach-1	22	50 Yr	360.00	35.10	39.73		39.83	0.000792	3.08	214.90	89.63	0.27
Reach-1	22	100 Yr	420.00	35.10	40.19		40.28	0.000699	3.10	256.58	93.61	0.25
Reach-1	22	500 Yr	610.00	35.10	40.95		41.07	0.000777	3.63	330.62	100.29	0.28
Reach-1	21.7	10 Yr	240.00	35.00	39.14		39.26	0.001078	2.88	114.10	68.82	0.29
Reach-1	21.7	25 Yr	285.00	35.00	39.32		39.47	0.001217	3.18	127.00	73.64	0.31
Reach-1	21.7	50 Yr	360.00	35.00	39.59		39.77	0.001417	3.61	147.78	80.79	0.34
Reach-1	21.7	100 Yr	420.00	35.00	40.07		40.23	0.001166	3.56	189.74	103.78	0.31
Reach-1	21.7	500 Yr	610.00	35.00	40.84		41.02	0.001137	3.94	274.78	117.32	0.32
Reach-1	21.6	10 Yr	240.00	35.00	39.15		39.21	0.000773	2.07	165.76	131.09	0.23
Reach-1	21.6	25 Yr	285.00	35.00	39.34		39.40	0.000811	2.22	191.00	138.74	0.24
Reach-1	21.6	50 Yr	360.00	35.00	39.62		39.69	0.000853	2.43	230.69	150.18	0.25
Reach-1	21.6	100 Yr	420.00	35.00	40.10		40.16	0.000611	2.27	303.44	167.89	0.21
Reach-1	21.6	500 Yr	610.00	35.00	40.88		40.94	0.000534	2.43	426.09	183.93	0.21
Reach-1	21.4	10 Yr	240.00	36.00	38.49	38.49	39.01	0.015189	5.90	47.24	58.55	0.92
Reach-1	21.4	25 Yr	285.00	36.00	38.64	38.64	39.20	0.014211	6.14	56.52	65.41	0.91
Reach-1	21.4	50 Yr	360.00	36.00	38.85	38.85	39.47	0.013579	6.58	71.03	74.90	0.91
Reach-1	21.4	100 Yr	420.00	36.00	39.89		40.09	0.002543	3.97	174.55	122.91	0.43
Reach-1	21.4	500 Yr	610.00	36.00	40.73		40.89	0.001649	3.83	286.57	143.69	0.36
Reach-1	21.35	10 Yr	240.00	35.00	37.75		38.13	0.004869	4.92	48.82	20.50	0.56
Reach-1	21.35	25 Yr	285.00	35.00	38.06		38.47	0.004775	5.16	55.28	21.12	0.56
Reach-1	21.35	50 Yr	360.00	35.00	38.61		39.05	0.004349	5.37	67.08	22.21	0.54
Reach-1	21.35	100 Yr	420.00	35.00	39.77		40.03	0.001863	4.26	126.02	71.64	0.37
Reach-1	21.35	500 Yr	610.00	35.00	40.48		40.81	0.001971	4.88	180.98	79.64	0.39

HEC-RAS Plan: ExistingUpdated River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	21.3	10 Yr	240.00	35.00	37.83		38.01	0.002694	3.45	69.50	34.31	0.43
Reach-1	21.3	25 Yr	285.00	35.00	38.16		38.35	0.002373	3.51	81.26	35.49	0.41
Reach-1	21.3	50 Yr	360.00	35.00	38.74		38.93	0.001898	3.52	102.21	37.22	0.37
Reach-1	21.3	100 Yr	420.00	35.00	39.86		39.97	0.000735	2.72	204.09	116.07	0.25
Reach-1	21.3	500 Yr	610.00	35.00	40.61		40.73	0.000735	3.06	296.44	131.72	0.25
Reach-1	20	10 Yr	240.00	34.00	37.11		37.51	0.004888	5.11	46.97	18.22	0.56
Reach-1	20	25 Yr	285.00	34.00	37.44		37.89	0.004841	5.36	53.16	18.88	0.56
Reach-1	20	50 Yr	360.00	34.00	38.07		38.54	0.004249	5.50	66.48	37.00	0.54
Reach-1	20	100 Yr	420.00	34.00	39.62		39.83	0.001273	3.90	158.52	81.84	0.31
Reach-1	20	500 Yr	610.00	34.00	40.31		40.58	0.001471	4.59	222.08	101.84	0.34
Reach-1	19	10 Yr	240.00	33.00	36.75		36.90	0.002193	3.15	76.21	35.79	0.38
Reach-1	19	25 Yr	285.00	33.00	37.21		37.35	0.001621	3.02	106.75	102.26	0.33
Reach-1	19	50 Yr	360.00	33.00	38.07		38.16	0.000810	2.55	201.57	119.80	0.25
Reach-1	19	100 Yr	420.00	33.00	39.67		39.70	0.000218	1.68	419.66	152.67	0.13
Reach-1	19	500 Yr	610.00	33.00	40.38		40.43	0.000262	1.99	533.75	167.32	0.15
Reach-1	18	10 Yr	240.00	31.99	36.00	34.38	36.21	0.002111	3.68	65.28	23.13	0.39
Reach-1	18	25 Yr	285.00	31.99	36.68	34.61	36.86	0.001461	3.45	93.73	66.48	0.33
Reach-1	18	50 Yr	360.00	31.99	37.80	34.97	37.91	0.000705	2.90	196.96	117.04	0.24
Reach-1	18	100 Yr	420.00	31.99	39.60	35.22	39.64	0.000187	1.87	480.42	197.92	0.13
Reach-1	18	500 Yr	610.00	31.99	40.30	35.96	40.35	0.000228	2.21	629.98	229.38	0.15


Proctor FIS Existing - 2 Plan: Existing with Survey Updated 12/17/2020
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
30
32
34
36
38
40
42
44
0
200
400
600
800
1000
1200
1400
1600
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1

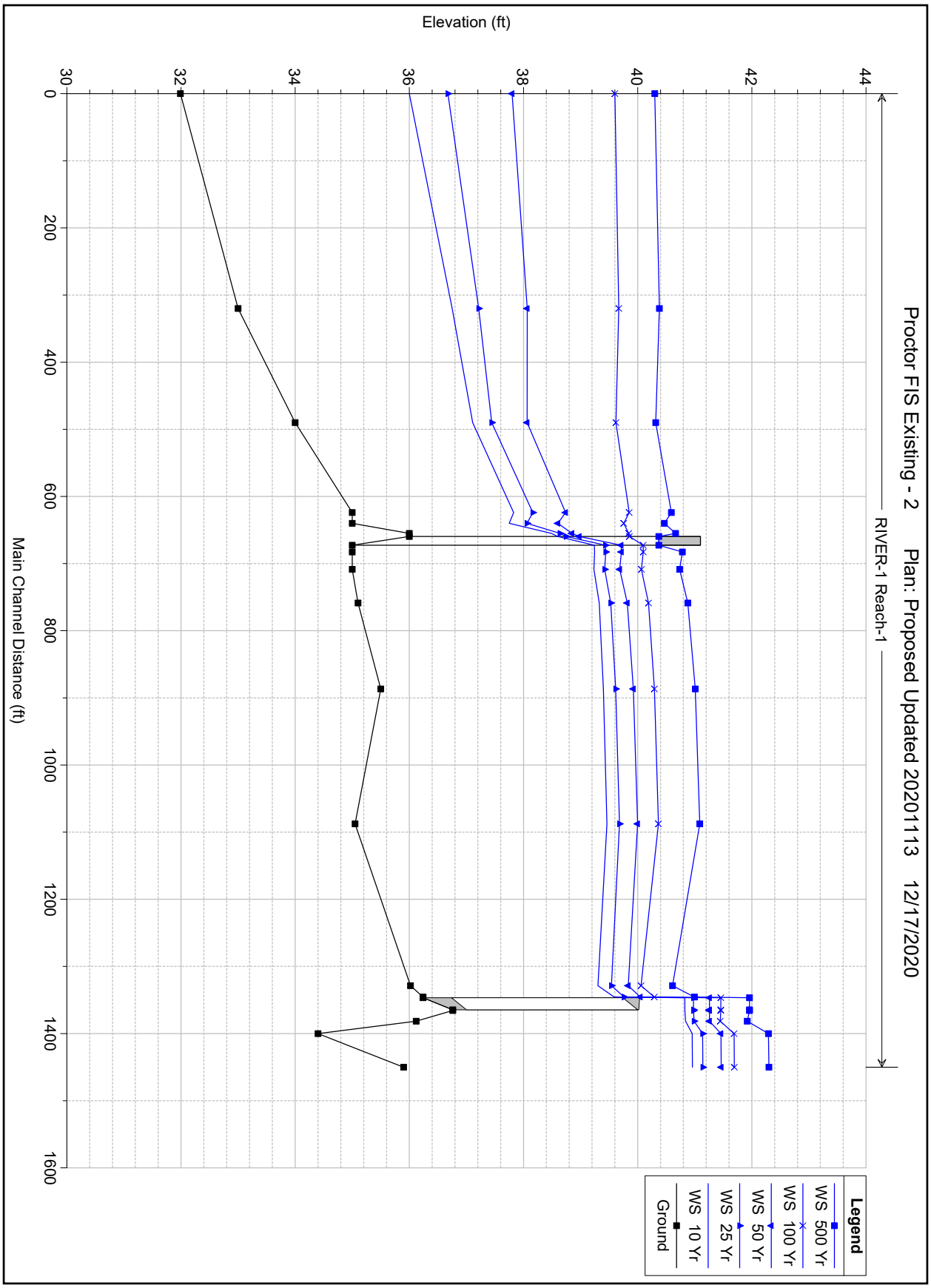
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.96		40.99	0.000246	1.44	255.94	183.41	0.14
Reach-1	26	25 Yr	285.00	35.90	41.14		41.17	0.000271	1.56	289.73	186.32	0.15
Reach-1	26	50 Yr	360.00	35.90	41.46		41.50	0.000287	1.71	350.66	191.45	0.15
Reach-1	26	100 Yr	420.00	35.90	41.69		41.73	0.000298	1.81	395.20	195.12	0.16
Reach-1	26	500 Yr	610.00	35.90	42.30		42.35	0.000333	2.10	515.98	204.73	0.17
Reach-1	25	10 Yr	240.00	34.40	40.95	38.45	40.97	0.000146	1.19	295.26	200.89	0.11
Reach-1	25	25 Yr	285.00	34.40	41.14	38.87	41.16	0.000165	1.31	332.20	204.77	0.12
Reach-1	25	50 Yr	360.00	34.40	41.46	39.54	41.49	0.000182	1.45	399.22	211.62	0.13
Reach-1	25	100 Yr	420.00	34.40	41.69	40.04	41.72	0.000193	1.55	448.46	216.52	0.13
Reach-1	25	500 Yr	610.00	34.40	42.29	40.31	42.33	0.000225	1.82	582.91	229.36	0.14
Reach-1	24.7	10 Yr	240.00	36.12	40.84		40.96	0.000893	2.81	95.92	47.88	0.26
Reach-1	24.7	25 Yr	285.00	36.12	40.99		41.14	0.001088	3.18	103.47	53.62	0.29
Reach-1	24.7	50 Yr	360.00	36.12	41.26		41.46	0.001338	3.70	119.38	64.06	0.32
Reach-1	24.7	100 Yr	420.00	36.12	41.45		41.69	0.001524	4.07	132.17	71.35	0.35
Reach-1	24.7	500 Yr	610.00	36.12	41.92		42.29	0.002089	5.11	170.21	89.60	0.41
Reach-1	24.6	10 Yr	240.00	36.76	40.83	39.63	40.93	0.001629	2.67	97.84	70.69	0.33
Reach-1	24.6	25 Yr	285.00	36.76	40.98	39.81	41.11	0.001767	2.92	109.01	76.29	0.35
Reach-1	24.6	50 Yr	360.00	36.76	41.26	40.05	41.41	0.001805	3.20	131.86	86.63	0.36
Reach-1	24.6	100 Yr	420.00	36.76	41.46	40.24	41.63	0.001839	3.41	149.72	93.92	0.37
Reach-1	24.6	500 Yr	610.00	36.76	41.96	40.66	42.19	0.002001	4.00	201.47	112.41	0.40
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	240.00	36.24	39.59	39.48	40.30	0.014076	6.79	35.36	21.49	0.93
Reach-1	24.4	25 Yr	285.00	36.24	39.76	39.71	40.58	0.015149	7.26	39.23	22.75	0.98
Reach-1	24.4	50 Yr	360.00	36.24	40.05	40.05	41.00	0.015958	7.83	45.99	24.79	1.01
Reach-1	24.4	100 Yr	420.00	36.24	40.29	40.29	41.30	0.014556	8.05	52.87	32.55	0.99
Reach-1	24.4	500 Yr	610.00	36.24	40.99	40.99	42.07	0.010902	8.47	85.79	61.01	0.90
Reach-1	24.3	10 Yr	240.00	36.02	39.30	39.30	40.04	0.017893	6.87	34.97	26.10	1.02
Reach-1	24.3	25 Yr	285.00	36.02	39.54	39.54	40.29	0.015203	6.96	41.81	31.71	0.96
Reach-1	24.3	50 Yr	360.00	36.02	39.83	39.83	40.65	0.014382	7.28	53.28	44.55	0.96
Reach-1	24.3	100 Yr	420.00	36.02	40.06	40.06	40.90	0.012861	7.44	64.24	53.01	0.92
Reach-1	24.3	500 Yr	610.00	36.02	40.61	40.61	41.55	0.010966	8.07	99.26	73.79	0.89
Reach-1	24	10 Yr	240.00	35.05	39.46		39.47	0.000052	0.72	410.37	157.71	0.07
Reach-1	24	25 Yr	285.00	35.05	39.68		39.69	0.000059	0.80	445.22	159.84	0.07
Reach-1	24	50 Yr	360.00	35.05	40.00		40.01	0.000070	0.92	496.49	162.80	0.08
Reach-1	24	100 Yr	420.00	35.05	40.36		40.38	0.000070	0.97	556.56	166.19	0.08
Reach-1	24	500 Yr	610.00	35.05	41.09		41.11	0.000085	1.18	679.20	172.92	0.09
Reach-1	23	10 Yr	240.00	35.50	39.40		39.44	0.000468	1.71	189.16	139.05	0.19
Reach-1	23	25 Yr	285.00	35.50	39.61		39.66	0.000475	1.82	219.37	143.21	0.19
Reach-1	23	50 Yr	360.00	35.50	39.92		39.98	0.000491	1.98	264.62	149.22	0.20
Reach-1	23	100 Yr	420.00	35.50	40.29		40.34	0.000420	1.98	321.21	156.42	0.19
Reach-1	23	500 Yr	610.00	35.50	41.01		41.07	0.000409	2.21	438.15	170.46	0.19
Reach-1	22	10 Yr	240.00	35.10	39.33		39.38	0.000496	2.28	180.52	69.50	0.21
Reach-1	22	25 Yr	285.00	35.10	39.53		39.59	0.000567	2.52	196.63	87.82	0.22
Reach-1	22	50 Yr	360.00	35.10	39.82		39.90	0.000678	2.89	222.46	90.36	0.25
Reach-1	22	100 Yr	420.00	35.10	40.19		40.28	0.000652	3.00	256.57	93.60	0.25
Reach-1	22	500 Yr	610.00	35.10	40.88		40.99	0.000770	3.57	323.09	99.63	0.27
Reach-1	21.7	10 Yr	240.00	35.00	39.23	37.45	39.34	0.000680	2.80	120.42	71.22	0.27
Reach-1	21.7	25 Yr	285.00	35.00	39.42	37.64	39.55	0.000765	3.08	134.24	76.20	0.29
Reach-1	21.7	50 Yr	360.00	35.00	39.69	37.90	39.85	0.000902	3.52	155.33	83.24	0.32
Reach-1	21.7	100 Yr	420.00	35.00	40.06	38.20	40.23	0.000820	3.58	189.40	103.73	0.31
Reach-1	21.7	500 Yr	610.00	35.00	40.73	38.80	40.94	0.000895	4.14	262.94	115.53	0.34
Reach-1	21.6	10 Yr	240.00	35.00	39.25	37.42	39.30	0.000474	2.00	178.75	135.08	0.22
Reach-1	21.6	25 Yr	285.00	35.00	39.44	37.60	39.50	0.000499	2.15	205.54	143.00	0.22
Reach-1	21.6	50 Yr	360.00	35.00	39.71	37.87	39.79	0.000543	2.38	245.20	154.23	0.24
Reach-1	21.6	100 Yr	420.00	35.00	40.10	38.11	40.17	0.000454	2.35	303.58	167.91	0.22
Reach-1	21.6	500 Yr	610.00	35.00	40.78	38.61	40.87	0.000447	2.62	411.27	182.01	0.23
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	240.00	36.00	38.49	38.49	39.02	0.010776	5.95	46.99	58.35	0.93
Reach-1	21.4	25 Yr	285.00	36.00	38.64	38.64	39.21	0.010102	6.21	56.29	65.25	0.92
Reach-1	21.4	50 Yr	360.00	36.00	38.85	38.85	39.49	0.009664	6.66	70.96	74.85	0.92
Reach-1	21.4	100 Yr	420.00	36.00	39.84		40.07	0.002046	4.21	168.11	120.48	0.46
Reach-1	21.4	500 Yr	610.00	36.00	40.66		40.86	0.001364	4.13	277.46	142.29	0.39
Reach-1	21.35	10 Yr	240.00	35.00	37.75		38.13	0.004869	4.92	48.82	20.50	0.56
Reach-1	21.35	25 Yr	285.00	35.00	38.06		38.47	0.004776	5.16	55.27	21.12	0.56

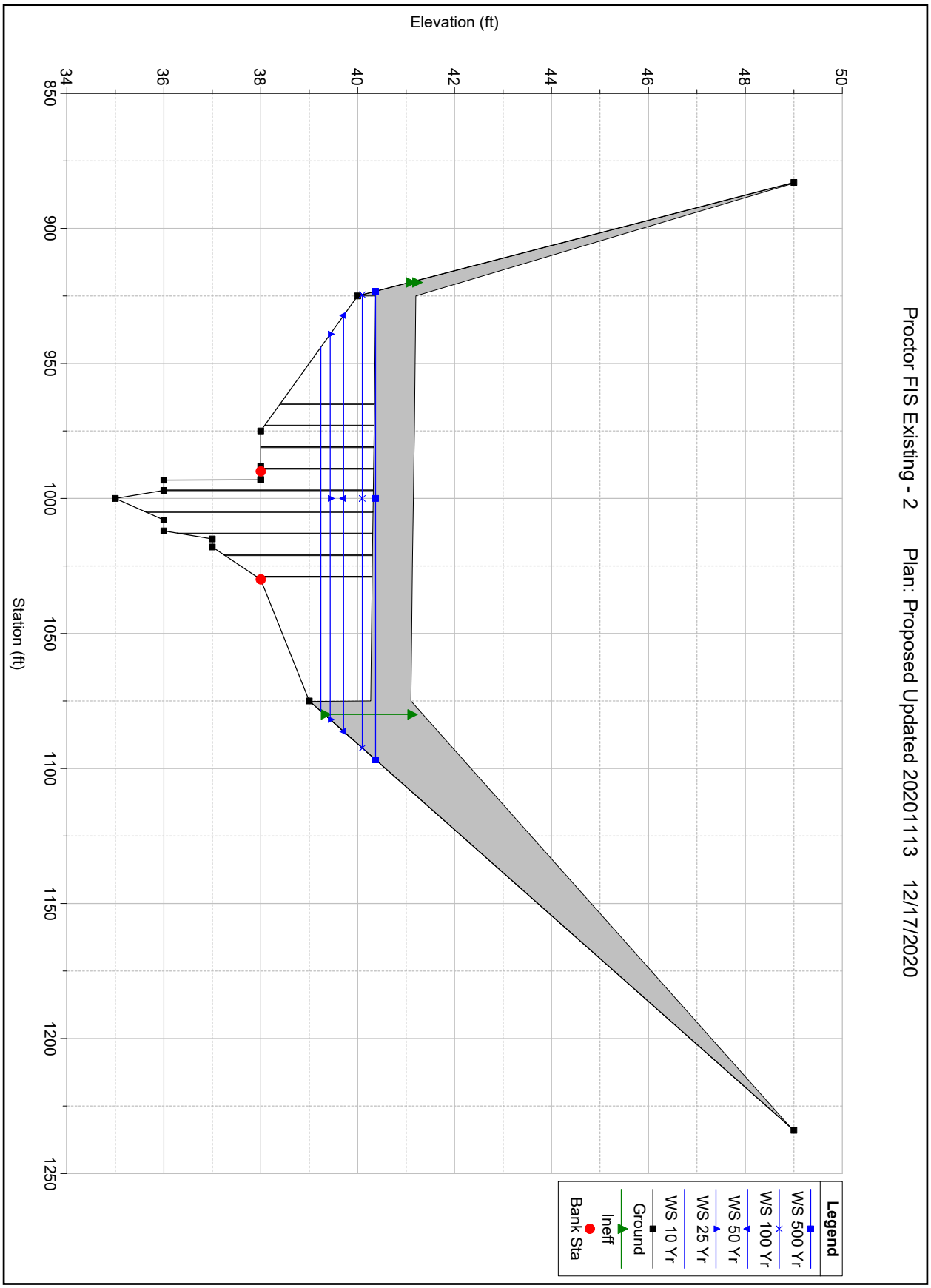
HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	21.35	50 Yr	360.00	35.00	38.60		39.05	0.004359	5.37	67.03	22.21	0.54
Reach-1	21.35	100 Yr	420.00	35.00	39.76		40.03	0.001873	4.27	125.38	71.49	0.37
Reach-1	21.35	500 Yr	610.00	35.00	40.47		40.80	0.001978	4.88	179.75	79.54	0.39
Reach-1	21.3	10 Yr	240.00	35.00	37.83	36.85	38.01	0.002694	3.45	69.50	34.31	0.43
Reach-1	21.3	25 Yr	285.00	35.00	38.16	37.01	38.35	0.002373	3.51	81.26	35.49	0.41
Reach-1	21.3	50 Yr	360.00	35.00	38.74	37.25	38.93	0.001903	3.53	102.12	37.21	0.38
Reach-1	21.3	100 Yr	420.00	35.00	39.85	37.44	39.96	0.000739	2.72	203.06	115.88	0.25
Reach-1	21.3	500 Yr	610.00	35.00	40.59	37.95	40.72	0.000738	3.06	294.35	131.39	0.25
Reach-1	20	10 Yr	240.00	34.00	37.11		37.51	0.004888	5.11	46.97	18.22	0.56
Reach-1	20	25 Yr	285.00	34.00	37.44		37.89	0.004842	5.36	53.15	18.88	0.56
Reach-1	20	50 Yr	360.00	34.00	38.06		38.54	0.004270	5.51	66.30	36.86	0.54
Reach-1	20	100 Yr	420.00	34.00	39.62		39.82	0.001240	3.85	158.60	81.87	0.31
Reach-1	20	500 Yr	610.00	34.00	40.32		40.57	0.001399	4.48	222.65	102.01	0.34
Reach-1	19	10 Yr	240.00	33.00	36.75		36.90	0.002193	3.15	76.21	35.79	0.38
Reach-1	19	25 Yr	285.00	33.00	37.21		37.35	0.001621	3.02	106.72	102.26	0.33
Reach-1	19	50 Yr	360.00	33.00	38.07		38.16	0.000806	2.55	201.25	119.74	0.25
Reach-1	19	100 Yr	420.00	33.00	39.67		39.70	0.000212	1.65	419.43	152.64	0.13
Reach-1	19	500 Yr	610.00	33.00	40.38		40.42	0.000252	1.95	533.45	167.28	0.15
Reach-1	18	10 Yr	240.00	31.99	36.00	34.38	36.21	0.002111	3.68	65.28	23.13	0.39
Reach-1	18	25 Yr	285.00	31.99	36.68	34.61	36.86	0.001460	3.45	93.73	66.48	0.33
Reach-1	18	50 Yr	360.00	31.99	37.80	34.97	37.91	0.000698	2.89	196.96	117.04	0.24
Reach-1	18	100 Yr	420.00	31.99	39.60	35.22	39.64	0.000183	1.85	480.42	197.92	0.13
Reach-1	18	500 Yr	610.00	31.99	40.30	35.96	40.35	0.000222	2.19	629.98	229.38	0.15

HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	21.7	10 Yr	39.34	39.23	37.45	0.01	0.03	71.22	3.53	217.17	19.30	2.80
Reach-1	21.7	25 Yr	39.55	39.42	37.64	0.02	0.03	76.20	4.89	253.01	27.10	3.08
Reach-1	21.7	50 Yr	39.85	39.69	37.90	0.02	0.05	83.24	7.58	311.04	41.38	3.52
Reach-1	21.7	100 Yr	40.23	40.06	38.20	0.02	0.05	103.73	11.71	349.00	59.29	3.58
Reach-1	21.7	500 Yr	40.94	40.73	38.80	0.02	0.06	115.53	29.31	470.53	110.16	4.14
Reach-1	21.6	10 Yr	39.30	39.25	37.42	0.01	0.00	135.08	15.45	212.59	11.97	2.00
Reach-1	21.6	25 Yr	39.50	39.44	37.60	0.01	0.00	143.00	21.41	245.35	18.24	2.15
Reach-1	21.6	50 Yr	39.79	39.71	37.87	0.01	0.00	154.23	32.31	298.09	29.59	2.38
Reach-1	21.6	100 Yr	40.17	40.10	38.11	0.01	0.00	167.91	46.39	330.25	43.36	2.35
Reach-1	21.6	500 Yr	40.87	40.78	38.61			182.01	89.78	440.94	79.28	2.62
Reach-1	21.5 BR U	10 Yr	39.29	39.24	37.48	0.03	0.14	128.10	18.50	204.94	16.56	2.01
Reach-1	21.5 BR U	25 Yr	39.49	39.43	37.66	0.03	0.15	132.93	25.63	234.09	25.28	2.14
Reach-1	21.5 BR U	50 Yr	39.78	39.71	37.92	0.04	0.16	139.77	38.71	280.30	40.99	2.34
Reach-1	21.5 BR U	100 Yr	40.16	40.10	38.19	0.02	0.05	146.98	55.61	304.20	60.19	2.26
Reach-1	21.5 BR U	500 Yr	40.86	40.37	38.70				86.83	443.02	80.15	3.10
Reach-1	21.5 BR D	10 Yr	39.12	38.60	38.60	0.06	0.00	56.77	4.65	226.92	8.43	5.97
Reach-1	21.5 BR D	25 Yr	39.31	38.75	38.75	0.06	0.00	63.55	8.23	263.35	13.42	6.25
Reach-1	21.5 BR D	50 Yr	39.58	38.98	38.98	0.05	0.01	73.33	16.34	319.80	23.87	6.59
Reach-1	21.5 BR D	100 Yr	40.08	39.85	39.14	0.01	0.00	113.59	48.50	316.37	55.13	4.34
Reach-1	21.5 BR D	500 Yr	40.86	40.37	39.57				92.29	430.04	87.67	5.01
Reach-1	21.4	10 Yr	39.02	38.49	38.49	0.10	0.08	58.35	2.43	232.53	5.04	5.95
Reach-1	21.4	25 Yr	39.21	38.64	38.64	0.10	0.08	65.25	4.82	271.63	8.55	6.21
Reach-1	21.4	50 Yr	39.49	38.85	38.85	0.09	0.10	74.85	10.05	334.54	15.41	6.66
Reach-1	21.4	100 Yr	40.07	39.84		0.03	0.01	120.48	36.67	341.65	41.68	4.21
Reach-1	21.4	500 Yr	40.86	40.66		0.02	0.04	142.29	87.30	439.98	82.72	4.13
Reach-1	21.35	10 Yr	38.13	37.75		0.06	0.06	20.50		240.00		4.92
Reach-1	21.35	25 Yr	38.47	38.06		0.05	0.07	21.12		285.00		5.16
Reach-1	21.35	50 Yr	39.05	38.60		0.04	0.08	22.21		360.00		5.37
Reach-1	21.35	100 Yr	40.03	39.76		0.02	0.05	71.49	0.04	398.51	21.46	4.27
Reach-1	21.35	500 Yr	40.80	40.47		0.02	0.06	79.54	0.23	535.83	73.94	4.88

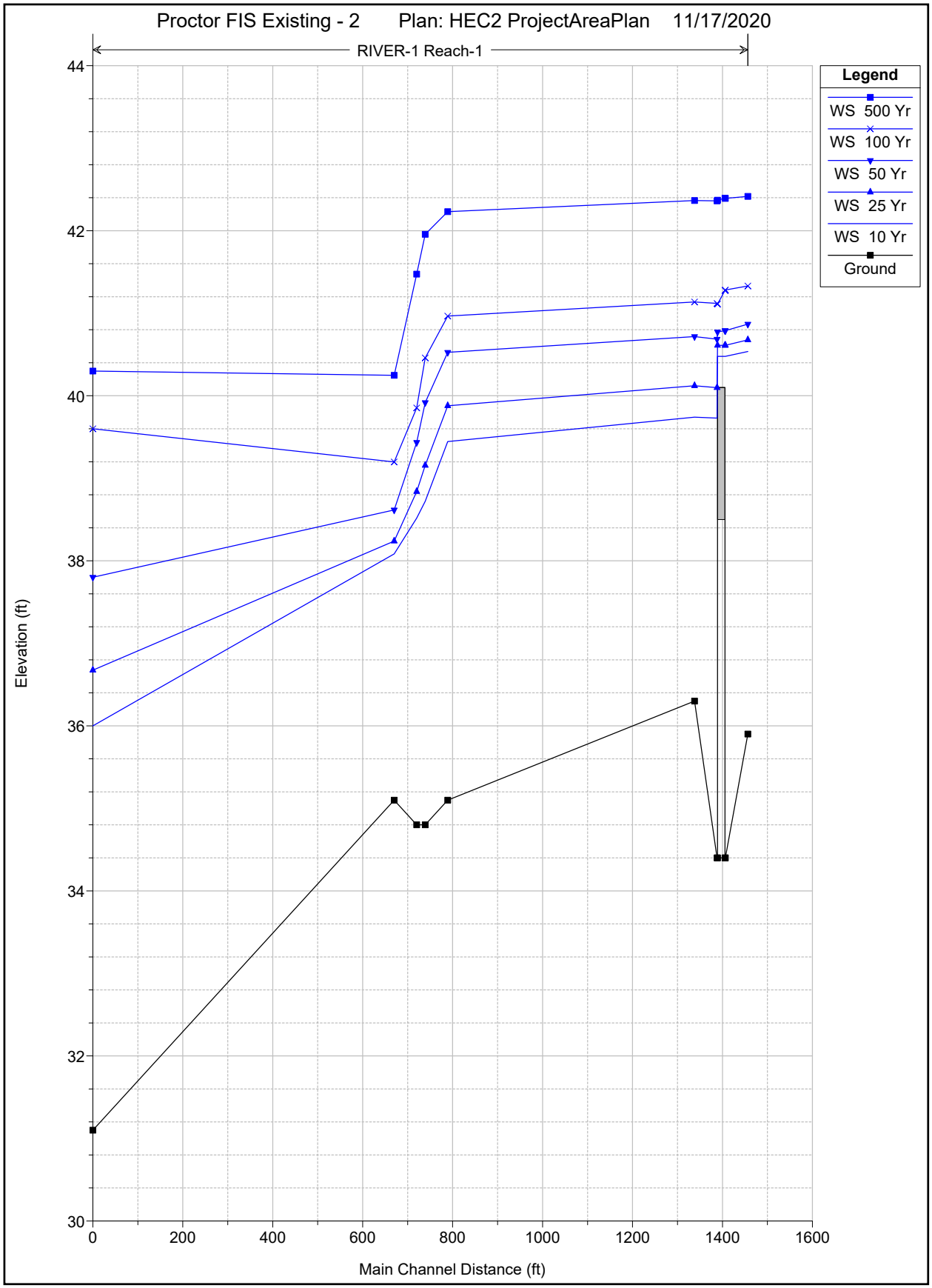

Proctor FIS Existing - 2 Plan: Proposed Updated 20201113 12/17/2020
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
30
32
34
36
38
40
42
44
0
200
400
600
800
1000
1200
1400
1600
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground


Proctor FIS Existing - 2 Plan: Proposed Updated 20201113 12/17/2020
Elevation (ft)
Station (ft)
34
36
38
40
42
44
46
48
50
850
900
950
1000
1050
1100
1150
1200
1250
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground
Ineff
Bank Sta

ATTACHMENT C: 1977 HEC-2 MODEL INPUT/OUTPUT AND RESULTANT HEC-RAS SUMMARY TABLE AND PLOT

HEC-RAS Plan: HEC2ProjectArea River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.54		40.62	0.001039	2.85	179.96	176.69	0.24
Reach-1	26	25 Yr	285.00	35.90	40.68		40.77	0.001165	3.08	205.01	178.93	0.26
Reach-1	26	50 Yr	360.00	35.90	40.87		40.98	0.001373	3.44	239.56	181.98	0.28
Reach-1	26	100 Yr	420.00	35.90	41.33		41.40	0.000950	3.04	325.38	189.34	0.24
Reach-1	26	500 Yr	610.00	35.90	42.42		42.46	0.000554	2.64	540.14	206.60	0.19
Reach-1	25	10 Yr	240.00	34.40	40.48	38.45	40.56	0.000951	3.16	201.95	190.74	0.24
Reach-1	25	25 Yr	285.00	34.40	40.61	38.87	40.69	0.001098	3.45	227.42	193.56	0.26
Reach-1	25	50 Yr	360.00	34.40	40.79	39.54	40.89	0.001338	3.89	262.21	197.35	0.28
Reach-1	25	100 Yr	420.00	34.40	41.28	40.04	41.35	0.000894	3.35	362.17	207.86	0.23
Reach-1	25	500 Yr	610.00	34.40	42.39	40.41	42.43	0.000500	2.79	605.91	231.49	0.18
Reach-1	24.5		Bridge									
Reach-1	24	10 Yr	240.00	34.40	39.73	38.10	39.83	0.001652	3.41	122.46	44.89	0.27
Reach-1	24	25 Yr	285.00	34.40	40.10	38.10	40.21	0.001672	3.60	139.59	47.91	0.28
Reach-1	24	50 Yr	360.00	34.40	40.69	38.10	40.80	0.001690	3.89	242.07	195.17	0.29
Reach-1	24	100 Yr	420.00	34.40	41.12	38.27	41.19	0.001222	3.47	328.79	204.41	0.25
Reach-1	24	500 Yr	610.00	34.40	42.36	38.94	42.39	0.000568	2.67	599.10	230.86	0.17
Reach-1	23	10 Yr	240.00	36.30	39.74		39.75	0.000360	1.27	406.62	258.12	0.12
Reach-1	23	25 Yr	285.00	36.30	40.12		40.13	0.000266	1.17	505.88	263.82	0.11
Reach-1	23	50 Yr	360.00	36.30	40.72		40.72	0.000185	1.08	665.80	272.76	0.09
Reach-1	23	100 Yr	420.00	36.30	41.14		41.14	0.000155	1.05	781.54	279.05	0.08
Reach-1	23	500 Yr	610.00	36.30	42.37		42.37	0.000106	1.01	1135.67	297.48	0.07
Reach-1	22	10 Yr	240.00	35.10	39.45		39.48	0.000600	1.83	189.57	81.92	0.16
Reach-1	22	25 Yr	285.00	35.10	39.88		39.91	0.000532	1.85	227.99	90.89	0.15
Reach-1	22	50 Yr	360.00	35.10	40.53		40.56	0.000452	1.87	288.61	96.55	0.15
Reach-1	22	100 Yr	420.00	35.10	40.97		41.00	0.000421	1.90	331.91	100.40	0.14
Reach-1	22	500 Yr	610.00	35.10	42.23		42.26	0.000350	1.99	465.93	111.46	0.13
Reach-1	21	10 Yr	240.00	34.80	38.72		39.34	0.008300	6.40	41.95	23.12	0.59
Reach-1	21	25 Yr	285.00	34.80	39.16		39.78	0.007459	6.54	53.41	29.38	0.57
Reach-1	21	50 Yr	360.00	34.80	39.92		40.45	0.005544	6.31	81.86	45.78	0.50
Reach-1	21	100 Yr	420.00	34.80	40.46		40.91	0.004381	6.02	109.91	57.70	0.46
Reach-1	21	500 Yr	610.00	34.80	41.96		42.21	0.002245	5.07	220.98	90.65	0.34
Reach-1	20	10 Yr	240.00	34.80	38.52	37.65	39.25	0.002594	6.89	37.54	20.20	0.65
Reach-1	20	25 Yr	285.00	34.80	38.84	37.96	39.68	0.002665	7.41	44.80	24.83	0.67
Reach-1	20	50 Yr	360.00	34.80	39.43	38.61	40.35	0.002459	7.84	62.34	35.16	0.66
Reach-1	20	100 Yr	420.00	34.80	39.85	39.07	40.80	0.002323	8.10	78.93	44.34	0.65
Reach-1	20	500 Yr	610.00	34.80	41.47	40.29	42.13	0.001302	7.36	179.85	80.04	0.51
Reach-1	19	10 Yr	240.00	35.10	38.08	37.81	39.05	0.004764	8.10	34.65	14.46	0.85
Reach-1	19	25 Yr	285.00	35.10	38.24	38.12	39.46	0.005584	9.09	36.91	14.69	0.93
Reach-1	19	50 Yr	360.00	35.10	38.62	38.62	40.11	0.005879	10.11	43.64	19.20	0.98
Reach-1	19	100 Yr	420.00	35.10	39.20	39.00	40.60	0.004522	9.87	55.62	21.99	0.88
Reach-1	19	500 Yr	610.00	35.10	40.25	40.25	41.92	0.004071	10.97	88.36	40.43	0.87
Reach-1	18	10 Yr	240.00	31.10	36.00	33.92	36.28	0.003140	4.56	75.12	42.81	0.38
Reach-1	18	25 Yr	285.00	31.10	36.68	34.20	36.90	0.002257	4.24	112.84	64.19	0.33
Reach-1	18	50 Yr	360.00	31.10	37.80	34.63	37.93	0.001216	3.54	198.56	94.60	0.25
Reach-1	18	100 Yr	420.00	31.10	39.60	34.93	39.64	0.000335	2.19	444.29	181.24	0.14
Reach-1	18	500 Yr	610.00	31.10	40.30	35.43	40.34	0.000403	2.54	584.68	219.86	0.15


Proctor FIS Existing - 2 Plan: HEC2 ProjectAreaPlan 11/17/2020
RIVER-1 Reach-1
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
44
42
40
38
36
34
32
30
0
200
400
600
800
1000
1200
1400
1600

ATTACHMENT D: SCOUR/STABILITY ANALYSES

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	10/13/2020
CHECKED BY	AGF	DATE	10/13/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 5 General Scour
Live-Bed Equation
25 YEAR DESIGN FLOW RATE

Live Bed Contraction Scour calculations:

$$y_2/y_1 = (Q_2/Q_1)^{6/7}(W_1/W_2)^{k1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:
y_1= Average depth in the upstream main channel (ft)
y_2= Average depth in the contracted section (ft)
y_0= Existing depth in the contracted section before scour (ft)
Q_1= Flow in the upstream channel transporting sediment (ft^3/s)
Q_2= Flow in the contracted channel (ft^3/s)
W_1= Bottom width of the upstream main channel that is transporting bed material (ft)
W_2= Bottom width of the main channel in the contracted section less pier width(s) (ft)
K_1= Exponent determined below

V*/w	K_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

For D_{50} = 2.7818 mm

y_1 =	y_0	Q_1	Q_2	W_1	W_2	K_1	y_2	y_s	
2.02	3.65	285	247	134	101	0.64	2.14	**-1.51**	*NO SCOUR*

Where,

$$V^* = (t/q)^{1/2} = (gy_1s_1)^{1/2}$$

s_1	Slope of energy grade line of main channel (ft/ft)
y_1	Average depth in the upstream main channel (ft)
g	Acceleration of Gravity(32.2 ft/s^2)
w	Fall velocity of bed material based on D_{50}, m/s (figure 5.8, HEC-18) (for velocity in english units (ft/s), multiply w in m/s by 3.28
t	Shear stress on the bed, Pa (N/m^2) (lb/ft^2)
q	Density of water (1000 Kg/m^3) (1.94 $slug/ft^3$)

Then for s_1 = 0.0034

V* = 0.47 ft/s

And for D_{50} = 2.7818 mm

w = 0.7872 ft/s (from figure 5.8 for temperature between 0 and 20 C degree)

V*/w = 0.6 then K_1 = 0.64

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	10/13/2020
CHECKED BY	AGF	DATE	10/13/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 5 General Scour
Live-Bed Equation
50 YEAR DESIGN FLOW RATE

Live Bed Contraction Scour calculations:

$$y_2/y_1 = (Q_2/Q_1)^{6/7}(W_1/W_2)^{k1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:
y_1= Average depth in the upstream main channel (ft)
y_2= Average depth in the contracted section (ft)
y_0= Existing depth in the contracted section before scour (ft)
Q_1= Flow in the upstream channel transporting sediment (ft^3/s)
Q_2= Flow in the contracted channel (ft^3/s)
W_1= Bottom width of the upstream main channel that is transporting bed material (ft)
W_2= Bottom width of the main channel in the contracted section less pier width(s) (ft)
K_1= Exponent determined below

V*/w	K_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

For D_{50} = 2.7818 mm

y_1 =	y_0	Q_1	Q_2	W_1	W_2	K_1	y_2	y_s	
3.67	3.65	360	280	144	104	0.64	3.64	**-0.01**	*NO SCOUR*

Where,

$$V^* = (t/q)^{1/2} = (gy_1s_1)^{1/2}$$

s_1	Slope of energy grade line of main channel (ft/ft)
y_1	Average depth in the upstream main channel (ft)
g	Acceleration of Gravity(32.2 ft/s^2)
w	Fall velocity of bed material based on D_{50}, m/s (figure 5.8, HEC-18) (for velocity in english units (ft/s), multiply w in m/s by 3.28
t	Shear stress on the bed, Pa (N/m^2) (lb/ft^2)
q	Density of water (1000 Kg/m^3) (1.94 $slug/ft^3$)

Then for s_1 = 0.0034

V* = 0.63 ft/s

And for D_{50} = 2.7818 mm

w = 0.7872 ft/s (from figure 5.8 for temperature between 0 and 20 C degree)

V*/w = 0.8 then K_1 = 0.64

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

25 YR Proposed Scour at Abutments

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft (m)
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft (m)
y_0 = Flow depth prior to scour, ft (m)

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.009
v_2= 6.25
d_2= 1.21
K_u= 11.17
q_{2f}= 7.56
y_c= 2.75
v_1= 2.15
d_1= 1.23
q_1= 2.64
q_2/q_1= 2.860
α_A= 1.15
y_{max}= 3.16
y_0= 1.21

Y_s = 1.95 ft

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

50 YR Proposed Scour at Abutments

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft
y_0 = Flow depth prior to scour, ft

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.009
v_2= 6.59
d_2= 1.35
K_u= 11.17
q_{2f}= 8.90
y_c= 3.16
v_1= 2.38
d_1= 1.35
q_1= 3.21
q_2/q_1= 2.769
α_A= 1.15
y_{max}= 3.63
y_0= 1.35

Y_s = 2.28 ft

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

25 YR Proposed Scour at Abutments with Scour Protection

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft (m)
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft (m)
y_0 = Flow depth prior to scour, ft (m)

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.500
v_2= 6.25
d_2= 1.21
K_u= 11.17
q_{2f}= 7.56
y_c= 0.87
v_1= 2.15
d_1= 1.23
q_1= 2.64
q_2/q_1= 2.860
α_A= 1.15
y_{max}= 1.00
y_0= 1.21

Y_s = -0.21 ft

Ys < 0. Say 0 ft scour

GREEN INTERNATIONAL AFFILIATES, INC.
Consulting Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/18/2021
CHECKED BY	AGF	DATE	2/18/2021
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 7 Determination of Local Scour at Piers

25 YR PROPOSED

Live Bed Contraction Scour calculations:

$$y_s/y_1 = 2.0*K_1*K_2*K_3*K_4(a/y_1)^{0.65}Fr_1^{0.43}$$

$$y_s/a = 2.0*K_1*K_2*K_3*K_4(y_1/a)^{0.35}Fr_1^{0.43}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:

y_s= Scour depth (ft)
y_1= Flow depth directly upstream of the pier (ft)
K_1= Correction factor for pier nose shape from Figure 6.3 and Table 6.1
K_2= Correction factor for angle of attack of flow from Table 6.2 or Equation 6.4
K_3= Correction factor for bed condition from Table 6.3
K_4= Correction factor for armoring by bed material size from Equation 6.5
a= Pier width (ft)
L= Length of pier (ft)
Fr_1= Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$
V_1= Mean velocity of flow directly upstream of the pier (ft/s)
g= Acceleration of gravity (32.2 ft/s^2)

Table 6.1. Correction Factor, K_1, for Pier Nose Shape.

Shape of Pier Nose	K_1
(a) Square nose	1.1
(b) Round nose	1.0
(c) Circular cylinder	1.0
(d) Group of cylinders	1.0
(e) Sharp nose	0.9

Table 6.2. Correction Factor, K_2, for Angle of Attack, Θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.0	1.0	1.0
15	1.5	2.0	2.5
30	2.0	2.8	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5.0
Angle = skew angle of flow			
L = length of pier, m			

Table 6.3. Increase in Equilibrium Pier Scour Depths, K_3, for Bed Condition.

Bed Condition	Dune Height (m)	K_3
Clear-Water Scour	N/A	1.1
Plane bed and Antidune flow	N/A	1.1
Small Dunes	3> H ≥ 0.6	1.1
Medium Dunes	9> H ≥ 3	1.2 to 1.1
Large Dunes	H ≥ 9	1.3

D_{50}=	0.009	ft
D_{95}=	0.033	ft
K_1=	1.0	(group of cylinders)
K_2=	1.0	(0 degree angle of attack for circular pier)
K_3=	1.1	(Clear-Water Scour and Plane Bed)
y_1=	1.46	ft
a=	0.33	ft
V_1=	6.25	ft/sec

$Fr_1 = V_1/(gy_1)^{1/2}$ Fr_1= 0.91

y_s = **1.17 ft**

GREEN INTERNATIONAL AFFILIATES, INC.
Consulting Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	11/17/2020
CHECKED BY	AGF	DATE	11/17/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 7 Determination of Local Scour at Piers

50 YR PROPOSED

Live Bed Contraction Scour calculations:

$$y_s/y_1 = 2.0*K_1*K_2*K_3*K_4(a/y_1)^{0.65}Fr_1^{0.43}$$

$$y_s/a = 2.0*K_1*K_2*K_3*K_4(y_1/a)^{0.35}Fr_1^{0.43}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:

y_s= Scour depth (ft)
y_1= Flow depth directly upstream of the pier (ft)
K_1= Correction factor for pier nose shape from Figure 6.3 and Table 6.1
K_2= Correction factor for angle of attack of flow from Table 6.2 or Equation 6.4
K_3= Correction factor for bed condition from Table 6.3
K_4= Correction factor for armoring by bed material size from Equation 6.5
a= Pier width (ft)
L= Length of pier (ft)
Fr_1= Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$
V_1= Mean velocity of flow directly upstream of the pier (ft/s)
g= Acceleration of gravity (32.2 ft/s^2)

Table 6.1. Correction Factor, K_1, for Pier Nose Shape.

Shape of Pier Nose	K_1
(a) Square nose	1.1
(b) Round nose	1.0
(c) Circular cylinder	1.0
(d) Group of cylinders	1.0
(e) Sharp nose	0.9

Table 6.2. Correction Factor, K_2, for Angle of Attack, Θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.0	1.0	1.0
15	1.5	2.0	2.5
30	2.0	2.8	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5.0
Angle = skew angle of flow			
L = length of pier, m			

Table 6.3. Increase in Equilibrium Pier Scour Depths, K_3, for Bed Condition.

Bed Condition	Dune Height (m)	K_3
Clear-Water Scour	N/A	1.1
Plane bed and Antidune flow	N/A	1.1
Small Dunes	3> H ≥ 0.6	1.1
Medium Dunes	9> H ≥ 3	1.2 to 1.1
Large Dunes	H ≥ 9	1.3

D_{50}=	0.009	ft
D_{95}=	0.033	ft
K_1=	1.0	(group of cylinders)
K_2=	1.0	(0 degree angle of attack for circular pier)
K_3=	1.1	(Clear-Water Scour and Plane Bed)
y_1=	1.66	ft
a=	0.33	ft
V_1=	6.59	ft/sec

$Fr_1 = V_1/(gy_1)^{1/2}$ Fr_1= 0.90

***y_s* = 1.22 ft**

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00831

ARMY CORPS OF ENGINEERS

GENERAL PERMIT

THIS PAGE INTENTIONALLY LEFT BLANK

Regulatory Division
Transportation & Utility Section
File Number: NAE-2024-01390

Brendan Callahan
City of Peabody
24 Lowell Street
Peabody, Massachusetts 01960
Via Email: brendan.callahan@peabody-ma.gov

Erica Larner
MassDOT - Highway Division
10 Park Plaza
Boston, Massachusetts 02116
Via Email: erica.n.larner@dot.state.ma.us

Dear Mr. Callahan and Ms. Larner:

This letter is in response to the application you submitted to the U.S. Army Corps of Engineers, New England District, on May 17, 2024, for a Department of the Army general permit verification. This project has been assigned the file number NAE-2024-01390. This file number should be referenced in all correspondence with this office.

The work includes the permanent discharge of fill material within 8,661 square feet below the Ordinary High Water (OHW) mark of Proctor Brook and two unnamed intermittent streams, and within 2,344 square feet of wetlands, associated with the extension of the Independence Greenway rail trail 1.3 miles from its current terminus at Essex Center Drive to Endicott Street, at Latitude 42.5343º and Longitude -70.9436º, in Peabody, Essex County, Massachusetts. The existing rail bed will be paved, and five existing culvert crossings and one former bridge will be replaced. Four culverts will be upsized, while one will be replaced with the same size culvert, as follows:

- STA 329+85: Two existing 42” reinforced concrete pipe (RCP) culverts conveying the trail over Proctor Brook will be replaced with a new 4’H x 8’W reinforced concrete box culvert embedded with 12” of natural streambed material.
- STA 340+10: Existing 30” corrugated metal pipe (CMP) culvert conveying trail over an unnamed intermittent stream will be replaced with a new 36” ductile iron pipe (DIP) embedded with 12” of natural streambed material.
- STA 342+20: Existing 24” CMP connecting Wetland V to Proctor Brook will be replaced with a new 24” DIP.

- STA 346+20: Existing collapsed 4'H x 6.4'W concrete box culvert that formerly conveyed the trail over Proctor Brook will be replaced with a new 4'H x 8'W reinforced concrete culvert embedded with 12" of natural streambed material.
- STA 358+51: Existing 15" RCP culvert conveying trail over an unnamed intermittent stream will be replaced with a new 16" DIP.

Rip-rap over-topped with natural material will be installed at culvert inlets and outlets. The project also includes temporary impacts within 2,312 square feet below the OHW marks of Proctor Brook and the two unnamed intermittent streams, and within 4,681 square feet of wetlands, due to cofferdams and dewatering associated with the culvert replacements, and the installation of temporary mats to facilitate the construction of a pile-supported bridge. The work is shown on the enclosed plans titled "MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION PLAN AND PROFILE OF INDEPENDENCE GREENWAY EXTENSION BRIDGE P-03-020 (CAK) IN THE CITY OF PEABODY ESSEX COUNTY," on 63 sheets, and dated "REVISED JULY 26, 2024."

Based on the information you have provided, we verify that the activity is authorized under General Permit 23 of the June 2, 2023, Federal Permit known as the Massachusetts General Permits (GPs). If the extent of the project area and/or nature of the authorized impacts to waters are modified, a revised application must be submitted to this office for written approval before work is initiated. A copy of these permits can be found at: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/.

Any deviation from the terms and conditions of the permit, or your submitted plans, may subject the permittee to the enforcement provisions of our regulations. Therefore, in the event changes to this project are contemplated, it is recommended you coordinate with this office prior to proceeding with the work. This office must approve any changes before you undertake them. You must perform this work in compliance with the terms and conditions of the GPs listed above, and also in compliance with the following special conditions:

Project Specific Special Conditions:

1. The permittee shall complete and return the enclosed Work-Start Notification Form to this office at least two weeks prior to the anticipated construction start date.

2. The permittee shall complete and return the enclosed Completion Certification Form to this office at least one month following the completion of the authorized work.

3. A conditioned Water Quality Certification (WQC) has been issued by the Massachusetts Department of Environmental Protection for your project and is attached. You must comply with the conditions specified in the WQC.

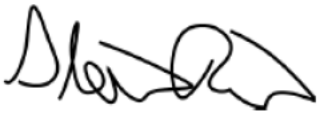
This verification is valid until June 1, 2028. You must commence or be under contract to commence the work authorized herein by June 1, 2028, and complete the work by June 1, 2029. If not, you must contact this office to determine the need for further authorization before beginning or continuing the activity. It is recommended that you contact this office before this authorization expires to discuss if permit reissuance is a possibility.

This general permit verification and any associated authorizations does not preclude the necessity to obtain any other Federal, State, or local permits, licenses, and/or certifications, which may be required.

If you have any questions related to this verification or have issues accessing documents referenced in this letter, please contact Dan Vasconcelos, Project Manager, at 978-318-8653, or by email at daniel.b.vasconcelos@usace.army.mil.

This agency continually strives to improve our customer service. In order to better serve you, please complete the Customer Service Survey located at: https://regulatory.ops.usace.army.mil/customer-service-survey/.

Sincerely,



Stephen Rochette
Chief, Technical Support Branch
Regulatory Division

Enclosures

cc (w/enclosures):

Ed Reiner, U.S. EPA, Region 1 (via reiner.ed@epa.gov)
Rachel Croy, U.S. EPA, Region 1 (via croy.rachel@epa.gov)
Kerry Bogdan, FEMA, Region (via kerry.bogdan@fema.dhs.gov)
Christopher Markesich, FEMA, Region 1, (via christopher.markesich@fema.dhs.gov)
Taelise Ricketts, FEMA, Region 1 (via taelise.ricketts@fema.dhs.gov)
Heidi Davis, MassDEP (via heidi.davis@mass.gov)
Ryan Hale, MassDEP (via ryan.hale@mass.gov)
Peabody Conservation Commission (via lucia.delnegro@peabody-ma.gov)
Danielle Spicer, Green International (via dspicer@greenintl.com)
Cori Beckwith, MassDOT – Highway Division (via corinna.beckwith@dot.state.ma.us)

Work-Start Notification Form

File Number: NAE-2024-01390 State: Massachusetts County: Essex

Permittee: MassDOT - Highway Division, Erica Larner
Date Verification Issued: 9/6/2024
Project Manager: Dan Vasconcelos

At least two weeks prior to commencing the activity authorized by this permit, sign this certification and return it to the following address:

US ARMY CORPS OF ENGINEERS
New England District
Attn: Dan Vasconcelos
696 Virginia Road
Concord, MA 01742
or
daniel.b.vasconcelos@usace.army.mil and cenae-r-ma@usace.army.mil
978-318-8653

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers (USACE) representative. Failure to comply with any terms or conditions of this authorization may result in the USACE suspending, modifying or revoking the authorization and/or issuing a Class I administrative penalty, or initiating other appropriate legal action.

The people (e.g. contractor) listed below will do the work, and they understand the permit's conditions and limitations.

Contractor Name/Contractor Firm: _____
Business Address: _____
_____
Contractor Phone and Email: _____

Proposed Construction Dates: Start: _____ Finish: _____

_____ _____
Signature of Permittee Date

Compliance Certification Form

File Number: NAE-2024-01390 State: Massachusetts County: Essex

Permittee: MassDOT - Highway Division, Erica Larner
Date Verification Issued: 9/6/2024
Project Manager: Dan Vasconcelos

Within one month of completion of the activity authorized by this permit and any mitigation required by the permit (you must submit this form after mitigation is complete, but not the mitigation monitoring, which requires separate submittals), sign this certification and return it to the following address:

US ARMY CORPS OF ENGINEERS
New England District
Attn: Dan Vasconcelos
696 Virginia Road
Concord, MA 01742
or
daniel.b.vasconcelos@usace.army.mil and cenae-r-ma@usace.army.mil

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers (USACE) representative. Failure to comply with any terms or conditions of this authorization may result in the USACE suspending, modifying, or revoking the authorization and/or issuing a Class I administrative penalty, or initiating other appropriate legal action.

I hereby certify that the work, and mitigation (if applicable), authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit including any general or specific conditions.

Date Authorized Work Started: _____ Completed: _____

Describe any deviations from permit (attach drawing(s) depicting the deviations):

_____

_____

***Note: The description of any deviations on this form does not constitute approval by the USACE.**

_____ _____

Signature of Permittee **Date**

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	142
PROJECT FILE NO.	609211		

TITLE SHEET & INDEX

PLAN AND PROFILE OF

INDEPENDENCE GREENWAY EXTENSION
BRIDGE P-03-020 (CAK)

IN THE CITY OF

PEABODY

ESSEX COUNTY

FEDERAL AID PROJECT NO.

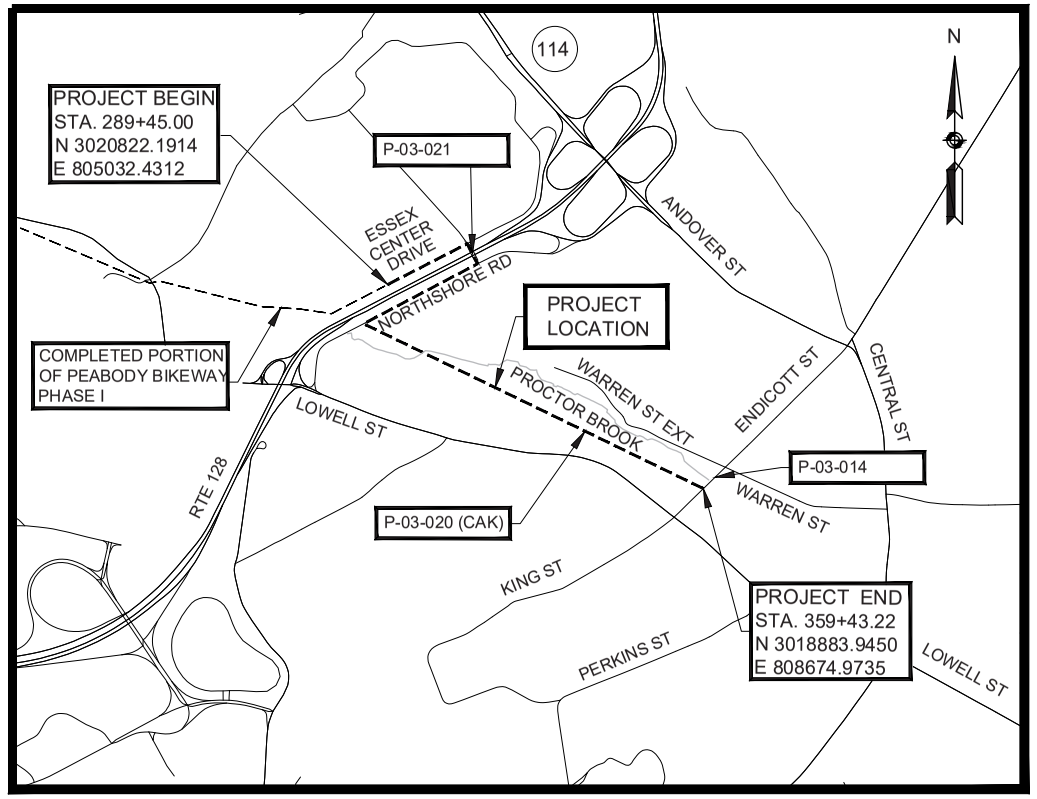
PS&E SUBMITTAL

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

WQC/ACOE PLAN SET
May 15, 2024
REVISED JULY 26, 2024

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX, REVISED 7/26/2024
2	LEGEND & ABBREVIATIONS
3	GENERAL NOTES
4	KEY PLAN
5 - 6	BORING LOGS
7 - 8	TYPICAL SECTIONS & DETAILS 1
9 - 16	CONSTRUCTION PLANS & PROFILES, REVISED 7/26/2024
~~17 - 20~~	~~CURB TIE & GRADING PLANS~~
21 - 24	DRAINAGE AND UTILITY PLANS, REVISED 7/26/2024
~~25 - 31~~	~~PAVEMENT MARKINGS AND SIGNING PLANS~~
~~32~~	~~COMPENSATORY FLOOD STORAGE PLAN~~
33	WETLAND REPLICATION PLAN, REVISED 6/11/024
34 - 39	CULVERT PLANS , REVISED 6/11/024
40 - 43	CONSTRUCTION DETAILS , REVISED 6/11/024
46 - 50	LANDSCAPE PLANS
~~51~~	~~LIGHTING & ELECTRICAL PLANS~~
~~52 - 59~~	~~TEMPORARY TRAFFIC CONTROL PLANS~~
60-76	BRIDGE PLANS (SELECTED SHEETS)
~~77 - 142~~	~~CROSS SECTIONS~~
XXX	CULVERT CROSS SECTIONS (SUPPLEMENTAL SHEETS)



LENGTH OF PROJECT = 6998.22 FEET = 1.325 MILES

DESIGN DESIGNATION

	ESSEX CENTER DRIVE	NORTHSHORE ROAD	ENDICOTT STREET
ADT (2019)	6,302	6,917	7,427
ADT (2041)	6,963	7,643	8,206
DESIGN SPEED (MPH)	30	35	35
K	8.8	8.7	7.8
D	55%	63%	55%
T (PEAK HOUR)	6%	2%	5%
T (AVERAGE DAY)	6%	2%	5%
DHV	613	665	640
DDHV	337	419	352
FUNCTIONAL CLASSIFICATION	LOCAL ROADWAY	LOCAL ROADWAY	URBAN COLLECTOR

DATE	DESCRIPTION	REV #
4/19/2024	REVISED PS&E SUBMISSION	5
2/2/2024	PS&E DESIGN SUBMISSION	4
11/7/2023	100% DESIGN SUBMISSION	3
2/2/2023	75% DESIGN SUBMISSION	2
4/20/2021	25% DESIGN SUBMISSION	1

massDOT Massachusetts Department of Transportation Highway Division

APPROVED

CHIEF ENGINEER _____ DATE _____

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
TRANSPORTATION | STRUCTURAL | WATER RESOURCES | CIVIL/SITE

WQC/ACOE PLAN SHEET 1 OF 63

Proposal No. 609211-132091

A00831 - 8

Proposal No. 609211-132091

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
		CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
Ⓒ	Ⓒ	CABLE MANHOLE
Ⓓ	Ⓓ	DRAINAGE MANHOLE
Ⓔ	Ⓔ	ELECTRIC MANHOLE
Ⓖ	Ⓖ	GAS MANHOLE
Ⓜ	Ⓜ	MISC MANHOLE
Ⓢ	Ⓢ	SEWER MANHOLE
Ⓣ	Ⓣ	TELEPHONE MANHOLE
Ⓦ	Ⓦ	WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		SEDIMENT CONTROL BARRIER
		COIR LOG
		TREE LINE
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT

TRAFFIC SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
1	1	CONTROLLER PHASE ACTUATED
		TRAFFIC SIGNAL HEAD (SIZE AS NOTED)
		WIRE LOOP DETECTOR (6' x 6' TYP UNLESS OTHERWISE SPECIFIED)
		VIDEO DETECTION CAMERA
		MICROWAVE DETECTOR
		PEDESTRIAN PUSH BUTTON, SIGN (DIRECTIONAL ARROW AS SHOWN) AND SADDLE
	*	EMERGENCY PREEMPTION CONFIRMATION STROBE LIGHT
		VEHICULAR SIGNAL HEAD
		VEHICULAR SIGNAL HEAD, OPTICALLY PROGRAMMED
		FLASHING BEACON
		PEDESTRIAN SIGNAL HEAD, (TYPE AS NOTED OR AS SPECIFIED)
RRSG	RRSG	RAILROAD SIGNAL
OR		SIGNAL POST AND BASE (ALPHA-NUMERIC DESIGNATION NOTED)
	20'	MAST ARM, SHAFT AND BASE (ARM LENGTH AS NOTED)
		HIGH MAST POLE OR TOWER
		SIGN AND POST
		SIGN AND POST (2 POSTS)
	20'	MAST ARM WITH LUMINAIRE
		OPTICAL PRE-EMPTION DETECTOR
		CONTROL CABINET, GROUND MOUNTED
		CONTROL CABINET, POLE MOUNTED
		FLASHING BEACON CONTROL AND METER PEDESTAL
		LOAD CENTER ASSEMBLY
		PULL BOX 12"x12" (OR AS NOTED)
		ELECTRIC HANDHOLE 12"x24" (OR AS NOTED)
		TRAFFIC SIGNAL CONDUIT
		INFORMATIONAL SIGN

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
ONLY	ONLY	LEGEND "ONLY" - WHITE
		STOP LINE (12")
	CW	CROSSWALK
	SWL	SOLID WHITE LINE (6")
	SYL	SOLID YELLOW LINE (6")
	BWL	BROKEN WHITE LINE (10' LINE SEGMENT, 30' GAP)
	BYL	BROKEN YELLOW LINE (10' LINE SEGMENT, 30' GAP)
	DWL	DOTTED WHITE LINE (3' LINE SEGMENT, 9' GAP)
	DYL	DOTTED YELLOW LINE (3' LINE SEGMENT, 9' GAP)
	DWLEx	DOTTED WHITE LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DYLEx	DOTTED YELLOW LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DBWL	DOUBLE WHITE LINE (6")
	DBYL	DOUBLE YELLOW LINE (6")

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	142
PROJECT FILE NO.	609211		

LEGEND & ABBREVIATIONS

ABBREVIATIONS (cont.)

GENERAL

PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
RMD	REMODEL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SGE	SLOPED GRANITE EDGING
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STATION
STD	STANDARD
STW	SPRING TENSION WIRE
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE OR TOP OF SEDIMENT
TOW	TOP OF WATER
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION
DGCB	DOUBLE GRATE CATCH BASIN

TRAFFIC SIGNAL ABBREVIATIONS

CAB	CABINET
CCVE	CLOSED CIRCUIT VIDEO EQUIPMENT
DW	STEADY UPRAISED HAND
FDW	FLASHING UPRAISED HAND
FR	FLASHING CIRCULAR RED
FRL	FLASHING RED LEFT ARROW
FRR	FLASHING RED RIGHT ARROW
FY	FLASHING CIRCULAR YELLOW
FYL	FLASHING YELLOW LEFT ARROW
FYR	FLASHING YELLOW RIGHT ARROW
G	STEADY CIRCULAR GREEN
GL	STEADY GREEN LEFT ARROW
GR	STEADY GREEN RIGHT ARROW
GSL	STEADY GREEN SLASH LEFT ARROW
GSR	STEADY GREEN SLASH RIGHT ARROW
GV	STEADY GREEN VERTICAL ARROW
OL	OVERLAP
PED	PEDESTRIAN
PTZ	PAN, TILT, ZOOM
R	STEADY CIRCULAR RED
RL	STEADY RED LEFT ARROW
RR	STEADY RED RIGHT ARROW
TR SIG	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONDUIT
W	STEADY WALKING PERSON
Y	STEADY CIRCULAR YELLOW
YL	STEADY YELLOW LEFT ARROW

A00831 - 9

WQC/ACOE PLAN SHEET 2 OF 63

GENERAL NOTES

1. ALL UTILITY POLES REQUIRING RELOCATION ARE TO BE RELOCATED BY OTHERS.
2. THE CONTRACTOR SHALL MAINTAIN COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD AT ALL OBSTRUCTIONS.
3. PEDESTRIAN CURB RAMPS SHALL CONFORM TO THE CURRENT MASSDOT STANDARDS.
4. TRANSITION GRANITE CURB SHALL BE INSTALLED AT PROJECT LIMITS TO MATCH EXISTING ELEVATIONS (PAVEMENT OR EXISTING CURB).
5. THE CONTRACTOR SHALL RETAIN ALL CURBS, FENCES, WALLS, TREES, SHRUBS, POSTS, LANDSCAPE FEATURES, AND OTHER MISCELLANEOUS ITEMS WITHIN ABUTTING PROPERTIES, UNLESS OTHERWISE NOTED. WHEN RETAINING THOSE ITEMS IS NOT PRACTICAL IN THE OPINION OF THE ENGINEER, THE CONTRACTOR SHALL REMOVE, STOCKPILE, PROTECT AND RESET THE ITEMS. THE CONTRACTOR SHALL REPLACE ITEMS DAMAGED DURING REMOVAL, STOCKPILING, OR RESETTING DUE TO NEGLIGENCE, CARELESSNESS, OR MISHANDLING WITH EQUIVALENT NEW ITEMS AT NO COST TO THE OWNER.
6. ALL TREES WITHIN THE SLOPE LIMIT SHALL BE RETAINED AND PROTECTED UNLESS OTHERWISE NOTED.
7. ALL TREES CALLED OUT TO BE RETAINED SHALL BE PROTECTED USING ITEM NO. 102.511 TREE PROTECTION - ARMORING AND PRUNING AND ITEM NO. 102.521 TREE AND PLANT PROTECTION FENCE.
8. CONTRACTOR SHALL PROTECT ALL PROPERTY MARKERS OF ABUTTERS.
9. TREATMENT OF SLOPE AREAS SHALL BE REPLACED IN KIND UNLESS OTHERWISE NOTED.
10. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN EXCAVATING ALONG THE ABUTMENT FOR THE SHARED-USE PATH AT THE ROUTE 128 UNDERPASS.

UTILITY NOTES:

1. THE LOCATION OF ALL UNDERGROUND UTILITIES ARE SHOWN APPROXIMATE AND WERE COMPILED USING FIELD SURVEY INFORMATION AND AVAILABLE RECORD INFORMATION. THE LOCATION OF EXISTING PIPES OR OTHER UNDERGROUND STRUCTURES OR PROPERTY LINES ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. THE CONTRACTOR SHALL CALL "DIG SAFE" (1-888-344-7233) AND NOTIFY THE CITY OF PEABODY AND MASSDOT AT LEAST 72 HOURS (EXCLUDING SATURDAYS, SUNDAYS AND HOLIDAYS) PRIOR TO ANY EXCAVATION TO OBTAIN ACCURATE UTILITY LOCATIONS.
2. RECORD UTILITY INFORMATION FROM THE VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES ARE APPROXIMATE ONLY AND ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD.
3. THE COMPLETION AND ACCURACY OF LATERAL UTILITY SERVICES IS NOT GUARANTEED AND MUST BE VERIFIED BY THE CONTRACTOR IN THE FIELD.
4. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE MUST BE NOTIFIED, INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN, (SEE CHAPTER 370, ACTS OF 1963, MASSACHUSETTS) PRIOR TO DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORING OR REPAVING.
5. SUBSURFACE UTILITY LOCATIONS HAVE BEEN PLOTTED TO MEET UTILITY QUALITY LEVEL "C" AS DESCRIBED IN ASCE STANDARD 38-02 AND SUMMARIZED ON THIS SHEET. THE UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS BASED ON ABOVE-GROUND FIELD OBSERVATION AND EXISTING RECORD INFORMATION RECEIVED FROM UTILITY STAKE-HOLDERS.
6. INVERTS SHOWN ON PLAN ARE NOT GUARANTEED TO BE ACCURATE. DUE TO THE LIMITATIONS OF FIELD OBSERVATION AND SURVEY TECHNIQUES THE INVERTS ARE SHOWN AS APPROXIMATE ONLY AND SHALL NOT BE WARRANTED TO BE CORRECT. ADDITIONAL FIELD INVESTIGATION IS NECESSARY WHERE ACCURATE MEASUREMENTS ARE REQUIRED FOR DESIGN OF CRITICAL AREAS.
7. WHERE AN EXISTING UTILITY IS FOUND TO BE IN CONFLICT WITH THE PROPOSED WORK, THE CONTRACTOR SHALL ACCURATELY DETERMINE THE LOCATION, ELEVATION AND SIZE OF THE UTILITY AND FURNISH THE INFORMATION TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
8. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHEN EXCAVATING NEAR AND BACKFILLING IN THE VICINITY OF EXISTING UTILITIES. THE CONTRACTOR SHALL USE HAND EXCAVATION WHERE APPROPRIATE TO PROTECT EXISTING UTILITIES.
9. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING UTILITIES IN SERVICE AT ALL TIMES UNLESS NOTED ON THE PLANS OR APPROVED BY THE ENGINEER.
10. THE CONTRACTOR SHALL SUPPORT AND PROTECT EXISTING UTILITIES IN AND AROUND EXCAVATIONS, AND IN PARTICULAR, WHEN CROSSING OVER OR UNDER ANY DUCT OR PIPE. ALL PROTECTIVE MEASURES SHALL BE CONSIDERED INCIDENTAL WORK.
11. IF THE CONTRACTOR DAMAGES ANY UTILITY SYSTEM, HE OR SHE SHALL IMMEDIATELY NOTIFY THE RESPECTIVE UTILITY COMPANY AND SHALL REPAIR/REPLACE THE AFFECTED SYSTEM AT HIS OR HER OWN EXPENSE.
12. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE UTILITY COMPANIES AND MAKE ARRANGEMENTS FOR ADJUSTMENTS, ALTERATIONS AND REPLACEMENT OF PRIVATE UTILITIES.
13. BELOW GROUND STRUCTURES ARE SHOWN SYMBOLIC UNLESS DIMENSIONED.
14. THE EXISTING CONDITIONS PLAN IS TO BE USED FOR THE SPECIFIED PROJECT ONLY AND IS NOT WARRANTED TO BE COMPLETE FOR ANY OTHER FUTURE PROJECTS.
15. THE EXISTING SEWER LINE WITHIN THE PROJECT LIMITS SHALL BE INSPECTED USING CLOSED CIRCUIT TV (CCTV) AT THE BEGINNING OF THE PROJECT, PRIOR TO ANY MAJOR WORK ACTIVITIES OR LARGE EQUIPMENT MOBILIZING ON SITE. A CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE SAME LIMITS SHALL ALSO BE PERFORMED AT THE END OF CONSTRUCTION TO CONFIRM ITS CONDITION HAS NOT CHANGED OVER THE COURSE OF THE PROJECT.
IN ADDITION TO THE PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE PROJECT LIMITS, INTERIM CCTV INSPECTION OF CERTAIN SEGMENTS OF THE SEWER LINE SHALL BE PERFORMED FOR SPECIFIC VIBRATION GENERATING ACTIVITIES. CCTV INSPECTION SHALL BE PERFORMED AT THE FOLLOWING LOCATIONS AND PROPOSED CONSTRUCTION ITEMS FOR EXCAVATION AND STONE INSTALLATION ACTIVITIES:

- STA 329+85 BOX CULVERT NO. 1
- STA 340+05 36" DIP PIPE CULVERT
- STA 342+25 24" DIP PIPE CULVERT
- STA 346+20 BOX CULVERT NO. 2
- STA 351+10 BOARDWALK WEST ABUTMENT
- STA 355+48 BOARDWALK EAST ABUTMENT
- STA 358+50 16" DUCTILE IRON PIPE

SUMMARY OF UTILITY MAPPING QUALITY LEVELS:

THE FOLLOWING IS A SUMMARY OF THE SURVEY MAPPING LEVELS FOR UTILITIES AS DESCRIBED IN ASCE STANDARD 38-02, "STANDARD GUIDELINE FOR THE DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". THESE GUIDELINES ARE MORE FULLY DESCRIBED IN THE ASCE STANDARD.

UTILITY QUALITY LEVEL A:
PRECISE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES OBTAINED BY THE ACTUAL EXPOSURE (OR VERIFICATION OF PREVIOUSLY EXPOSED AND SURVEYED UTILITIES) AND SUBSEQUENT MEASUREMENT OF SUBSURFACE UTILITIES, USUALLY AT A SPECIFIC POINT. MINIMALLY INTRUSIVE EXCAVATION EQUIPMENT IS TYPICALLY USED TO MINIMIZE THE POTENTIAL FOR UTILITY DAMAGE. A PRECISE HORIZONTAL AND VERTICAL LOCATION, AS WELL AS OTHER UTILITY ATTRIBUTES, IS SHOWN ON PLAN DOCUMENTS. ACCURACY IS TYPICALLY SET TO 15-MM VERTICAL AND TO APPLICABLE HORIZONTAL SURVEY AND MAPPING ACCURACY AS DEFINED OR EXPECTED BY THE PROJECT OWNER.

UTILITY QUALITY LEVEL B:
INFORMATION OBTAINED THROUGH THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND APPROXIMATE HORIZONTAL POSITION OF SUBSURFACE UTILITIES. QUALITY LEVEL B DATA SHOULD BE REPRODUCIBLE BY SURFACE GEOPHYSICS AT ANY POINT OF THEIR DEPICTION. THIS INFORMATION IS SURVEYED TO APPLICABLE TOLERANCES DEFINED BY THE PROJECT AND REDUCED ONTO PLAN DOCUMENTS.

UTILITY QUALITY LEVEL C:
INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D INFORMATION.

UTILITY QUALITY LEVEL D:
INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS.

SURVEY NOTES

1. THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULT OF AN ARIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON THE GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.
2. HORIZONTAL DATUM IS BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, VERTICAL DATUM IS NAVD88. THE UNIT OF MEASUREMENTS IS US SURVEY FEET.
3. WETLANDS WERE DELINEATED BY GREEN ON 2/15/2018 AND REFLAGGED BY ECOSYSTEMS-SOLUTIONS IN 2022 ACCORDANCE WITH THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION AND FIELD LOCATED BY GREEN ON 2/20/2018. REFLAGGING DETERMINED BOUNDARIES HAD NOT CHANGED.
4. THE RIGHT OF WAY LINES SHOWN ON THIS PLAN ARE THE DIRECT RESULT OF AN INSTRUMENT SURVEY PERFORMED ON THE GROUND BY GREEN INTERNATIONAL AFFILIATES, INC. WITH AN ERROR OF CLOSURE LESS THAN 1:15,000, AND FROM PLANS AND DEEDS OF RECORD. PRIVATE PROPERTY LINES ARE COMPILED FROM DEEDS AND PLANS AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE SAID PARCELS SHOWN HERE ARE SUBJECT TO RIGHTS AND EASEMENTS AS CONTAINED IN THE VARIOUS DEEDS OF RECORD DESCRIBING SAID PREMISES. THE LOCATIONS AND EXTENT OF SAID RIGHTS AND EASEMENTS ARE NOT THE SUBJECT OF THIS SURVEY.

EROSION AND SEDIMENT CONTROL

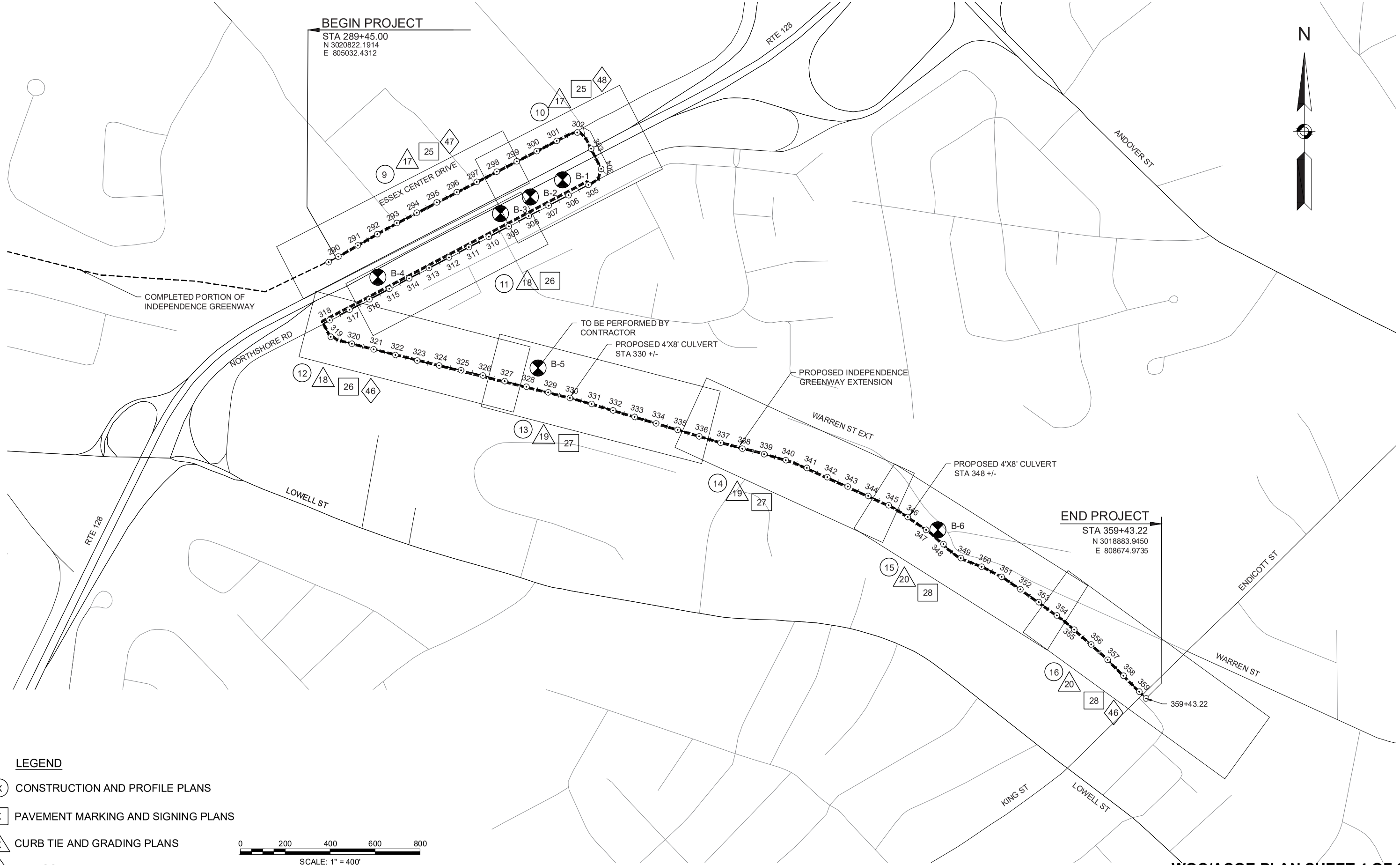
1. ALL EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE START OF ANY LAND DISTURBANCE/EARTHWORK ACTIVITIES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE, REPAIR AND REPLACEMENT OF ALL SEDIMENTATION/EROSION CONTROL MEASURES UNTIL ALL DISTURBED AREAS ARE STABILIZED.

Proposal No. 609211-132091
A00831 - 10

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	142
PROJECT FILE NO.	609211		

KEY PLAN



LEGEND

(X) CONSTRUCTION AND PROFILE PLANS

[X] PAVEMENT MARKING AND SIGNING PLANS

△X CURB TIE AND GRADING PLANS

◇X LANDSCAPE PLAN

0 200 400 600 800
SCALE: 1" = 400'

WQC/ACOE PLAN SHEET 4 OF 63

Proposal No. 609211-132091

A00831 - 11

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021910.4030, E 806262.1626
Ground Surface Elev. (ft.): 68.6
Final Boring Depth (ft.): 15.3
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1030	6.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
5		S-1	0-2	24	14	1 2 2 3	4	S-1: (Top 7") Dry, dark brown, fine SAND and SILT, trace Roots. (TOPSOIL) (Bottom 7") Dry, brown, fine SAND, some Silt, trace Roots. (SUBSOIL)	1 2			FILL	
		S-2	5-7	24	13	8 19 86 22	R	S-2: (Top 3") Moist, brown, fine to medium SAND, some Silt. (FILL) (Bottom 10") Moist, brown, fine to coarse SAND, little Silt, trace Gravel. (Piece of gravel stuck in tip of spoon.)			5.3		63.3'
10		S-3	7-9	24	10	38 42 45 50	87	S-3: Very dense, wet, brown/gray, GRAVEL, some fine to coarse Sand, trace Silt.	3			GLACIAL DEPOSIT	
		S-4	9-11	24	7	25 30 13 36	43	S-4: Dense, wet, brown, fine to medium SAND, some Silt, some Gravel.	4				
15		S-5	15-15.1	1	1	100/1"	R	S-5: Very dense, wet, brown/gray, GRAVEL, trace Silt. (Fragment of possible bedrock stuck in tip of spoon.) Bottom of boring at 15.3 feet.	5 6		15.3		53.3'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Borehole relocated approximately 25 feet from staked location due to access.
3. Driller noted increased drilling resistance at 6.5 feet below ground surface (bgs).
4. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 11 feet bgs.
5. Auger refusal at 15.3 feet bgs on possible bedrock. Borehole terminated.
6. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021834.6298, E 806118.9857
Ground Surface Elev. (ft.): 68.4
Final Boring Depth (ft.): 10.5
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1230	10	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
5		S-1	0-2	24	18	1 4 27 36	31	S-1: (Top 10") Dry, dark brown, fine SAND, some Silt, trace Roots. (TOPSOIL) (Bottom 8") Dry, dark brown/black, fine to medium SAND, little Silt, trace Gravel.	1			FILL	
		S-2	2-4	24	20	30 56 40 36	96	S-2: Very dense, moist, black/gray, fine to coarse SAND, little Silt, trace Gravel.			4		64.4'
		S-3	4-6	24	9	28 11 19 17	30	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.				GLACIAL DEPOSIT	
		S-4	6-8	24	14	70 25 20 20	45	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.	2				
10		S-5	10-10.3	3	0	100/3"	R	S-5: No recovery. (Fragments of possible bedrock stuck in tip of spoon.) Bottom of boring at 10.5 feet.	3 4		10.5		57.9'
15													
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 6.5 feet below ground surface (bgs).
3. Auger refusal at 10.5 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021760.5337, E 805985.8731
Ground Surface Elev. (ft.): 62.3
Final Boring Depth (ft.): 14.7
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19		Not encountered		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
5		S-1	0-2	24	13	2 3 11 14	14	S-1: Medium dense, dry, dark brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots. (TOPSOIL)	1				
		S-2	2-4	24	18	14 35 72 69	R	S-2: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.				FILL	
		S-3	4-6	24	14	27 11 12 14	23	S-3: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
		S-4	6-8	24	10	12 14 5 3	19	S-4: Very dense, moist, black with brown, GRAVEL and fine to coarse SAND, trace Silt, trace Ash.			8		54.3'
10		S-5	8-10	24	9	3 6 9 14	15	S-5: Medium dense, moist, brown, fine to coarse SAND, little Gravel, trace Silt.				GLACIAL DEPOSIT	
15		S-6	14.5-14.7	2	0	100/2"	R	S-6: No recovery. Bottom of boring at 14.7 feet.	2 3		14.7		47.6'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Auger refusal at 14.5 feet below ground surface (bgs) on possible bedrock. Advanced split spoon. Split spoon refusal at 14.7 feet bgs. Borehole terminated.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

BORING NOTES

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

Proposal No. 609211-132091
A00831 - 12

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021477.6337, E 805439.9424
Ground Surface Elev. (ft.): 51.8
Final Boring Depth (ft.): 17
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1145	9.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	9	3 2 3 2	5	S-1: Loose, dry, dark brown, fine to medium SAND, some Silt, trace Roots.	1				
		S-2	2-4	24	6	2 3 3 14	6	S-2: Loose, moist, brown, fine to coarse SAND, trace Gravel, trace Silt.			3.5	FILL	48.3'
5		S-3	4-6	24	14	12 15 23 17	38	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-4	6-8	24	13	13 20 19 19	39	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	6	15 21 30 21	51	S-5: Very dense, wet, brown, fine to coarse SAND, some Gravel, little Silt.	2			GLACIAL DEPOSIT	
15		S-6	15-16.9	23	12	12 18 69 100/5"	87	S-6: Very dense, wet, brown/gray, fine to coarse SAND, some Gravel, little Silt. (Possible bedrock fragments stuck in tip of spoon.)			17		34.8'
20								Bottom of boring at 17 feet.	3 4				
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Driller noted increased drilling effort at 9 feet below ground surface (bgs).
3. Auger refusal at 17 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:HSA/D&W

Boring Location: N 3020353.9560, E 807932.5686
Ground Surface Elev. (ft.): 40.5
Final Boring Depth (ft.): 25.9
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA/HW
I.D/O.D.(in): 2.75/5.75 & 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1530	3.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	4 4 11 5	15	S-1: Medium dense, dry, dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1				
		S-2	2-4	24	14	9 6 5 6	11	S-2: Medium dense, wet, brown, fine to medium SAND and SILT, trace Gravel.			2	FILL	38.5'
5		S-3	4-6	24	14	4 8 10 14	18	S-3: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt.					
		S-4	6-8	24	19	13 16 17 16	33	S-4: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
10		S-5	10-12	24	16	6 11 19 28	30	S-5: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.	2				
15		S-6	14-16	24	7	4 5 6 6	11	S-6: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.				SAND AND GRAVEL	
20		S-7	19-21	24	8	5 6 5 5	11	S-7: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
25		S-8	24-25.9	22	10	16 14 22 100/2"	36	S-8: Dense, wet, brown/gray, fine to coarse SAND and GRAVEL, trace Silt. (Possible bedrock fragments stuck in tip of spoon.)			25.9		14.6'
30								Bottom of boring at 25.9 feet.	3				

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Hole appears to have blown in prior to sampling S-5. Blow counts at S-5 may be inaccurate. Driller removed augers and offset 4 feet southeast of staked location and continued hole with 4-inch casing. Samples S-6 through S-8 obtained using drive and wash drilling methods.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-6

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

BORING NOTES

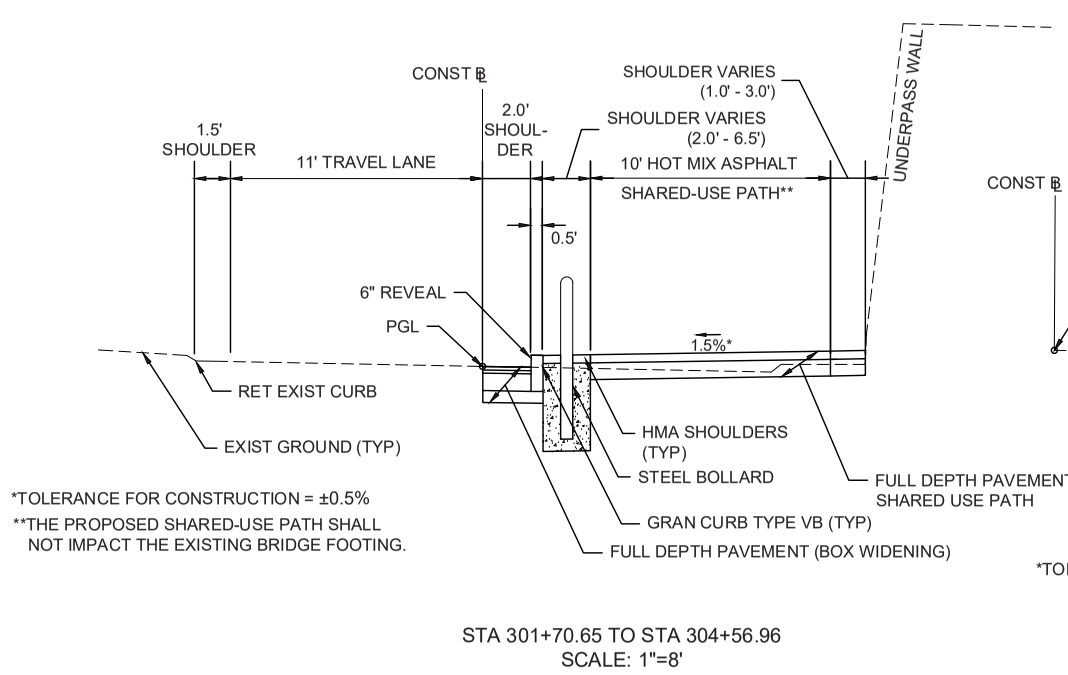
1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

Proposal No. 609211-132091
A00831 - 13

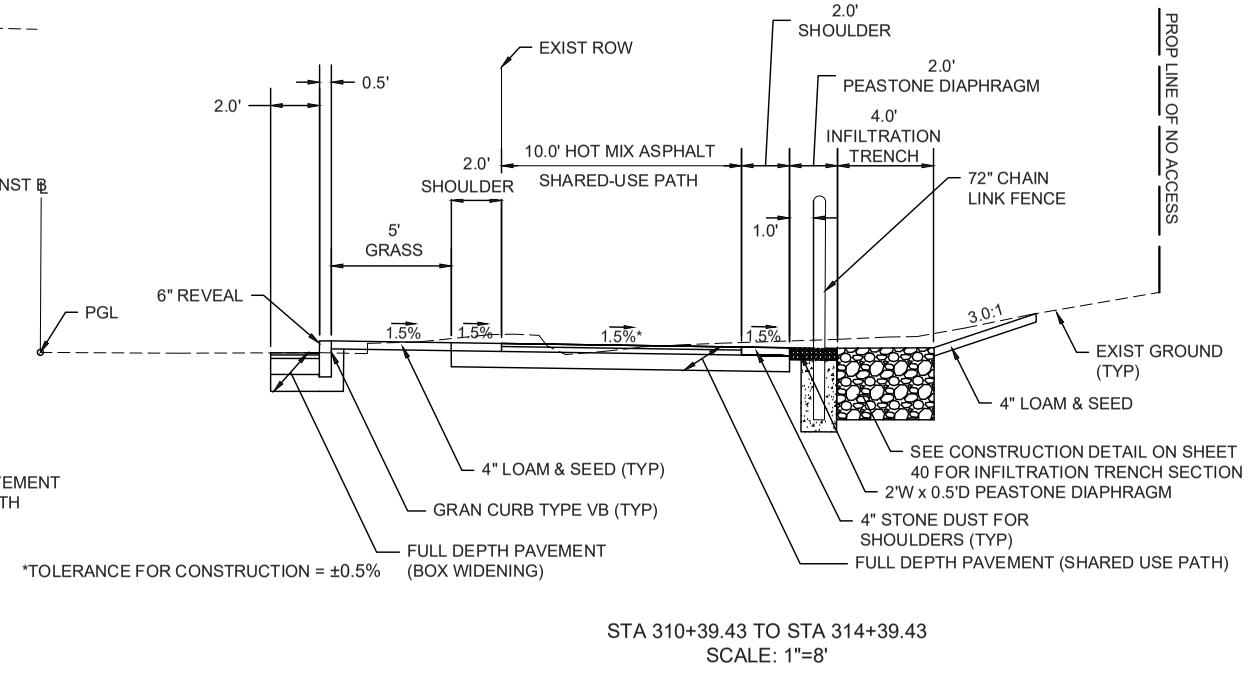
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	142
PROJECT FILE NO.	609211		

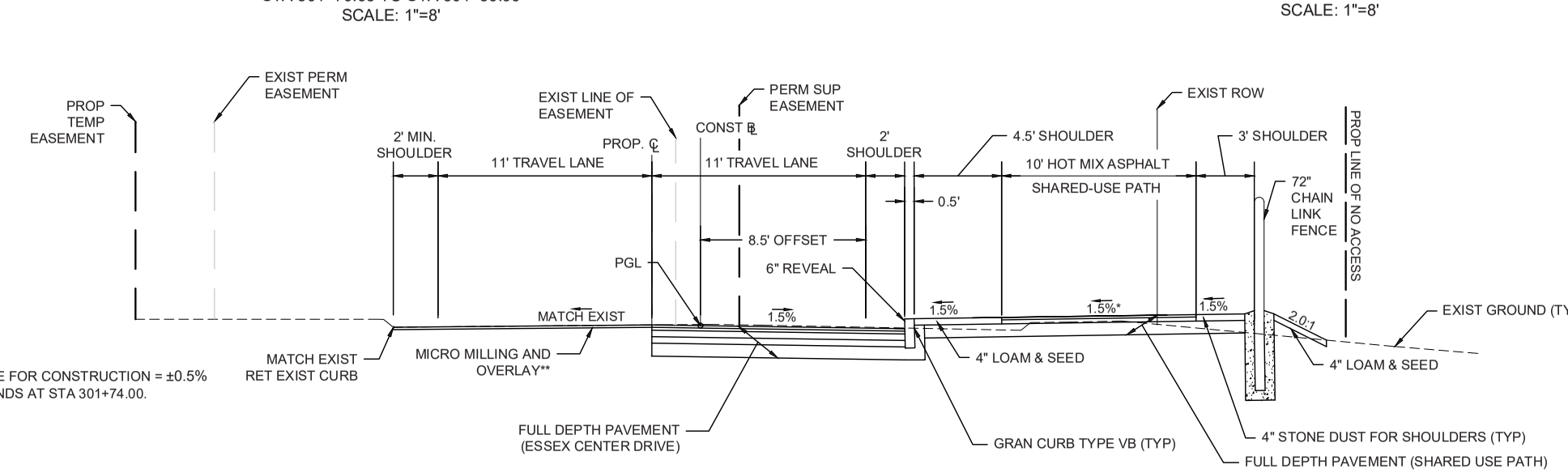
TYPICAL SECTIONS & DETAILS 1



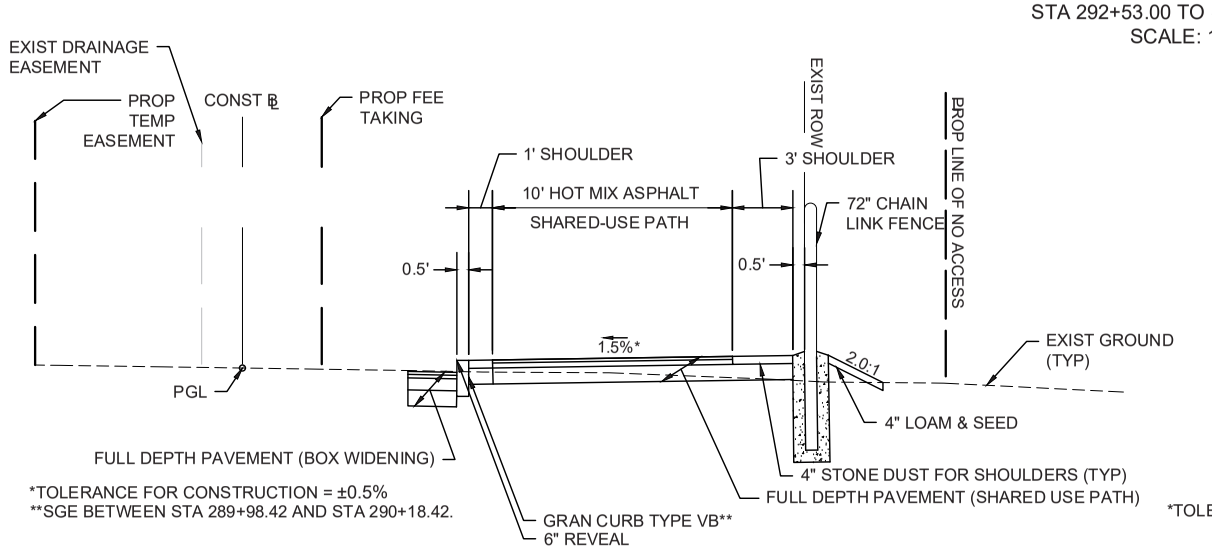
STA 301+70.65 TO STA 304+56.96
SCALE: 1"=8'



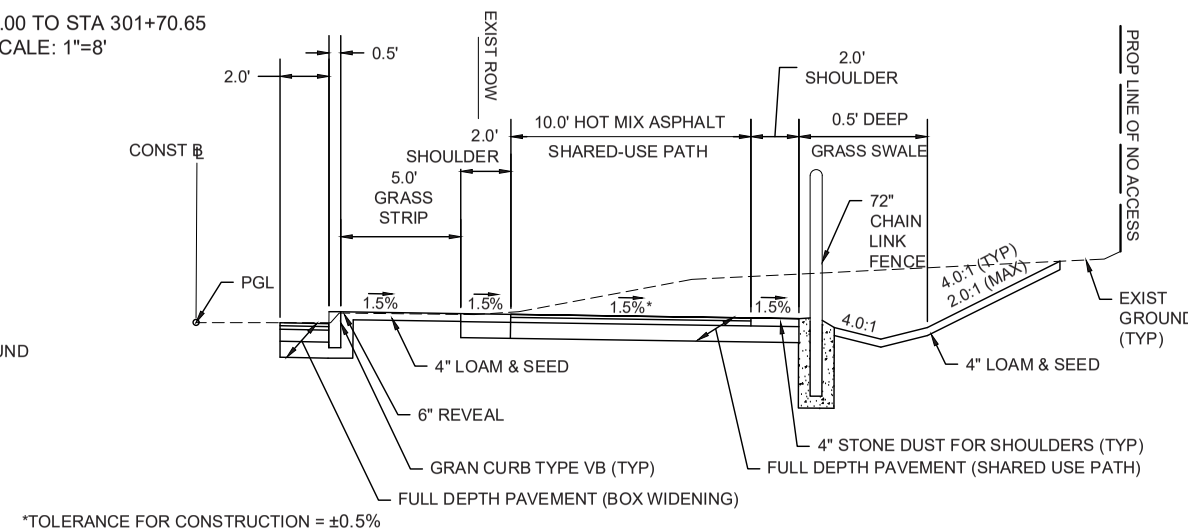
STA 310+39.43 TO STA 314+39.43
SCALE: 1"=8'



STA 292+53.00 TO STA 301+70.65
SCALE: 1"=8'



STA 289+83.24 TO STA 292+53.00
SCALE: 1"=8"



STA 314+39.43 TO STA 318+32.11
SCALE: 1"=8'

PAVEMENT NOTES

PROPOSED FULL DEPTH PAVEMENT (SHARED USE PATH)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
INTERMEDIATE COURSE: 2.5" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH PAVEMENT (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER
BASE COURSE: 4" SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) OVER
4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH PAVEMENT (BOX WIDENING)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER
BASE COURSE: 6" HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE OVER
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED MICRO MILLING AND OVERLAY (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
MILLING COURSE: 1.5" PAVEMENT MICRO MILLING

PROPOSED HMA WALK
SURFACE COURSE: 1.25" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
1.75 SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5)
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA DRIVEWAY
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
2.5" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) (SEE NOTE 2)
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE WALK/PEDESTRIAN CURB RAMP
SURFACE COURSE: 4" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610)
SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE REINFORCED PAVEMENT
SURFACE COURSE: 6" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610) WITH WWF 6x6 - W1.4 x W1.4 AT MID DEPTH
SUB-BASE COURSE: 18" GRAVEL BORROW (TYPE B)

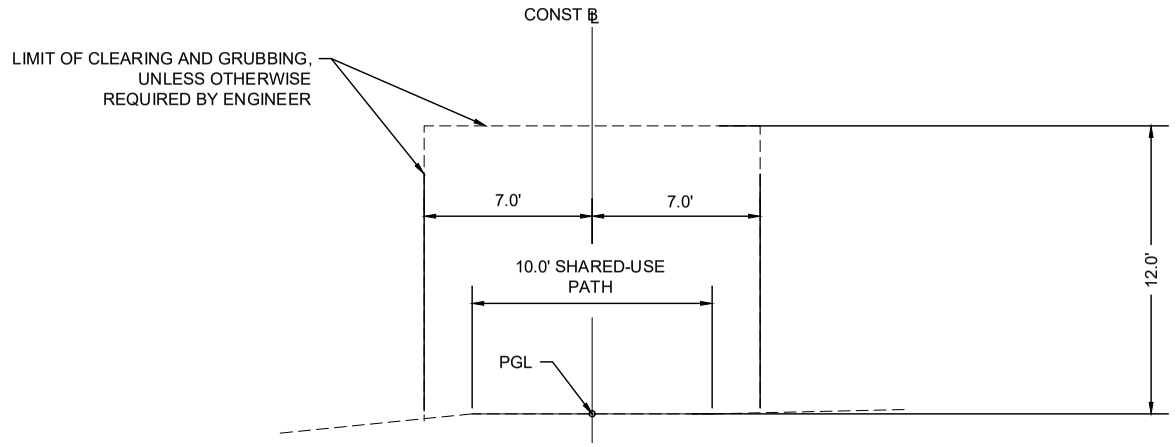
NOTES:
1. ALL HMA FOR PATCHING, ASPHALT EMULSION FOR TACK COAT AND HMA JOINT ADHESIVE SHALL BE INSTALLED PER SECTION 450 AND 700.
2. HMA SIDEWALKS, DRIVEWAYS, AND SHARED USE PATH ARE TO BE PAID FOR UNDER ITEM 702.

4 0 4 8
SCALE IN FEET

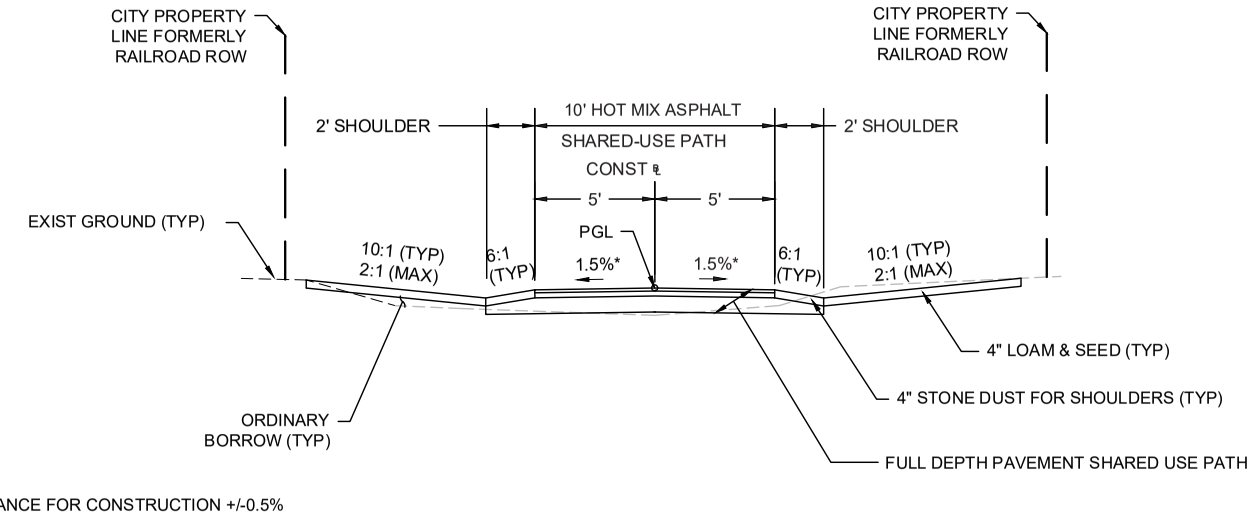
WQC/ACOE PLAN SHEET 7 OF 63

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	142
PROJECT FILE NO.	609211		

TYPICAL SECTIONS & DETAILS 2

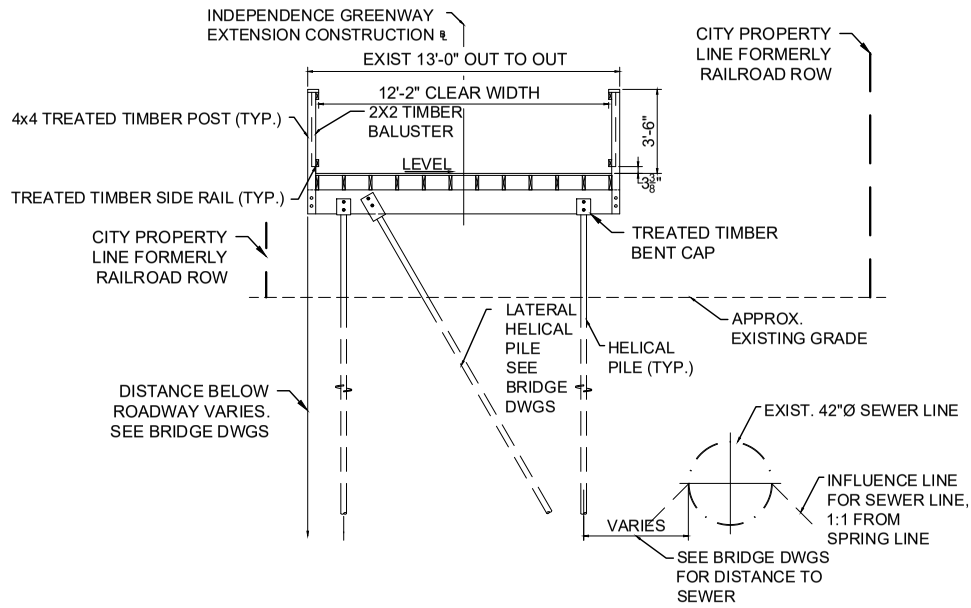


TYPICAL BIKEWAY CLEARANCE
SCALE: 1'=8"



* TOLERANCE FOR CONSTRUCTION +/-0.5%

STA 355+47.73 TO STA 358+93.89
SCALE: 1"=8'



STA 351+09.93 TO STA 355+47.73
SCALE: 1"=8'

4 0 4 8
SCALE IN FEET

WQC/ACOE PLAN SHEET 8 OF 63

Proposal No. 609211-132091
A00831 - 15

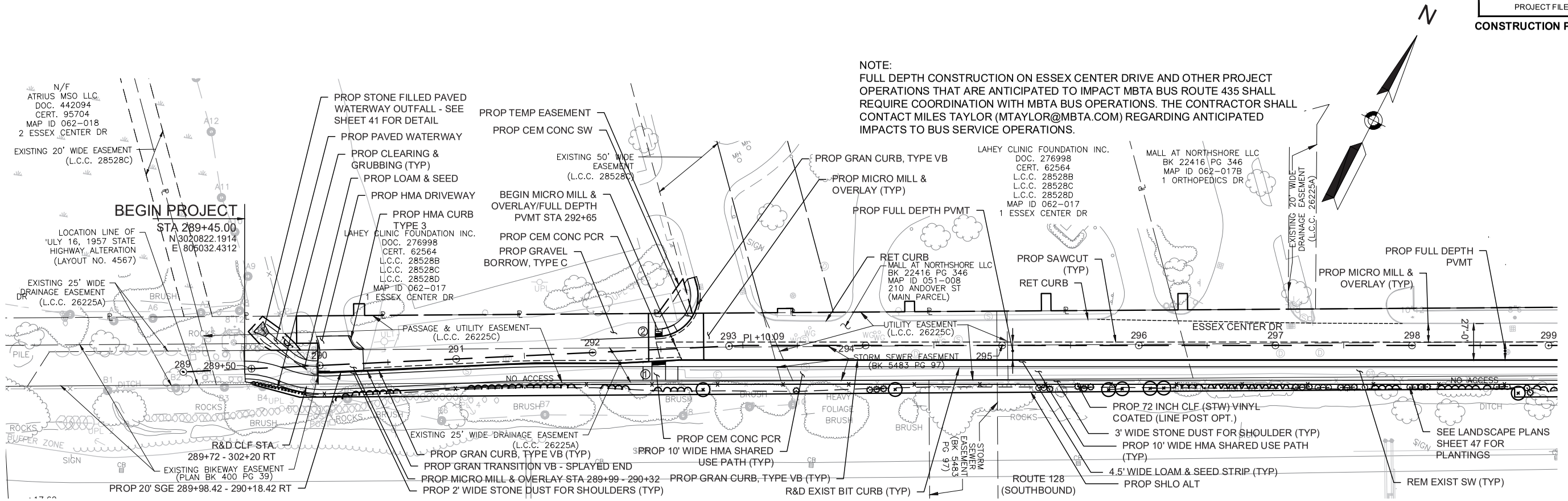
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 1

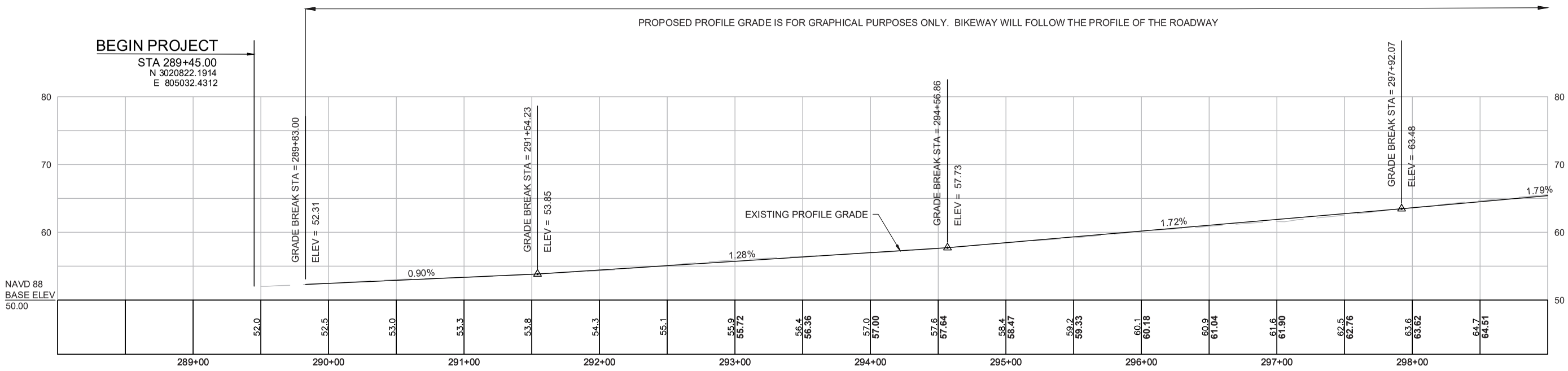
HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

NOTE:
FULL DEPTH CONSTRUCTION ON ESSEX CENTER DRIVE AND OTHER PROJECT OPERATIONS THAT ARE ANTICIPATED TO IMPACT MBTA BUS ROUTE 435 SHALL REQUIRE COORDINATION WITH MBTA BUS OPERATIONS. THE CONTRACTOR SHALL CONTACT MILES TAYLOR (MTAYLOR@MBTA.COM) REGARDING ANTICIPATED IMPACTS TO BUS SERVICE OPERATIONS.



CONTINUED ON SHEET NO. 10

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 9 OF 63

Proposal No. 609211-132091

A00831 - 16

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

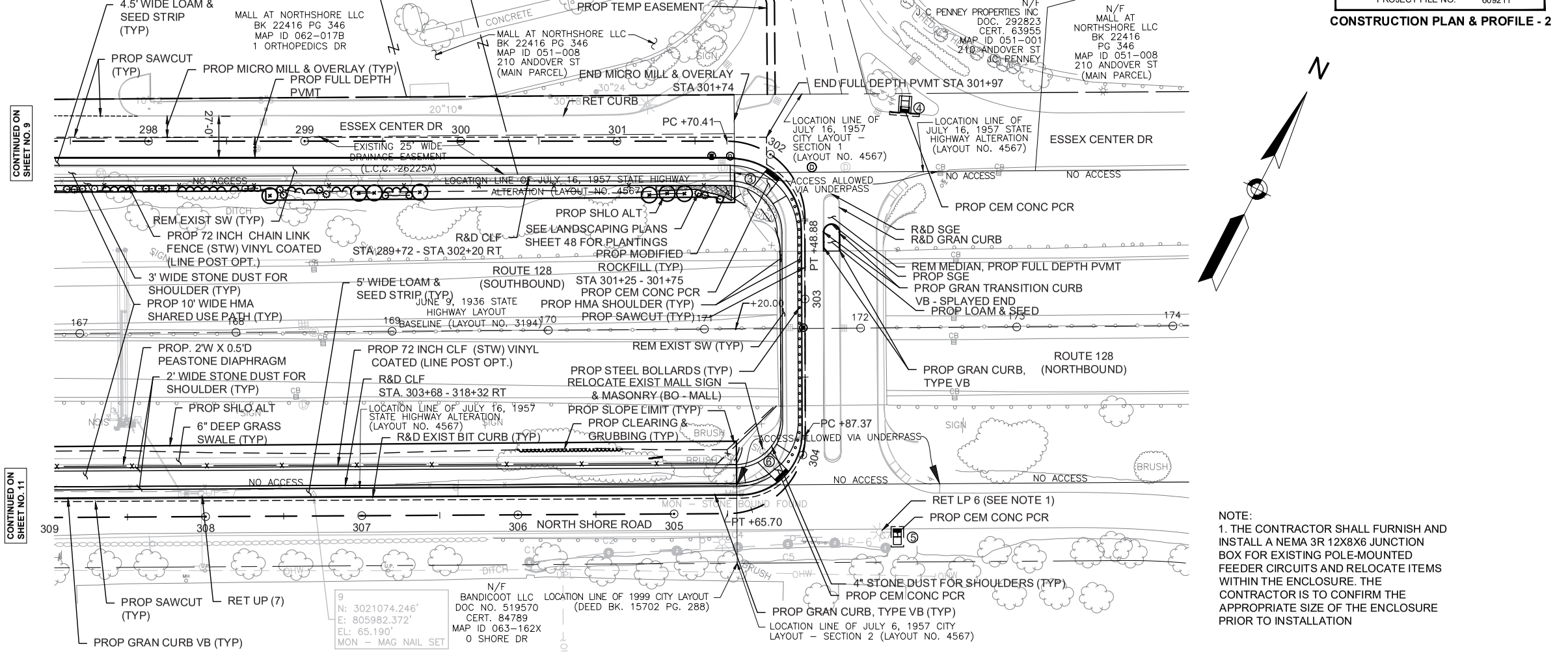
DRAINAGE DETAILS

SHEET 21

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

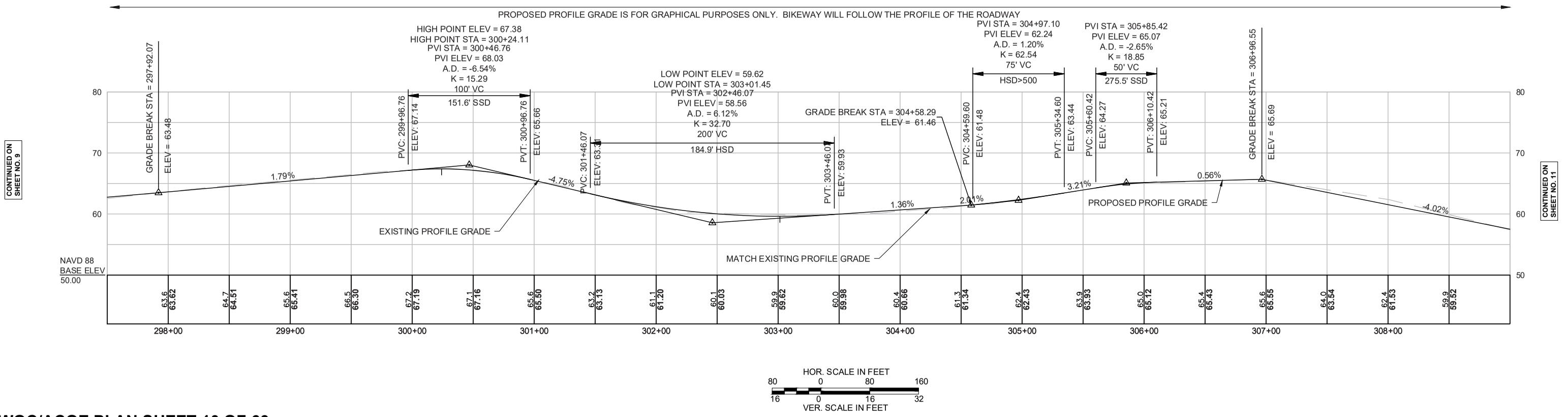
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	10	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 2



NOTE:
1. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA 3R 12X8X6 JUNCTION BOX FOR EXISTING POLE-MOUNTED FEEDER CIRCUITS AND RELOCATE ITEMS WITHIN THE ENCLOSURE. THE CONTRACTOR IS TO CONFIRM THE APPROPRIATE SIZE OF THE ENCLOSURE PRIOR TO INSTALLATION

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 10 OF 63

Proposal No. 609211-132091

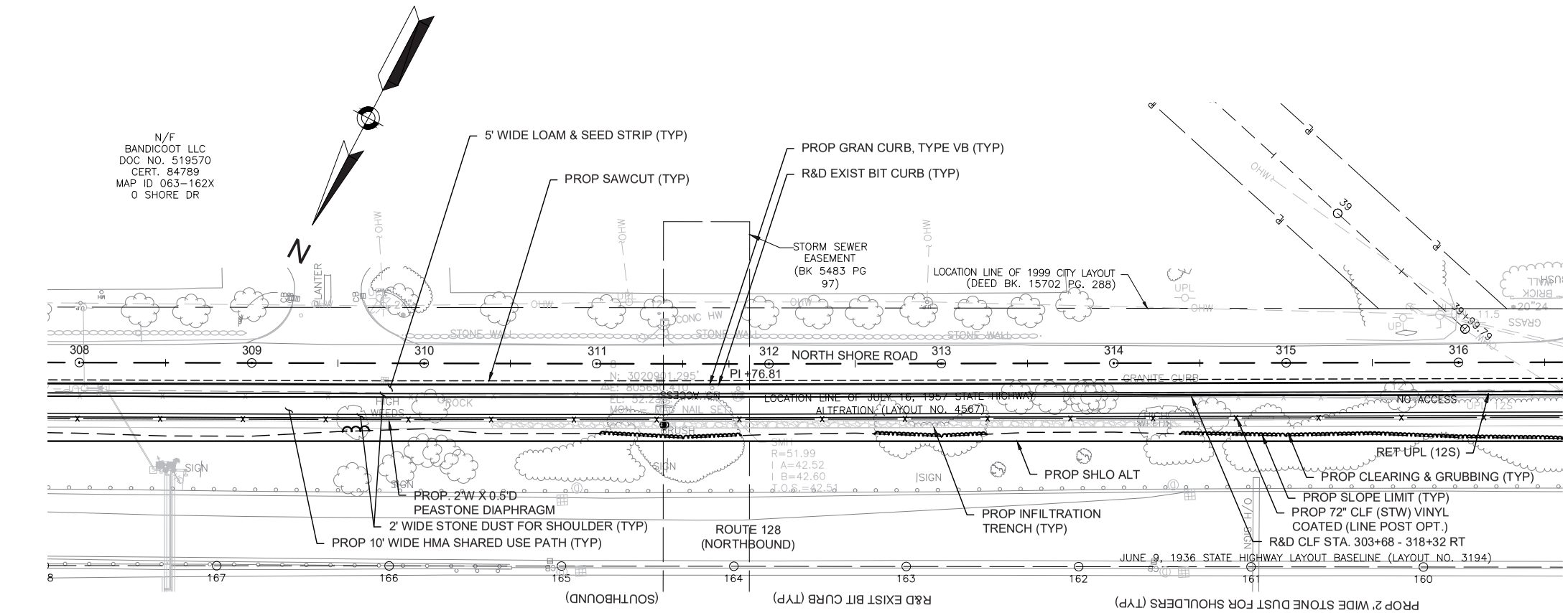
A00831 - 17

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	11	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 3

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21



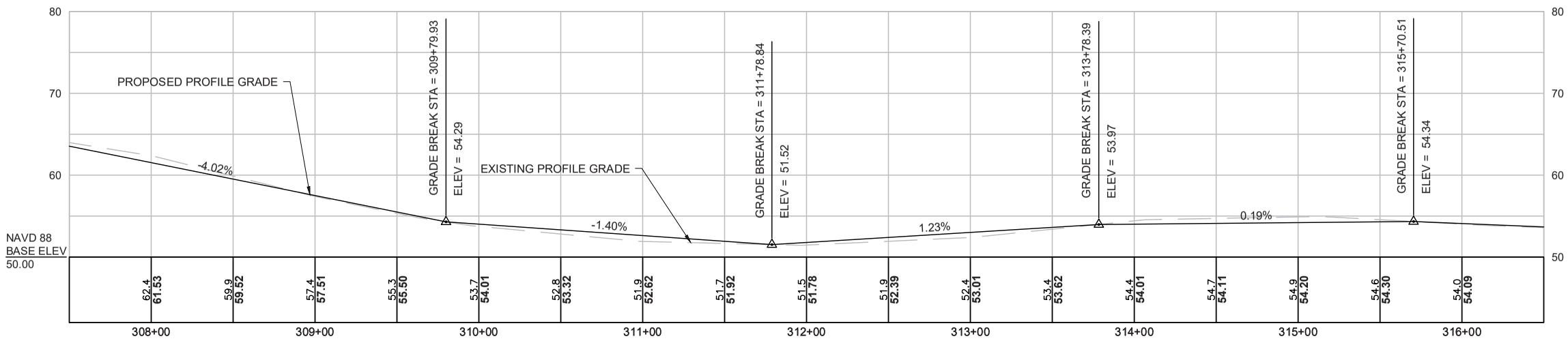
NOTE:
THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

CONTINUED ON SHEET NO. 10

CONTINUED ON SHEET NO. 12

PEABODY BIKEWAY ALIGNMENT

PROPOSED PROFILE GRADE IS FOR GRAPHICAL PURPOSES ONLY. BIKEWAY WILL FOLLOW THE PROFILE OF THE ROADWAY



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 11 OF 63

Proposal No. 609211-132091

A00831 - 18

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	12	142
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 4

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

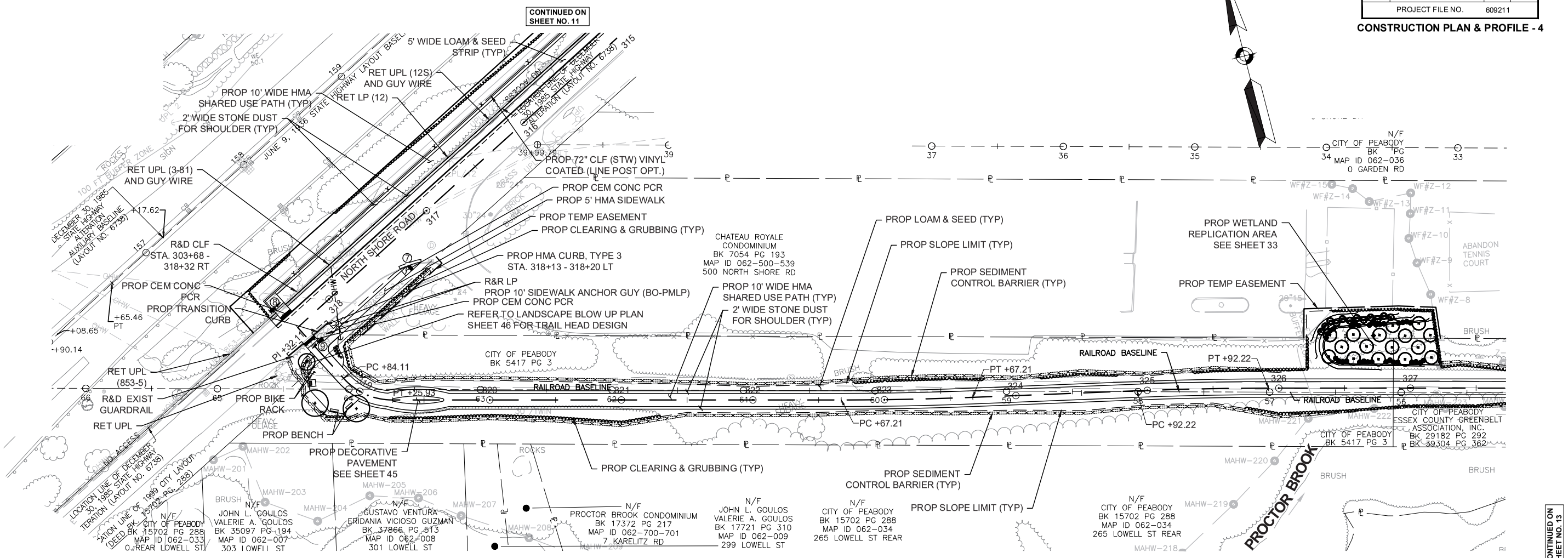
NONE

WATER SUPPLY ALTERATIONS

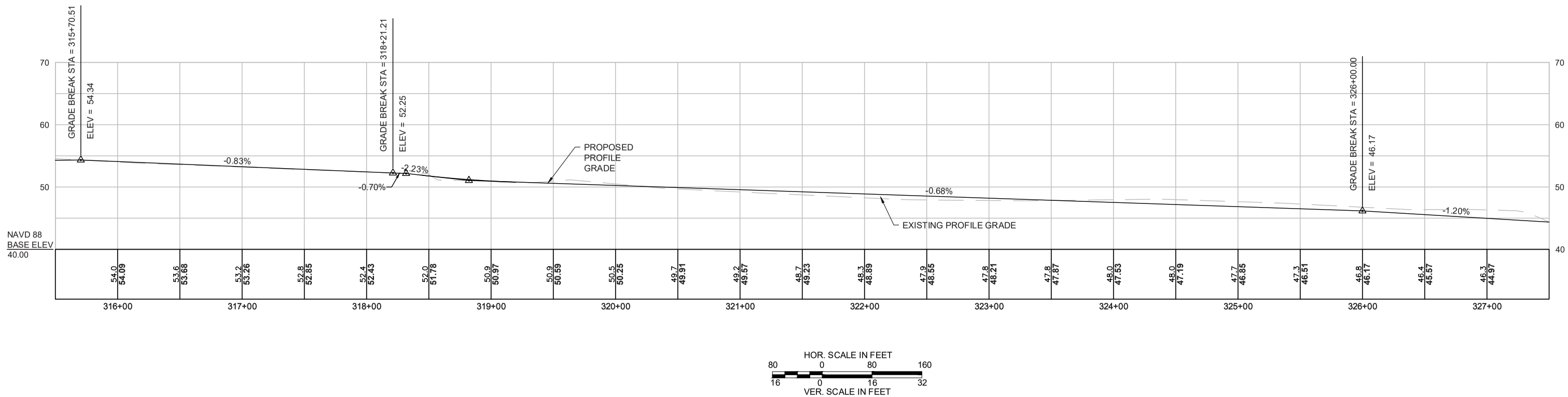
NONE

DRAINAGE DETAILS

NONE



PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 12 OF 63

Proposal No. 609211-132091

A00831 - 19

Plotted on 25-Jul-2024 6:05 PM
SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

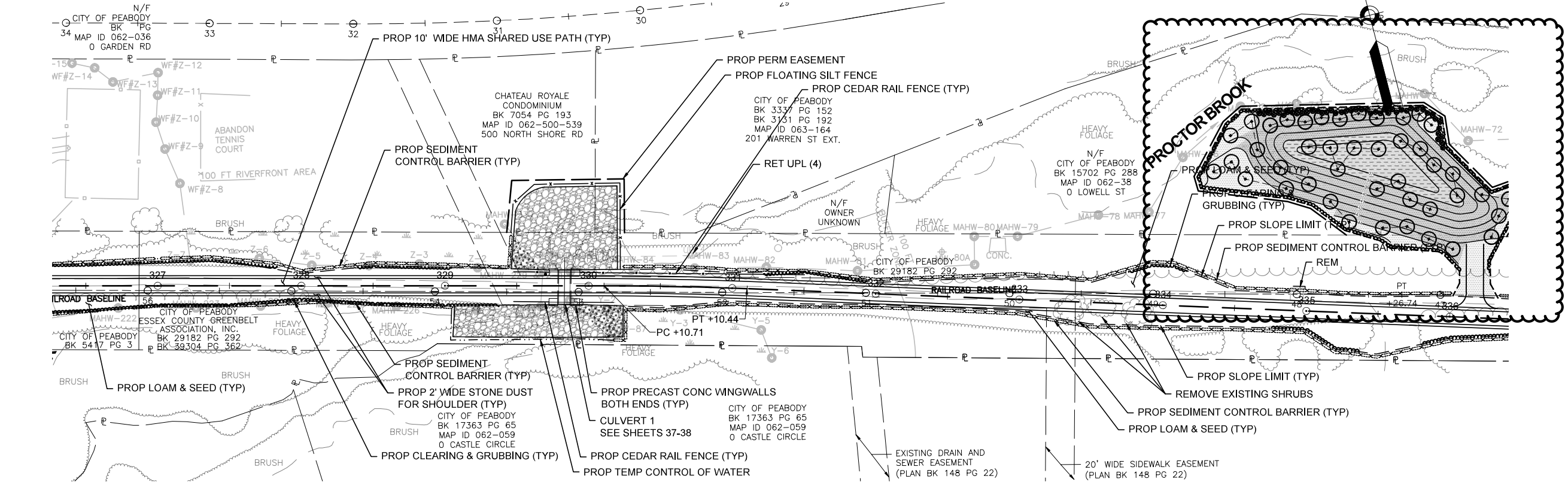
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

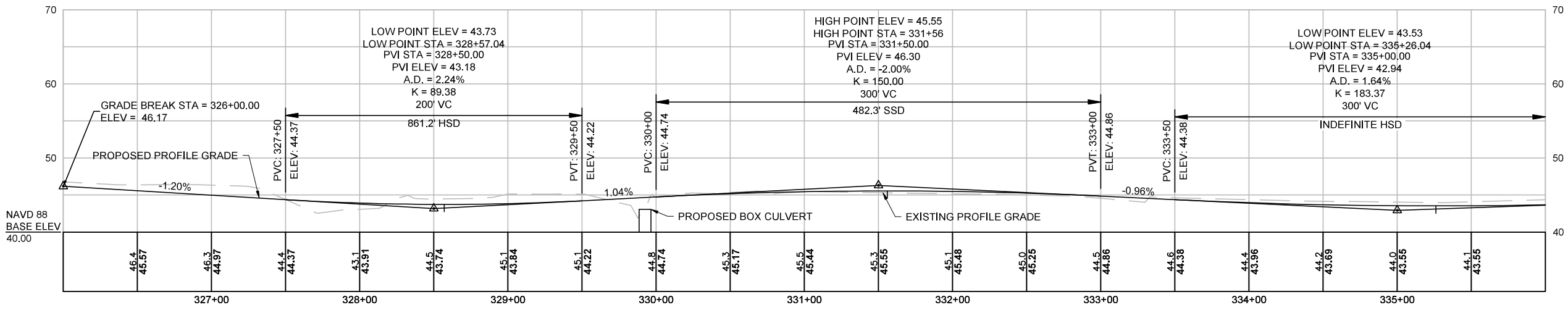
SEE SHEET 23 FOR DRAINAGE DETAILS
SEE SHEETS 37-38 FOR CULVERT DETAILS

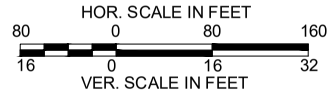


CONTINUED ON SHEET NO. 12

CONTINUED ON SHEET NO. 14

PEABODY BIKEWAY ALIGNMENT





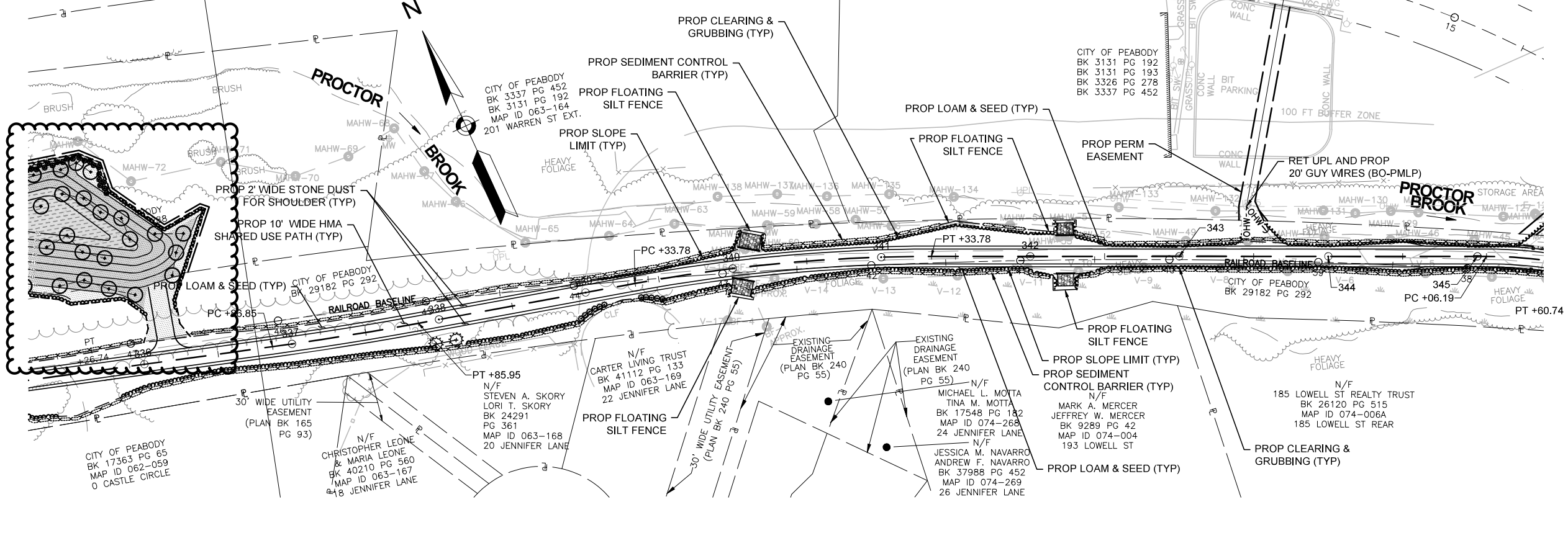
Proposal No. 609211-132091
A00831 - 20

HIGHWAY GUARD DETAILS
NONE

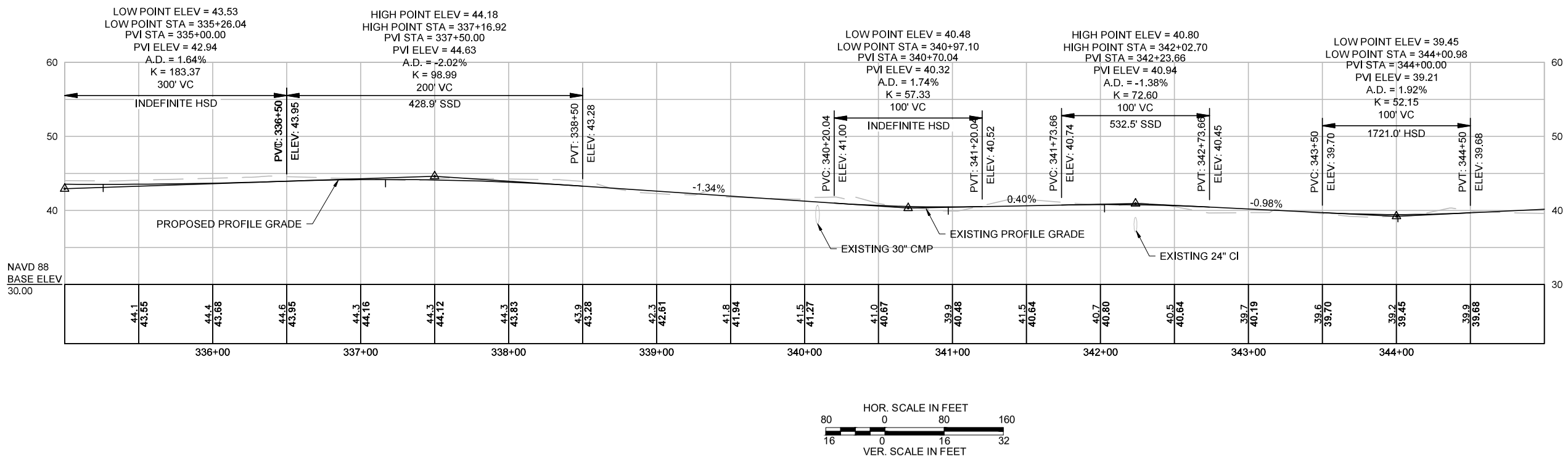
TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SHEET 23



PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 14 OF 63, REVISED 07/26/2024

Proposal No. 609211-132091
A00831 - 21
Plotted on 25-Jul-2024 5:30 PM
SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG

Proposal No. 609211-132091

HIGHWAY GUARD DETAILS

STA. 347+72 LT - STA. 348+07 LT TANGENT END TREATMENT
STA. 348+07 LT - STA. 348+32 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 348+32 LT - STA. 348+41 LT TRAILING ANCHORAGE
STA. 348+70 LT - STA. 349+11 LT TANGENT END TREATMENT
STA. 349+11 LT - STA. 349+61 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 349+61 LT - STA. 347+70 LT TRAILING ANCHORAGE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

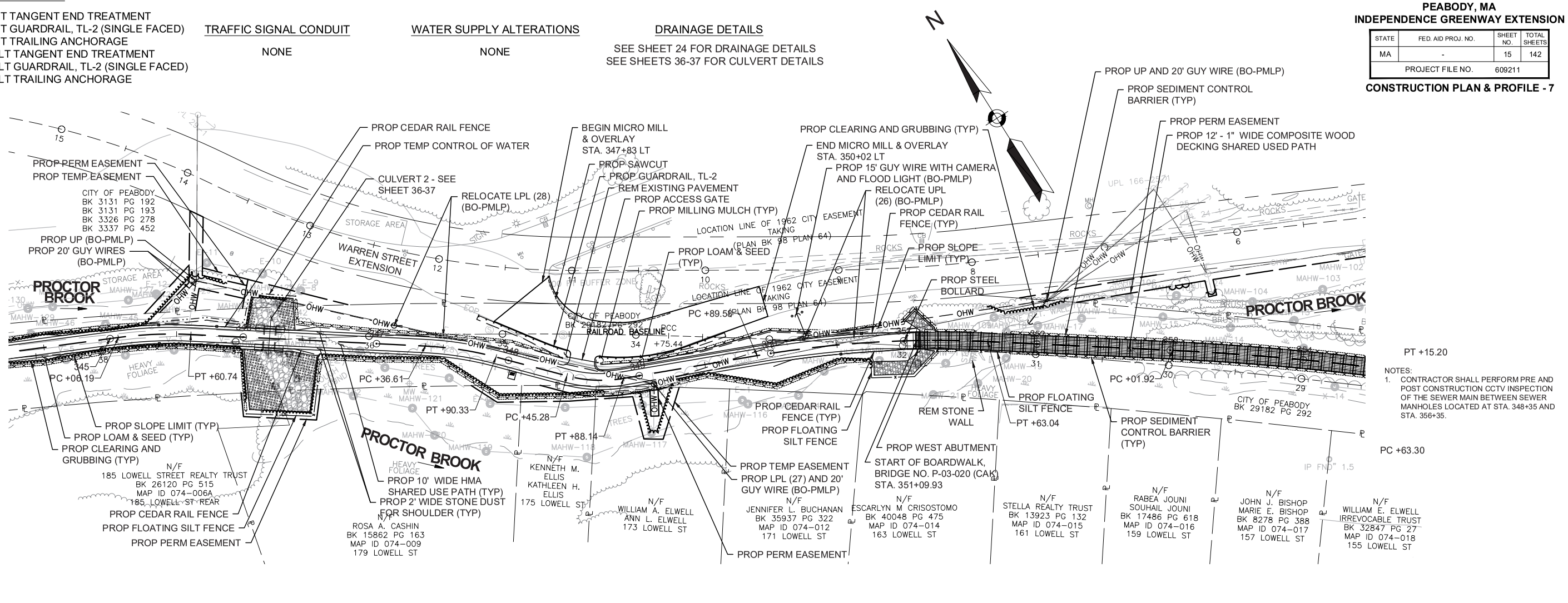
DRAINAGE DETAILS

SEE SHEET 24 FOR DRAINAGE DETAILS
SEE SHEETS 36-37 FOR CULVERT DETAILS

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	142
PROJECT FILE NO.	609211		

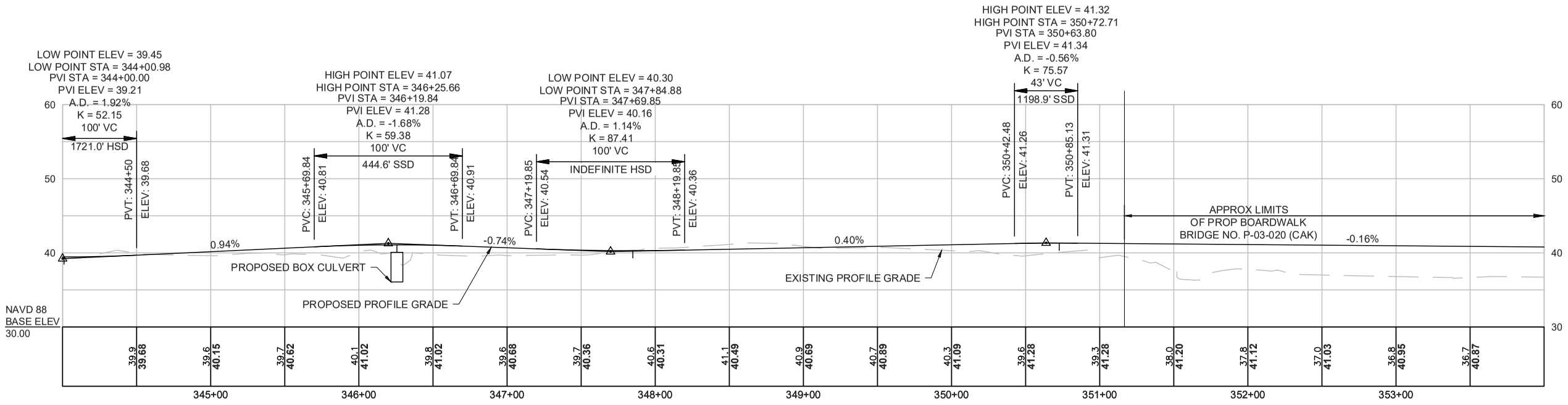
CONSTRUCTION PLAN & PROFILE - 7



CONTINUED ON SHEET NO. 14

CONTINUED ON SHEET NO. 16

PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 15 OF 63

A00831 - 22

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	143
PROJECT FILE NO.	609211		

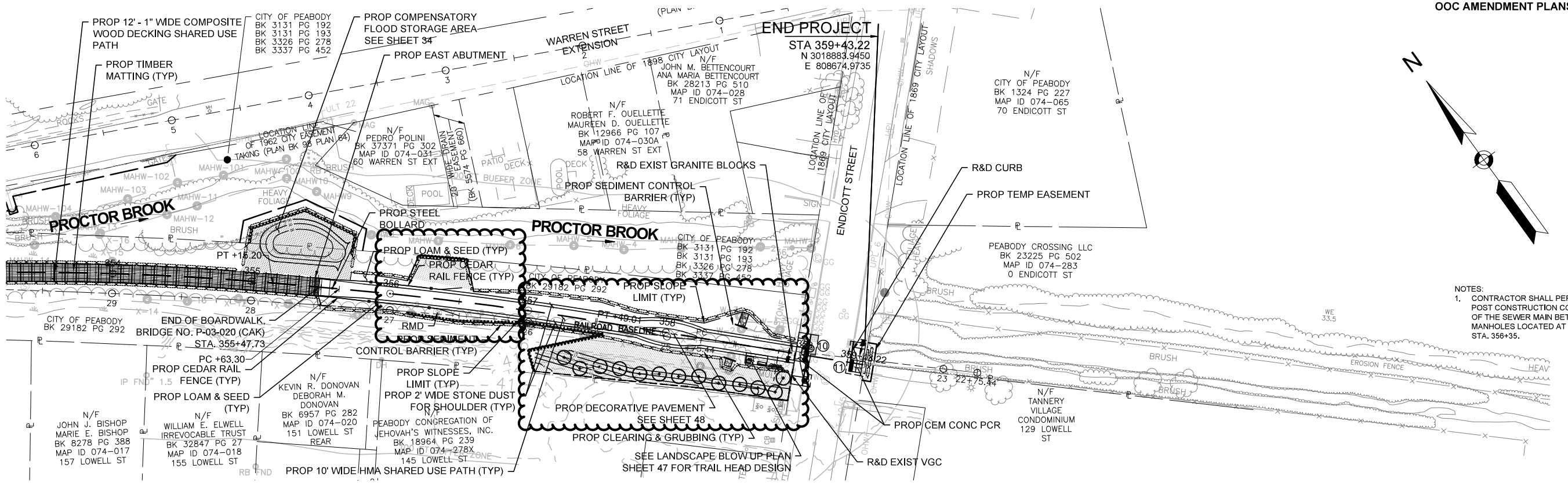
CONSTRUCTION PLAN & PROFILE - 8
OOC AMENDMENT PLANS - 7/25/2024

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

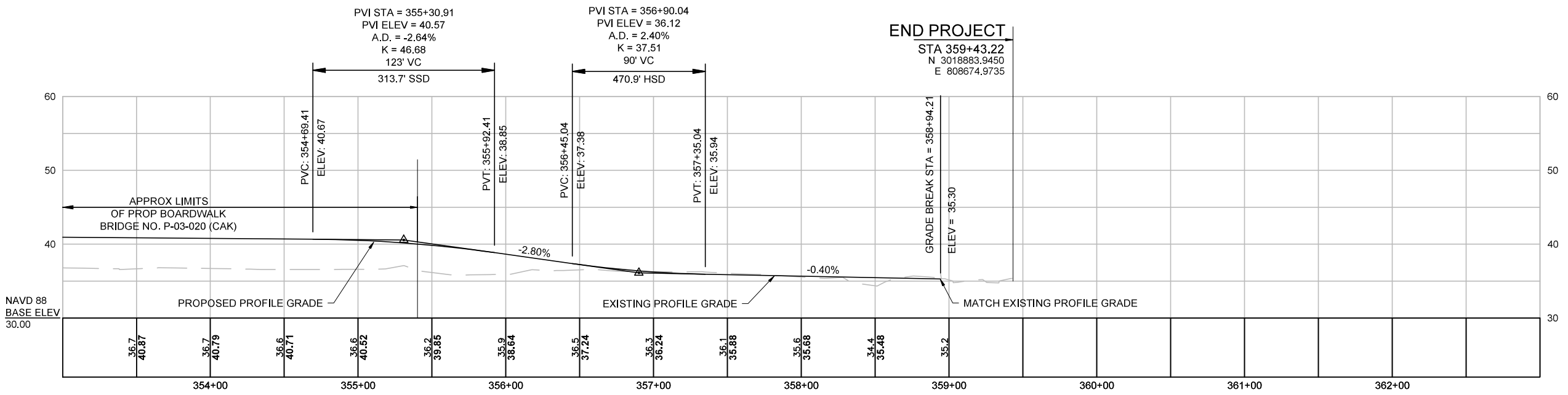
WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE SHEET 24



CONTINUED ON SHEET NO. 15

PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
80 0 80 160
VER. SCALE IN FEET
16 0 16 32

WQC/ACOE PLAN SHEET 16 OF 63, REVISED 07/26/2024

Proposal No. 609211-132091

A00831 - 23

Plotted on 25-Jul-2024 5:31 PM

SHT005_HD\CONSTRUCTION PLANS & PROFILES\.DWG

WQC/ACOE PLAN SHEET 17 OF 63, REVISED 07/22/2024

TOTAL PROJECT IMPACTS TO WATERS OF THE UNITED STATES:

PERMANENT VW IMPACT AREA = 2,344 SF ±	TEMPORARY VW IMPACT AREA = 4,681 SF ±	
PERMANENT LUW IMPACT AREA = 8,661 SF ±	TEMPORARY LUW/WOTUS IMPACT AREA = 2,312 SF ±	
TOTAL PERMANENT IMPACT AREA = 11,005 SF ±	TOTAL TEMPORARY IMPACT AREA = 6,993 SF ±	

DREDGE VOLUME = 1,491 CY

FILL VOLUME = 1,491 CY

PERMANENT STREAM/BANK IMPACT = 588 LF ±

TEMPORARY STREAM/BANK IMPACT = 166 LF ±

VEGETATED WETLAND (VW)

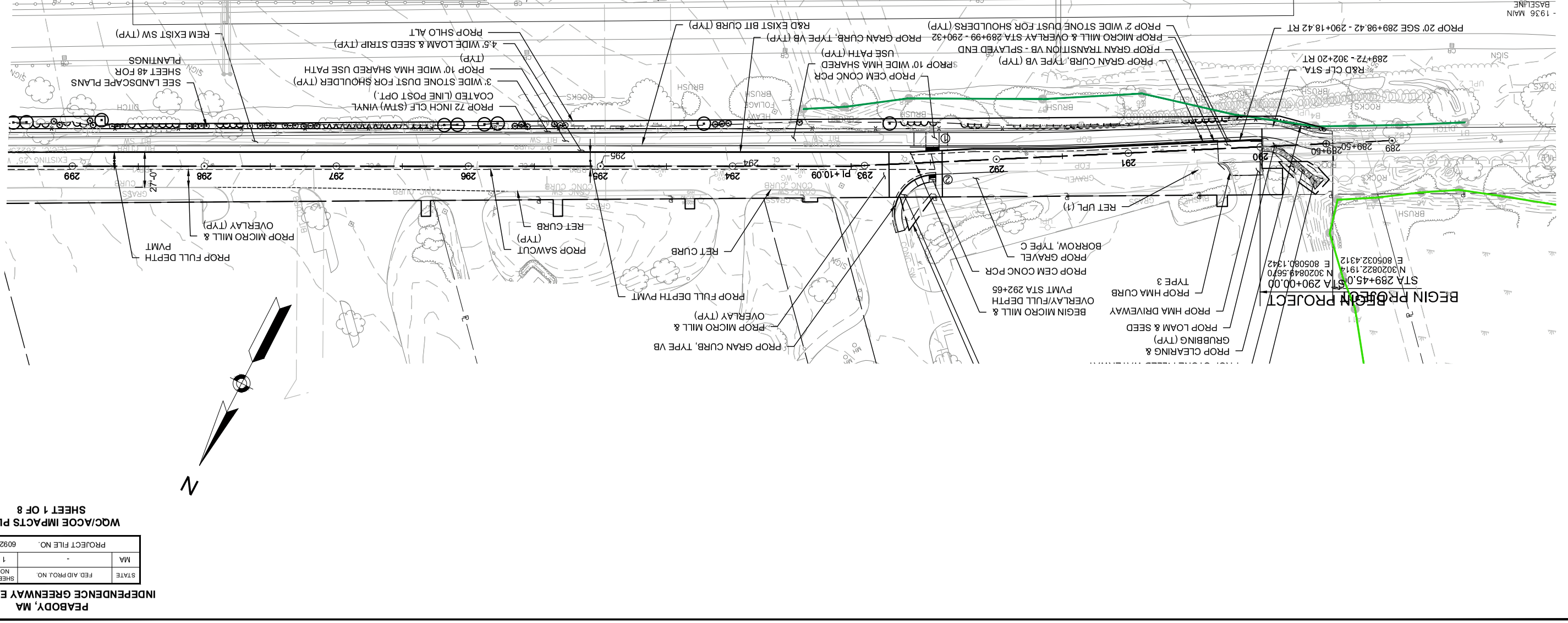
DITCH

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

SCALE IN FEET

40 0 40 80



WQC/ACOE IMPACTS PLAN
SHEET 1 OF 8

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	8

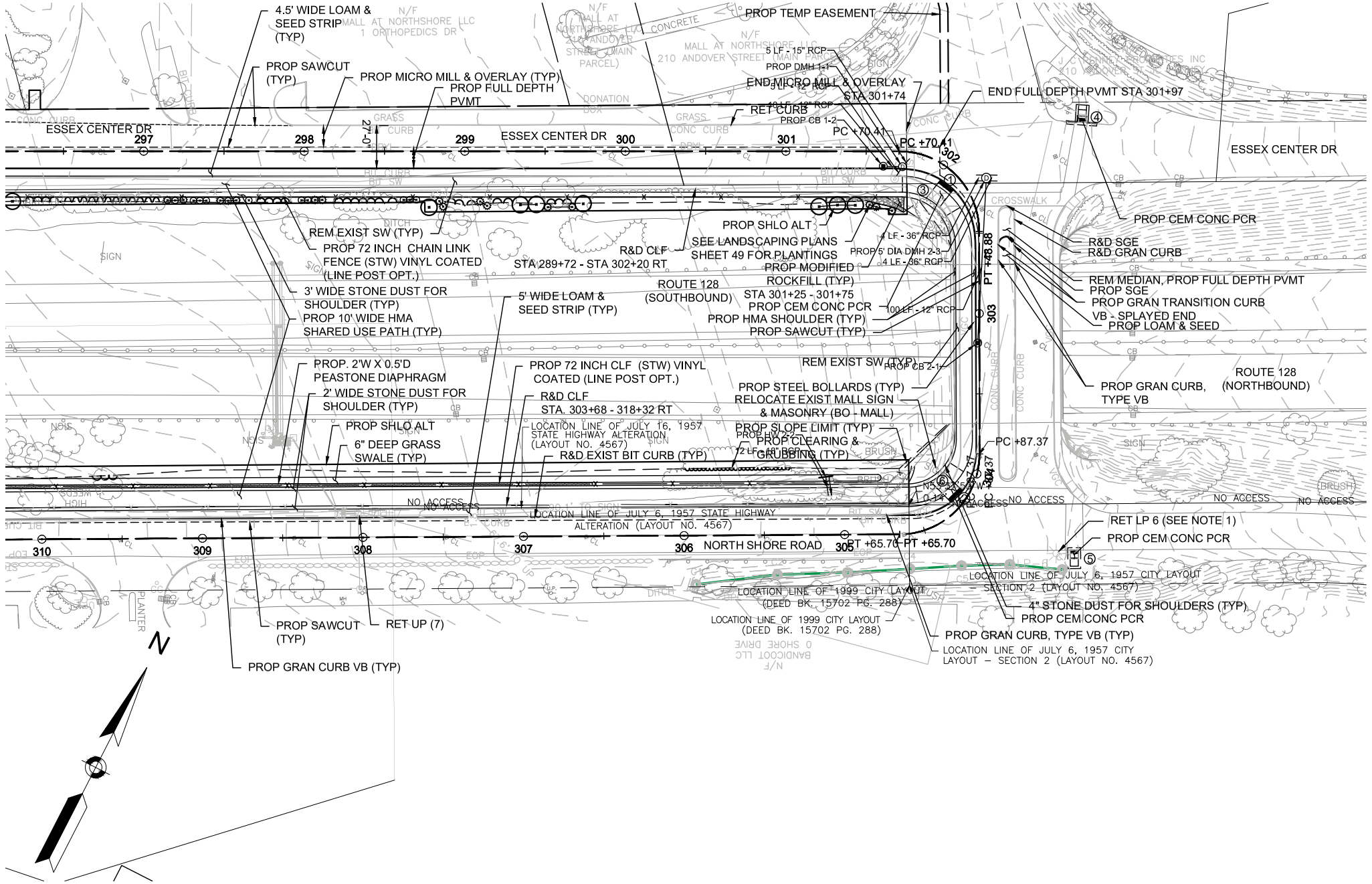
PROJECT FILE NO. 609211

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 2 OF 8



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 40'

WQC/ACOE PLAN SHEET 18 OF 63, REVISED 07/03/2024

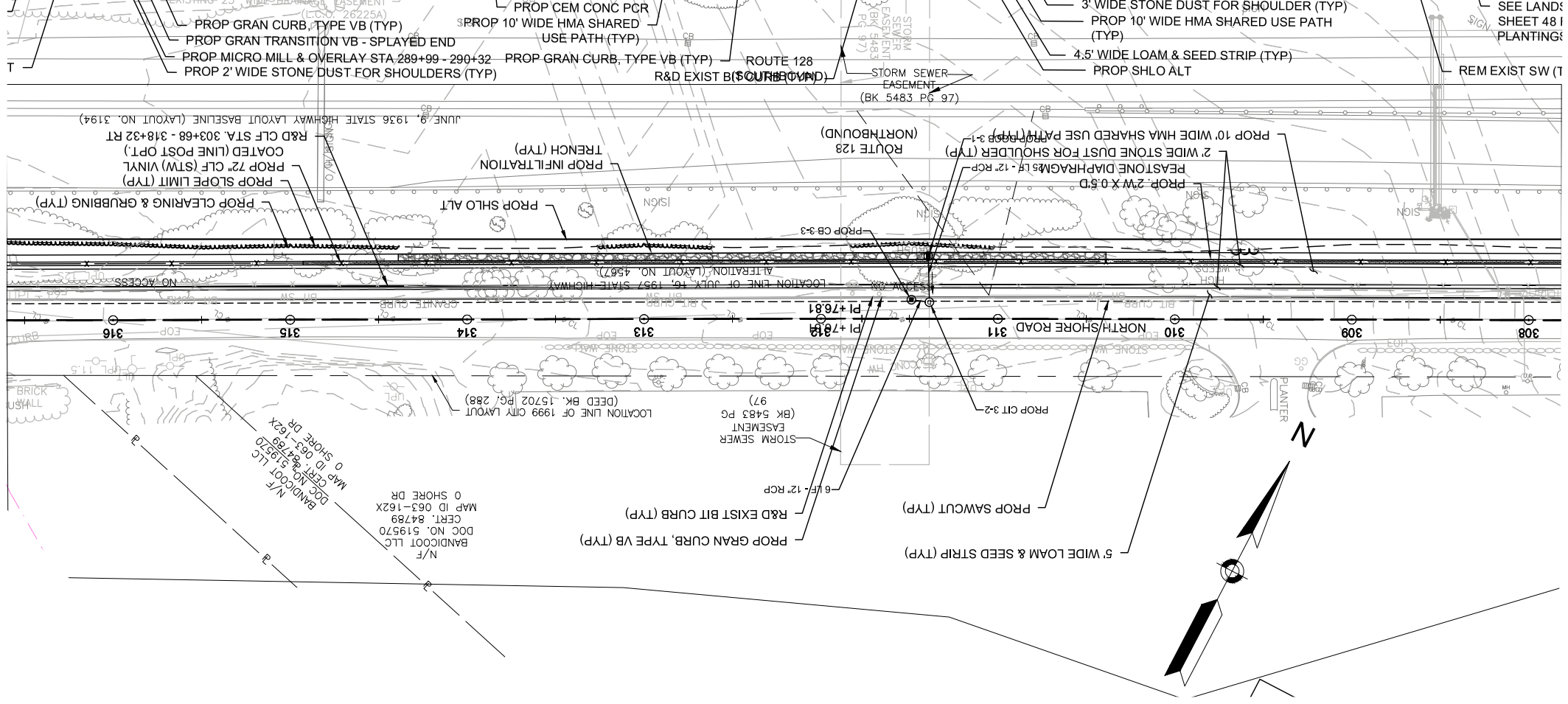
Proposal No. 609211-132091

A00831 - 25

WQC/ACOE PLAN SHEET 19 OF 63, REVISED 07/03/2024

- PERMANENT VW IMPACT AREA
- TEMPORARY VW IMPACT AREA
- PERMANENT LUW/WOTUS IMPACT AREA
- TEMPORARY LUW/WOTUS IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- BANK (INTERMITTENT STREAM)
- DITCH
- PERMANENT STREAM/BANK IMPACT
- TEMPORARY STREAM/BANK IMPACT

SCALE IN FEET
1" = 40'
40 0 40 80



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	3	8
PROJECT FILE NO. 609211			

WQC/ACOE IMPACTS PLAN
SHEET 3 OF 8

A00831 - 26

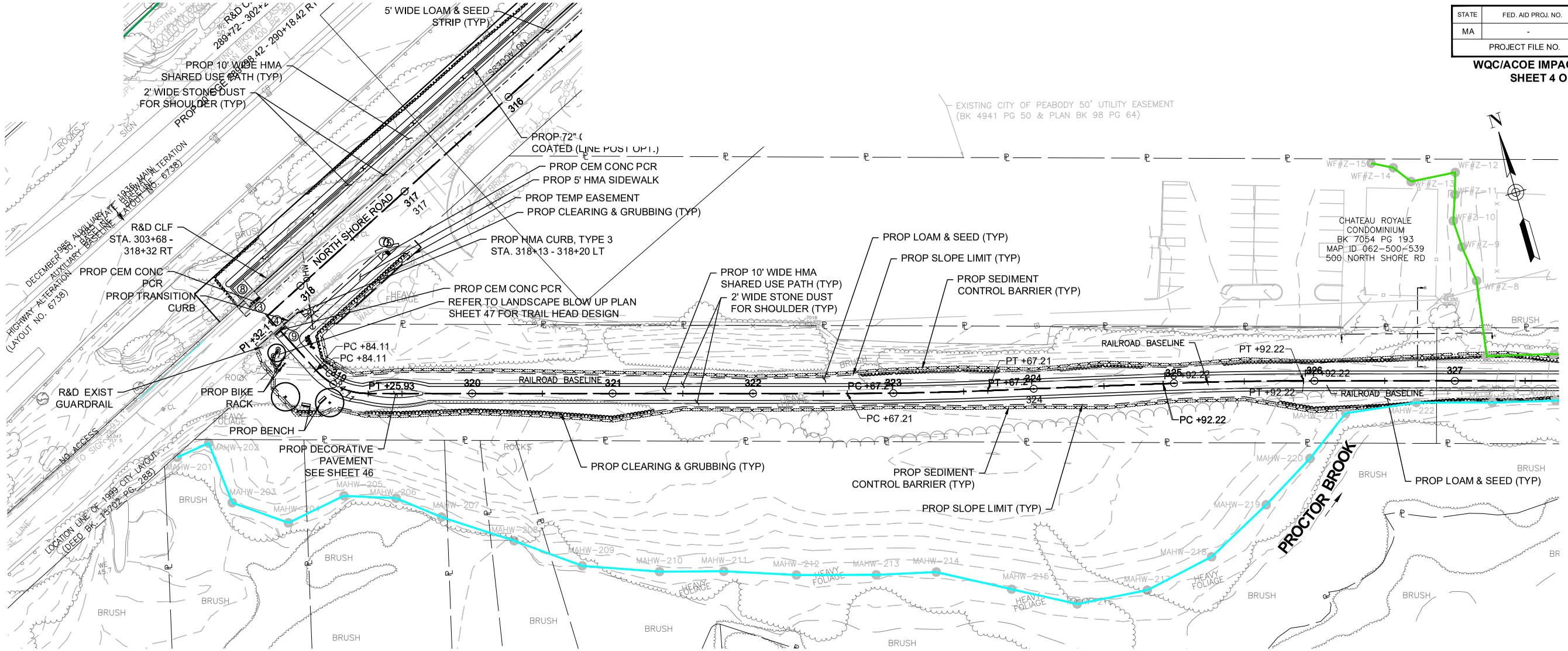
Proposal No. 609211-132091

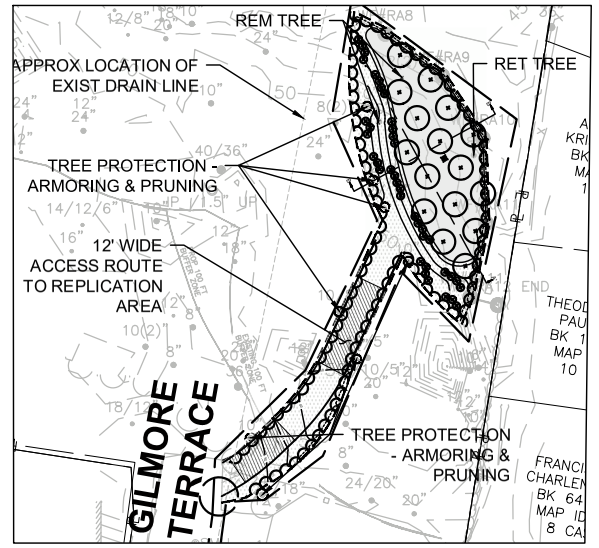
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 4 OF 8

Proposal No. 609211-132091

A00831 - 27





INSET A - WETLAND REPLICATION AREA

- PERMANENT VW IMPACT AREA
- TEMPORARY VW IMPACT AREA
- PERMANENT LUW/WOTUS IMPACT AREA
- TEMPORARY LUW/WOTUS IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- BANK (INTERMITTENT STREAM)
- DITCH
- PERMANENT STREAM/BANK IMPACT
- TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 40'

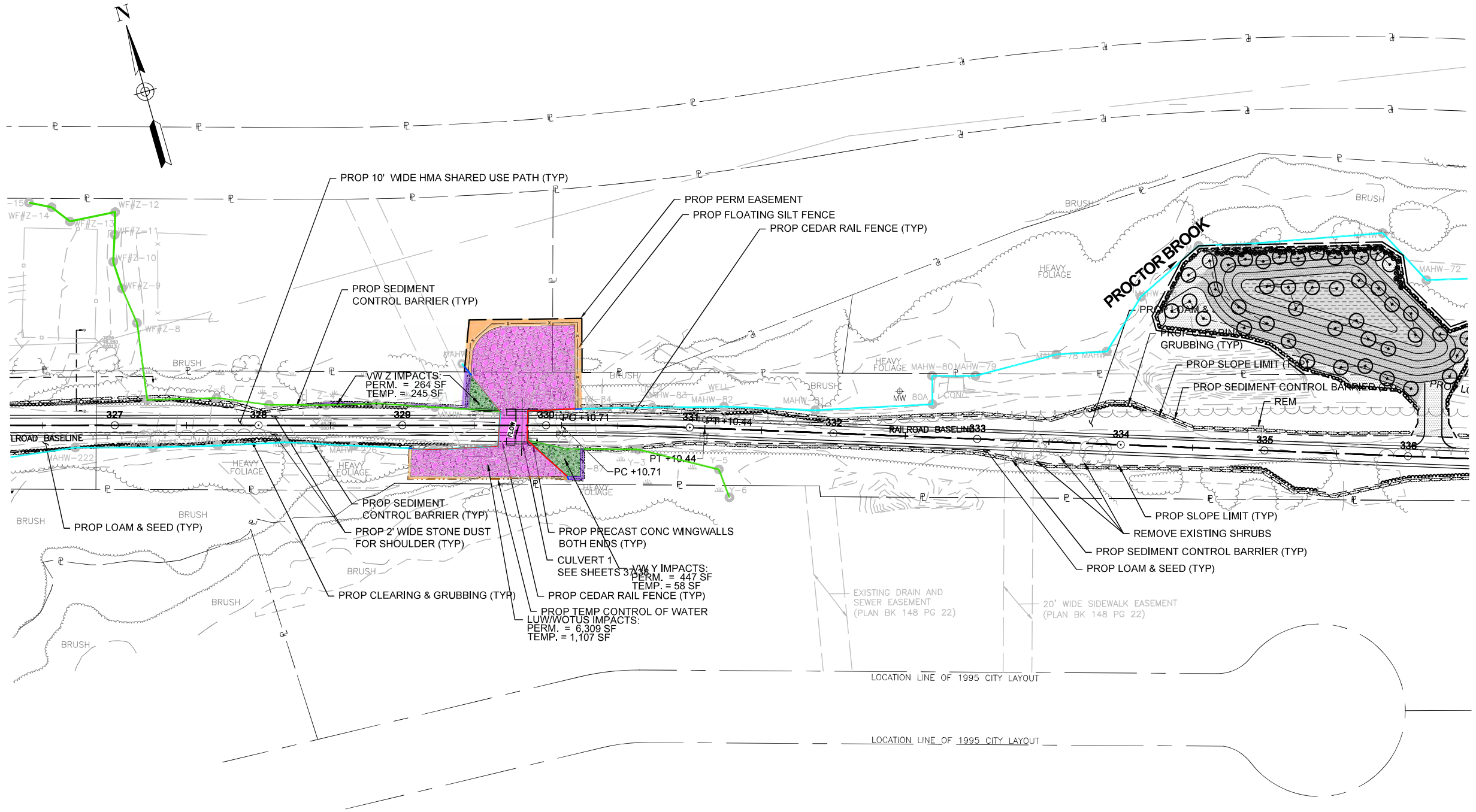
WQC/ACOE PLAN SHEET 20 OF 63, REVISED 07/03/2024

Proposal No. 609211-132091

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 5 OF 8



PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

40 0 40 80
SCALE IN FEET
1" = 80'

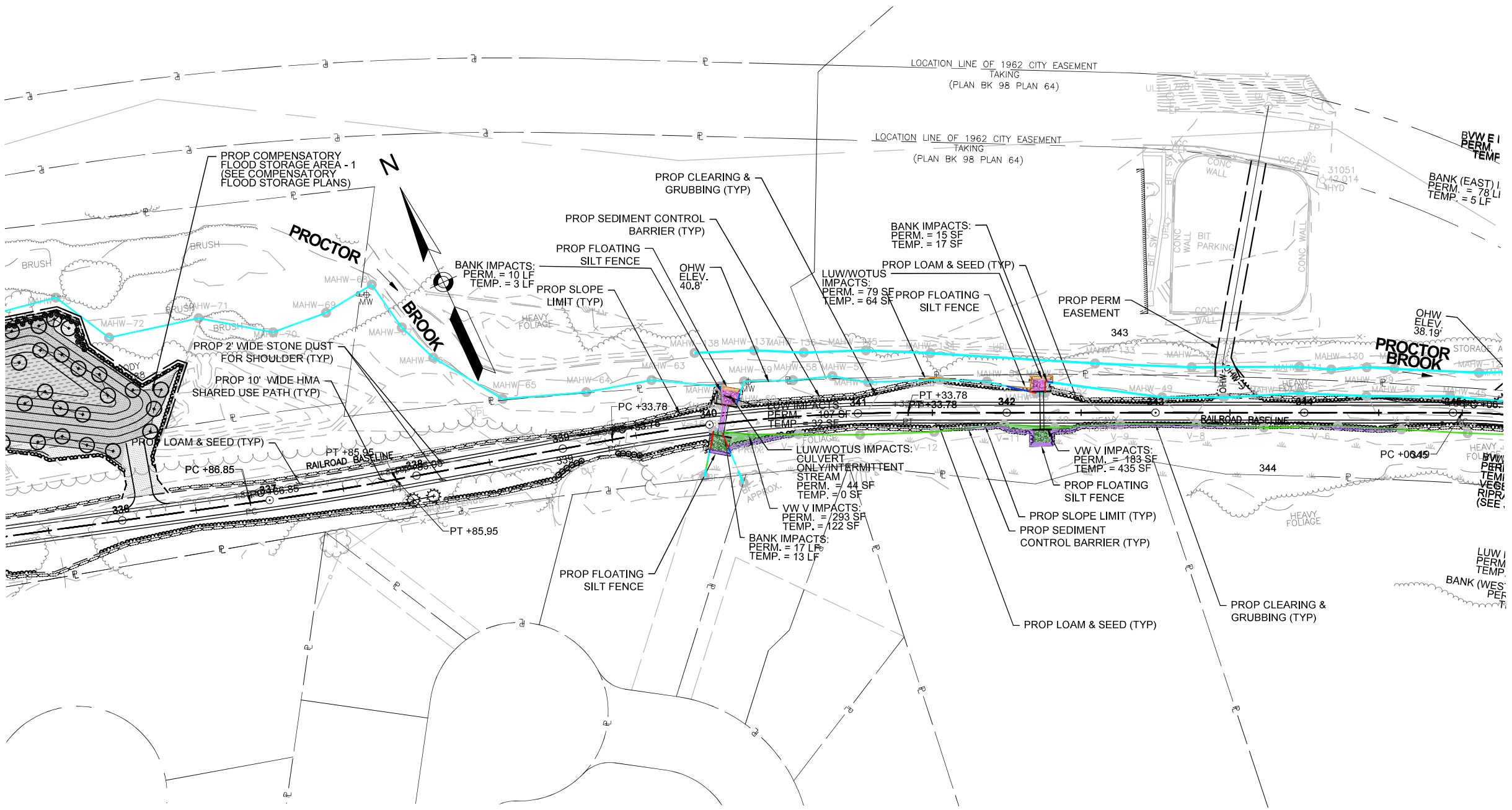
WQC/ACOE PLAN SHEET 21 OF 63, REVISED 07/26/2024

A00831 - 28

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	6	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 6 OF 8

Plotted on 26-Jul-2024 11:17 AM
17116_EV IMPACTS.DWG



WQC/ACOE PLAN SHEET 22 OF 63, REVISED 07/26/2024

Proposal No. 609211-132091
A00831 - 29

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

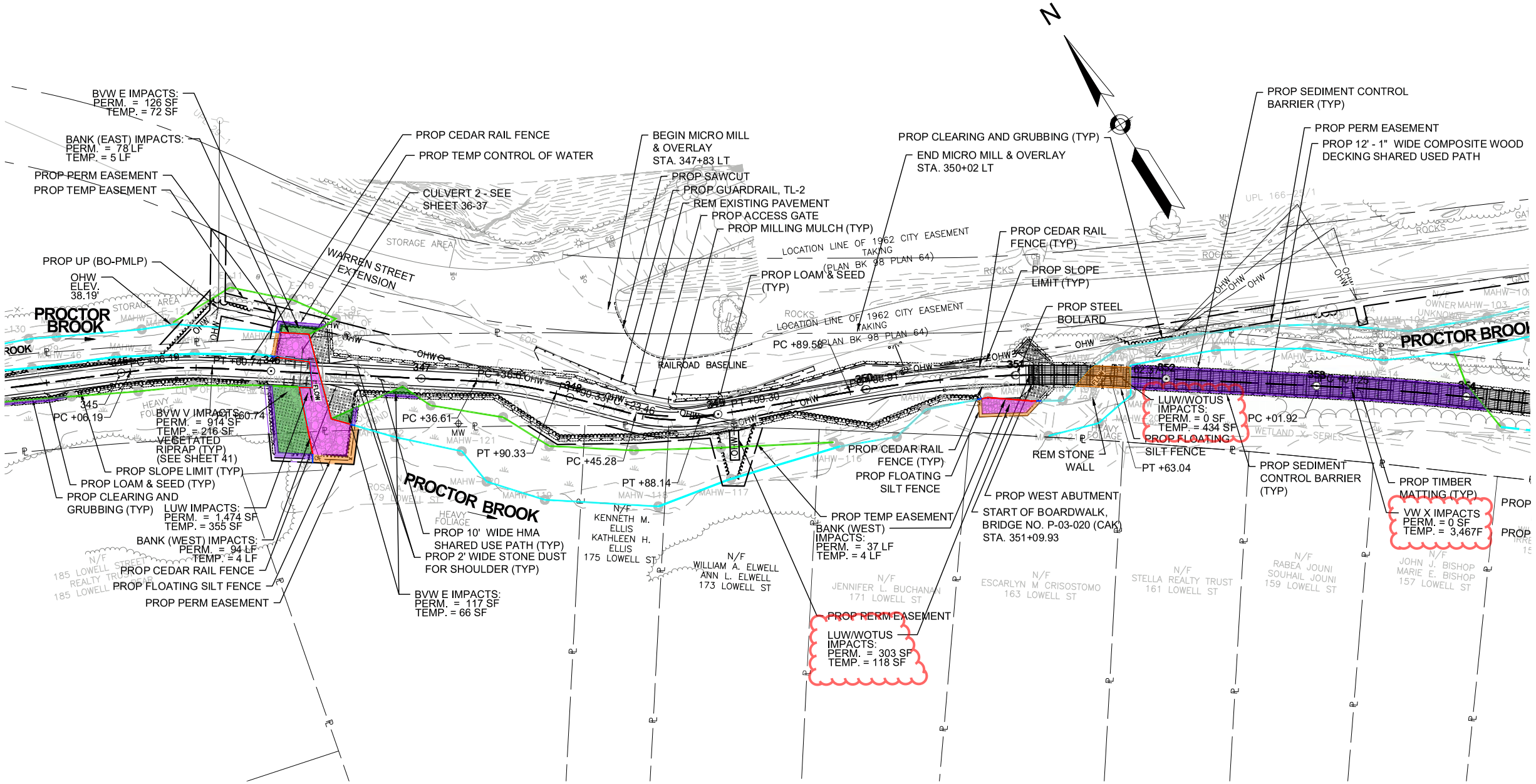
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 7 OF 8

Plotted on 22-Jul-2024 12:52 PM
17118_EV IMPACTS.DWG

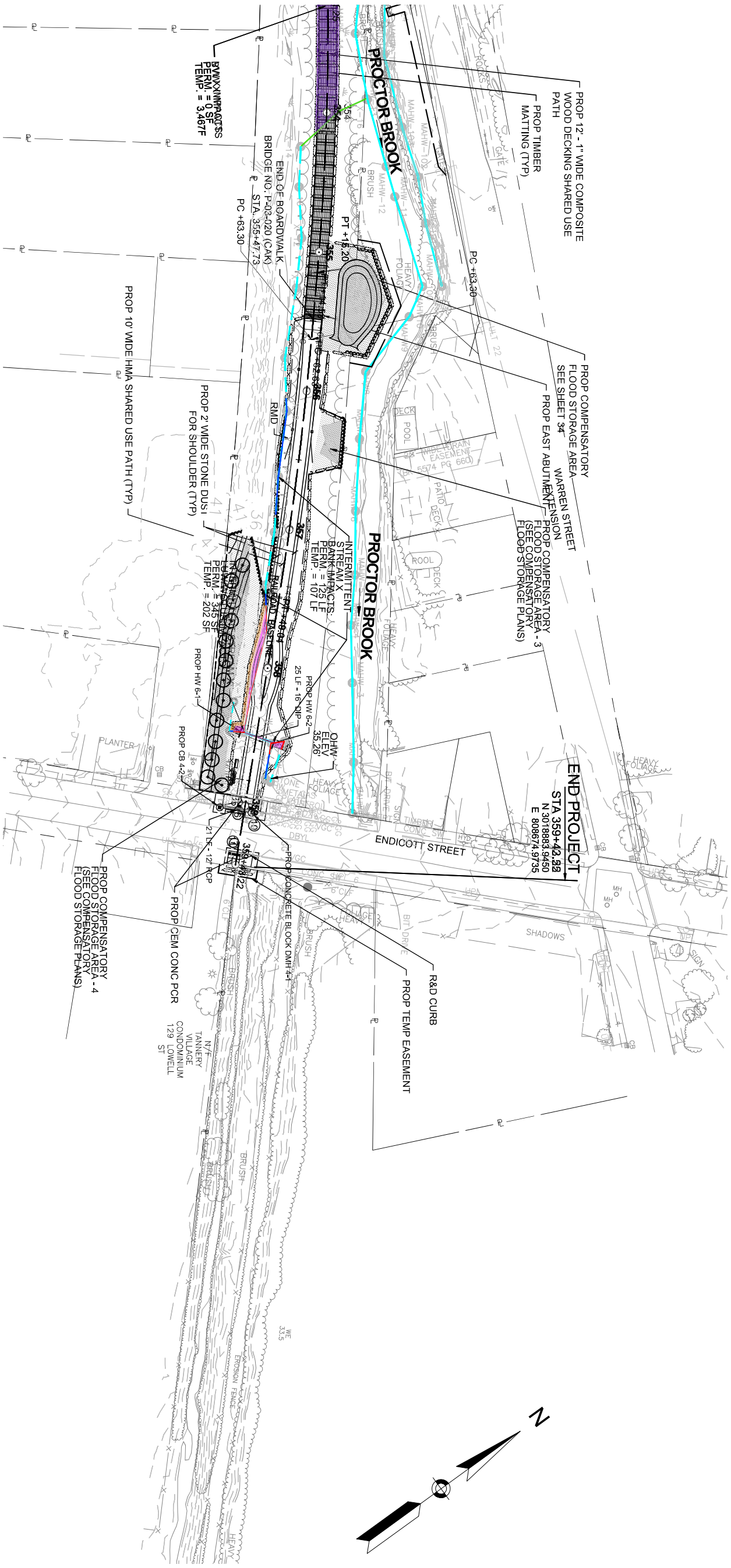
Proposal No. 609211-132091

A00831 - 30



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

WQC/ACOE PLAN SHEET 23 OF 63, REVISED 07/22/2024



WQC/ACOE PLAN SHEET 24 OF 63, REVISED 07/26/2024

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 8 OF 8

Proposal No. 609211-132091

GENERAL PLAN (1 OF 3)

SCALE: $\frac{1}{4}$" = 1'–0"

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

BOARDWALK IMPACTS SHEET 1 OF 3

STATION EQUATION: INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄ STA. 351+64.36 = PROCTOR BROOK ℄ STA. 88+67.46

℄ BRG. WEST ABUTMENT

W.P. #1 STA. 351+09.93

351+00

BOLLARD (HWY. ITEM)

PT +63.04

352+00

LOCATION OF LOW CHORD STA. 351+73.93

PROP. GRS–IBS ABUTMENT

PROP. RIPRAP

INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄

MAHW–112

MAHW–110

MAHW–109

ROCKS

STONE WALL

4 0 4 8

SCALE IN FEET

107

TIMBER POST

PROP. APPROACH SHARED–USE PATH

PROP. GRADE

PROP. GRS–IBS ABUTMENT

PROP. CEDAR RAIL FENCE (HWY. ITEM)

3'–0"

℄ PIER BENT 1 | ℄ PIER BENT 2 | ℄ PIER BENT 3 | ℄ PIER BENT 4 | ℄ PIER BENT 5 | ℄ PIER BENT 6 | ℄ PIER BENT 7 | ℄ PIER BENT 8 | ℄ PIER BENT 9 | ℄ PIER BENT 10 | ℄ PIER BENT 11 | ℄ B

PROP. TIMBER RAI

TOP OF REINFORCED SOIL FOUNDATION EL. 36.50

18" MIN. CRUSHED STONE

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

PERMANENT VW IMPACT AREA = 0 SF

TEMPORARY VW IMPACT AREA = 3,467 SF

PERMANENT LUW IMPACT AREA = 303 SF

TEMPORARY LUW IMPACT AREA = 552 SF

STREAM/BANK IMPACT (PERM.) = 37 LF

STREAM/BANK IMPACT (TEMP.) = 4 LF

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

TYPICAL ELEVATION (1 OF 3)

WQC/ACOE PLAN SHEET 25 OF 63, REVISED 7/22/2024

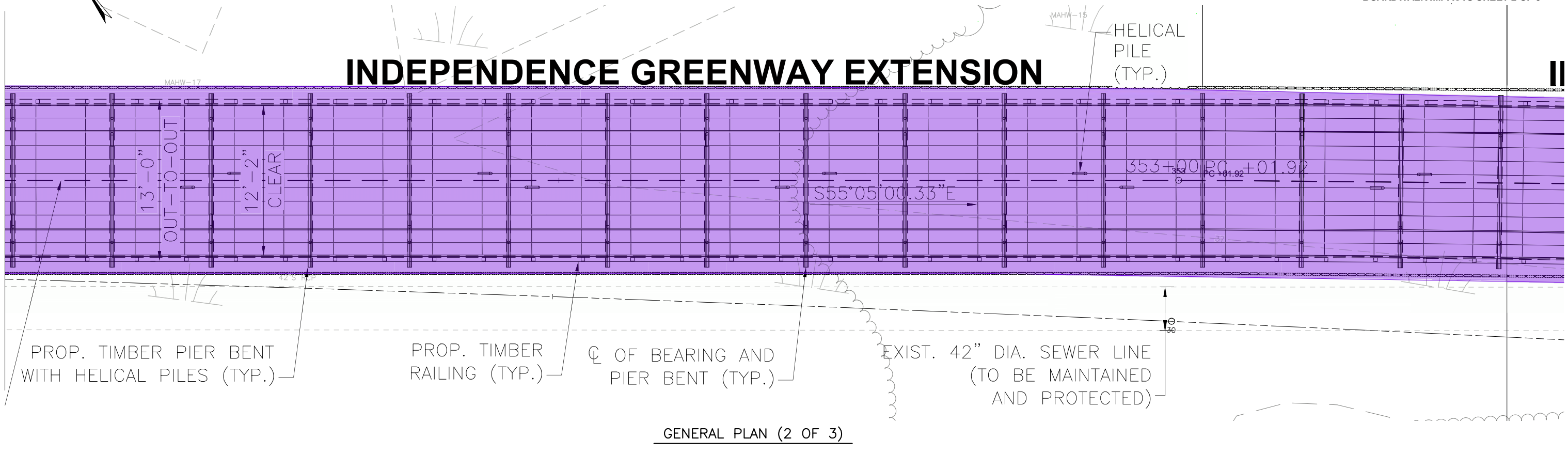
A0083 - 32

PEABODY
INDEPENDENCE GREENWAY EXTENSION

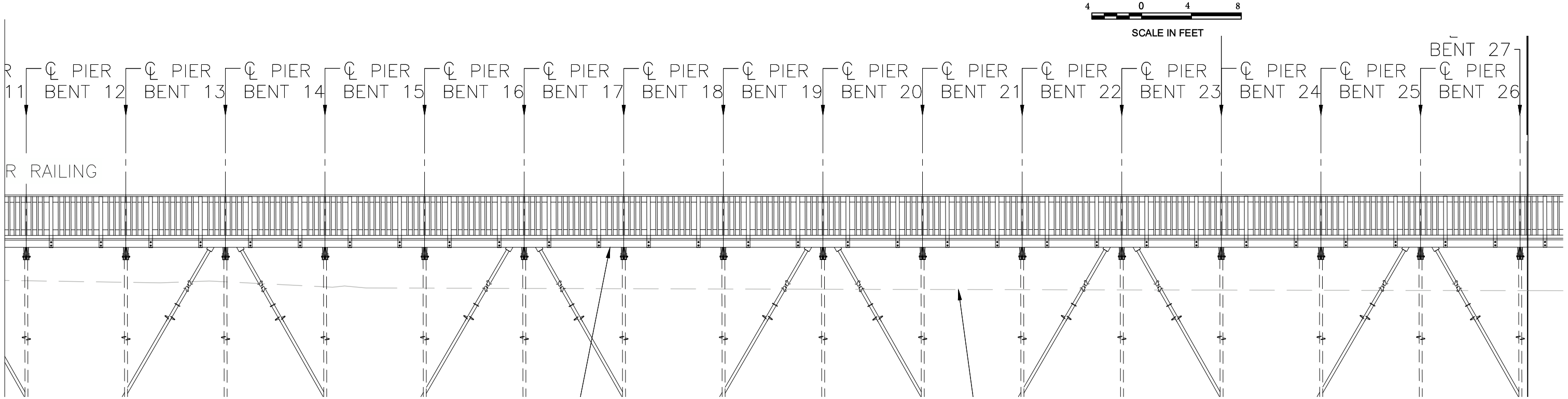
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.		609211	

BOARDWALK IMPACTS SHEET 2 OF 3

INDEPENDENCE GREENWAY EXTENSION



GENERAL PLAN (2 OF 3)



TYPICAL ELEVATION (2 OF 3)

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

- PERMANENT BVW IMPACT AREA
- TEMPORARY BVW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY LUW IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)

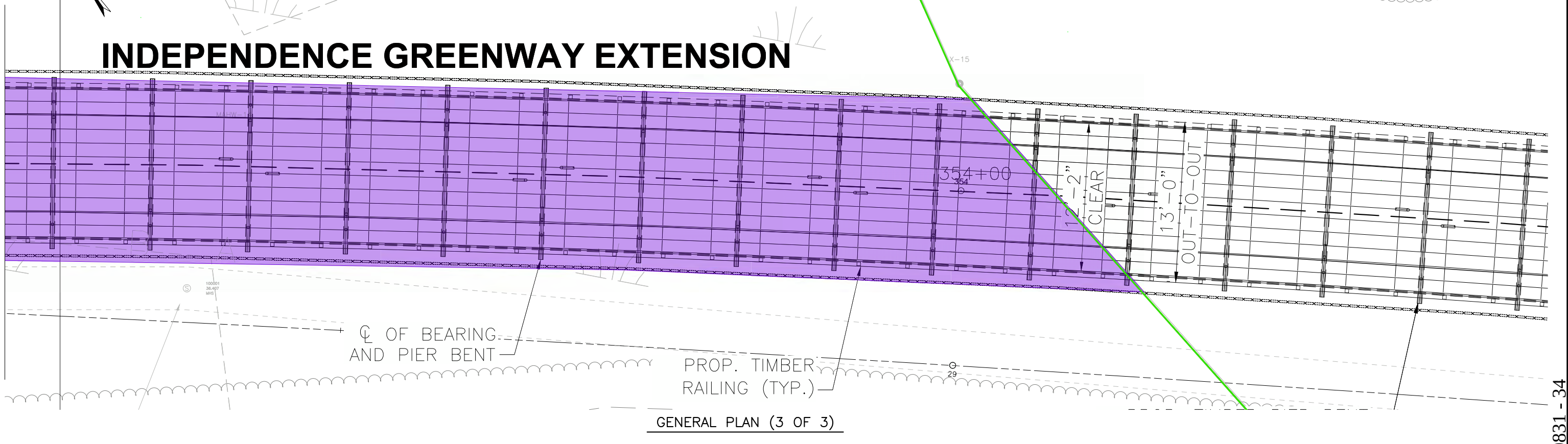
4 0 4 8
SCALE IN FEET

WQC/ACOE PLAN SHEET 26 OF 63, REVISED 7/22/2024

Proposal No. 609211-132091

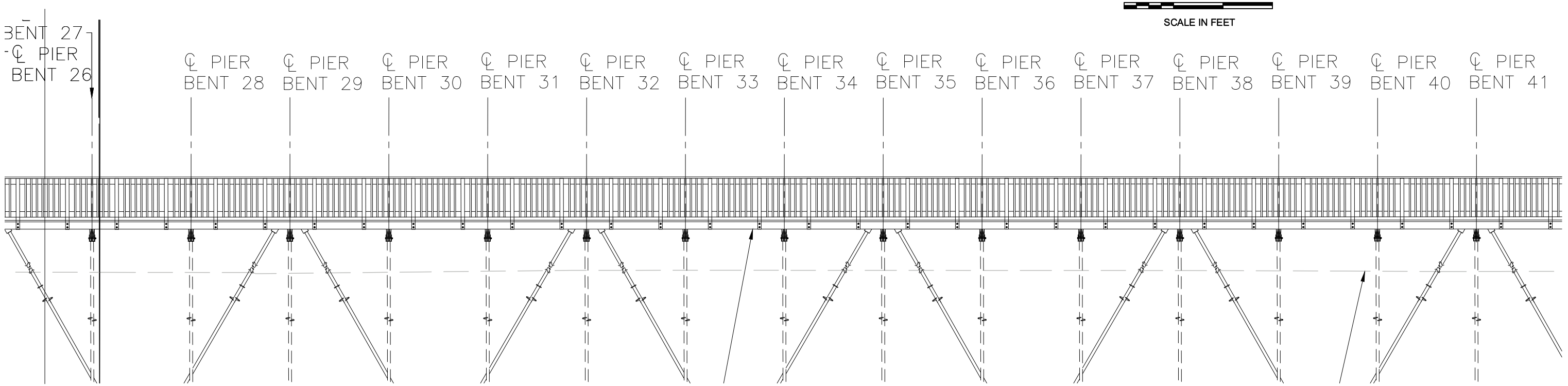
A00831 - 33

INDEPENDENCE GREENWAY EXTENSION



GENERAL PLAN (3 OF 3)

4 0 4 8
SCALE IN FEET



TYPICAL ELEVATION (3 OF 3)

4 0 4 8
SCALE IN FEET

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

- PERMANENT VW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY B W IMPACT AREA
- TEMPORARY LUW IMPACT AREA
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)

WQC/ACOE PLAN SHEET 27 OF 63, REVISED 7/22/2024

Proposal No. 609211-132091
A00831 - 34

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	142
PROJECT FILE NO.	609211		

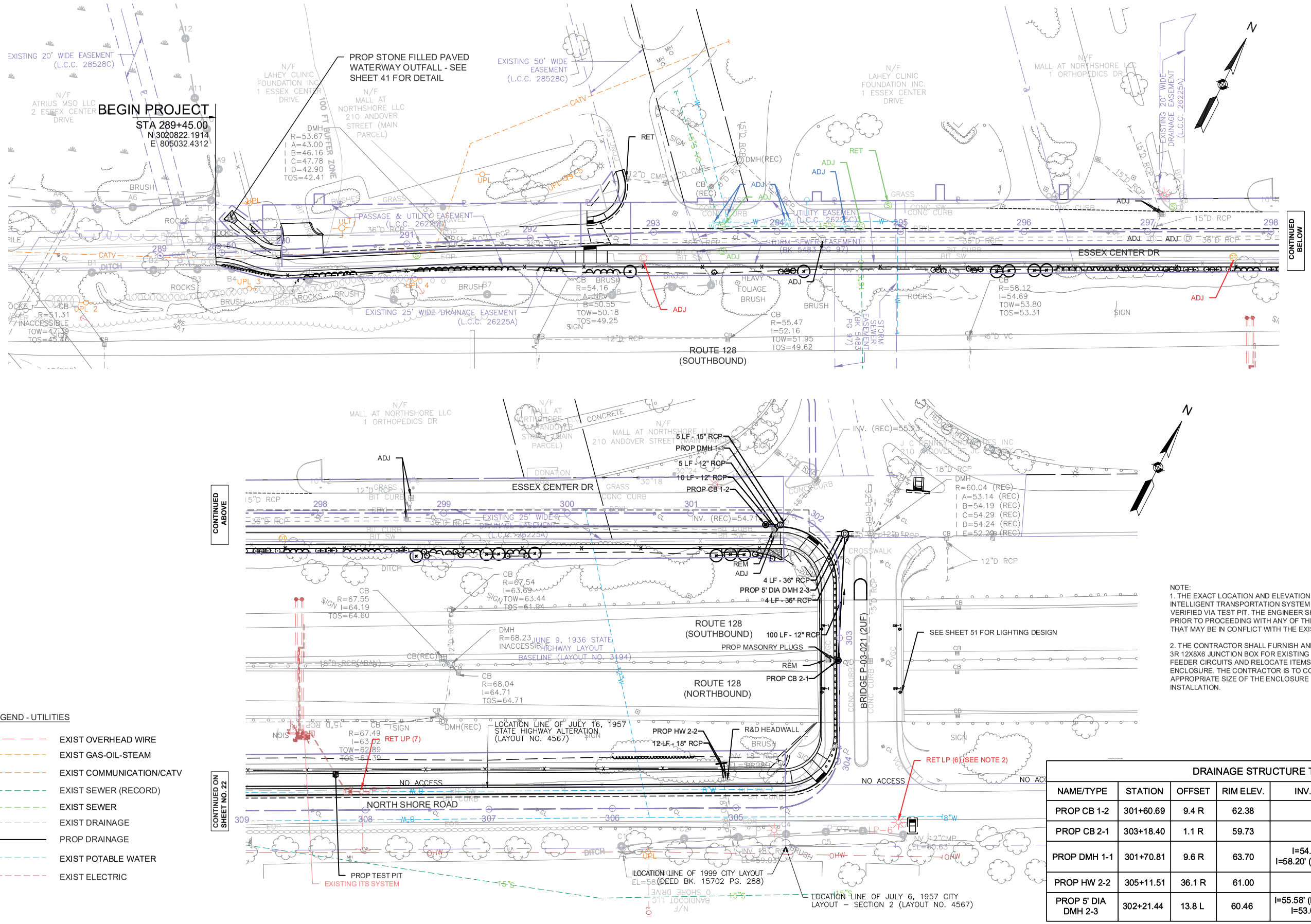
DRAINAGE AND UTILITY PLAN - 1

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
SEE BELOW

DRAINAGE DETAILS
SEE BELOW



NOTE:
1. THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

2. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA 3R 12X8X6 JUNCTION BOX FOR EXISTING POLE-MOUNTED FEEDER CIRCUITS AND RELOCATE ITEMS WITHIN THE ENCLOSURE. THE CONTRACTOR IS TO CONFIRM THE APPROPRIATE SIZE OF THE ENCLOSURE PRIOR TO INSTALLATION.

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 1-2	301+60.69	9.4 R	62.38		I=58.38' (PROP DMH 1-1)
PROP CB 2-1	303+18.40	1.1 R	59.73		I=55.63' (PROP 5' DIA DMH 2-3)
PROP DMH 1-1	301+70.81	9.6 R	63.70	I=54.79' (V.I.F.) I=58.20' (PROP CB 1-2)	I=53.79' (EX DMH 1-3)
PROP HW 2-2	305+11.51	36.1 R	61.00		I=59.33' ()
PROP 5' DIA DMH 2-3	302+21.44	13.8 L	60.46	I=55.58' (PROP CB 2-1) I=53.08' (V.I.F.)	I=53.07' ()

WQC/ACOE PLAN SHEET 28 OF 63

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	142
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 2

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

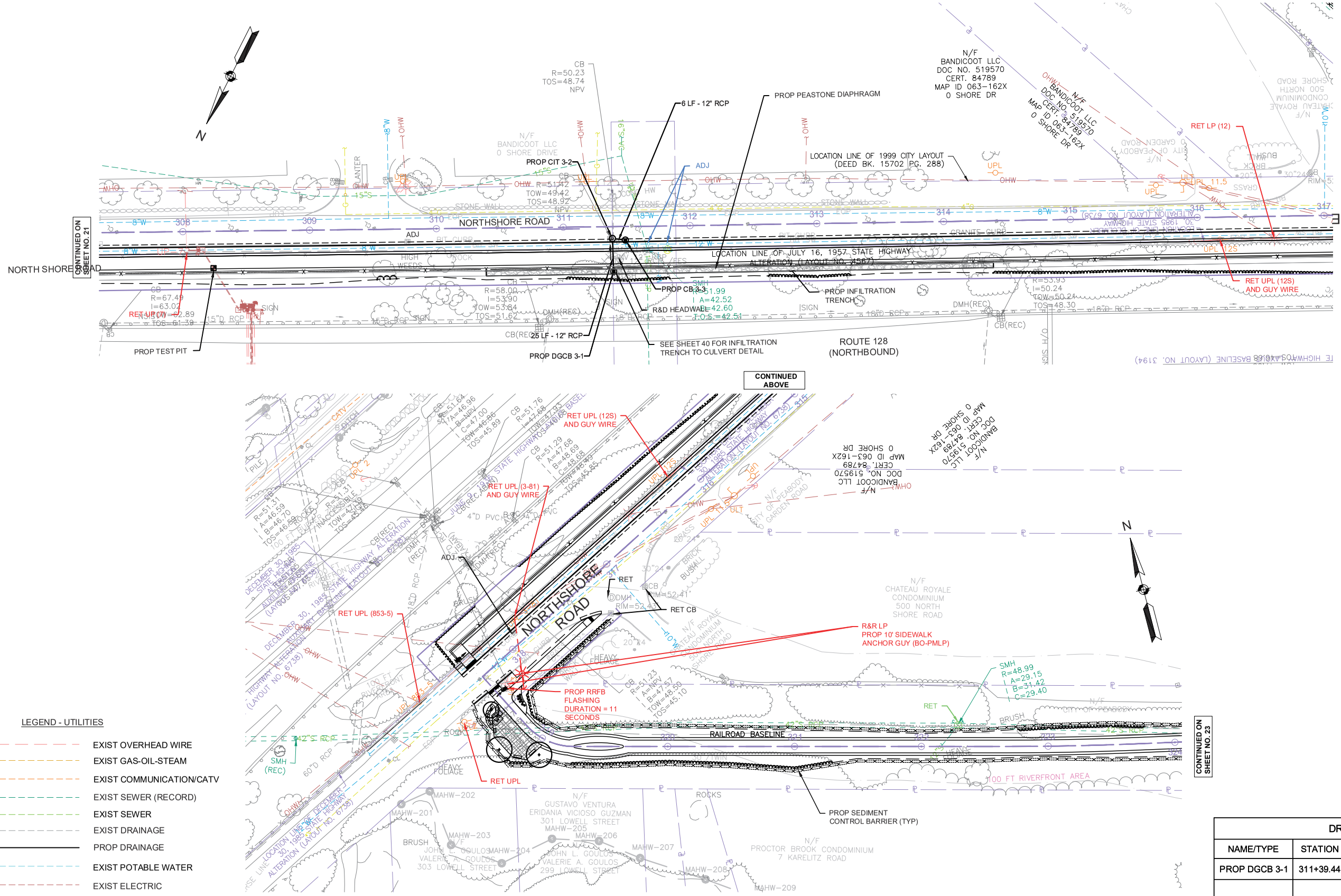
NONE

WATER SUPPLY ALTERATIONS

SEE BELOW

DRAINAGE DETAILS

SEE BELOW



NOTE:
THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP DGCB 3-1	311+39.44	38.4 R	51.26		I=48.61' (PROP CIT 3-2)
PROP CIT 3-2	311+38.53	9.5 R	51.42	I=48.40' (PROP DGCB 3-1) I=48.40' (PROP CB 3-3)	I=48.30' (V.I.F.)
PROP CB 3-3	311+48.84	10.7 R	51.41		I=48.60' (PROP. CIT 3-2)

0 40 100 160

SCALE: 1" = 80'

WQC/ACOE PLAN SHEET 29 OF 63

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

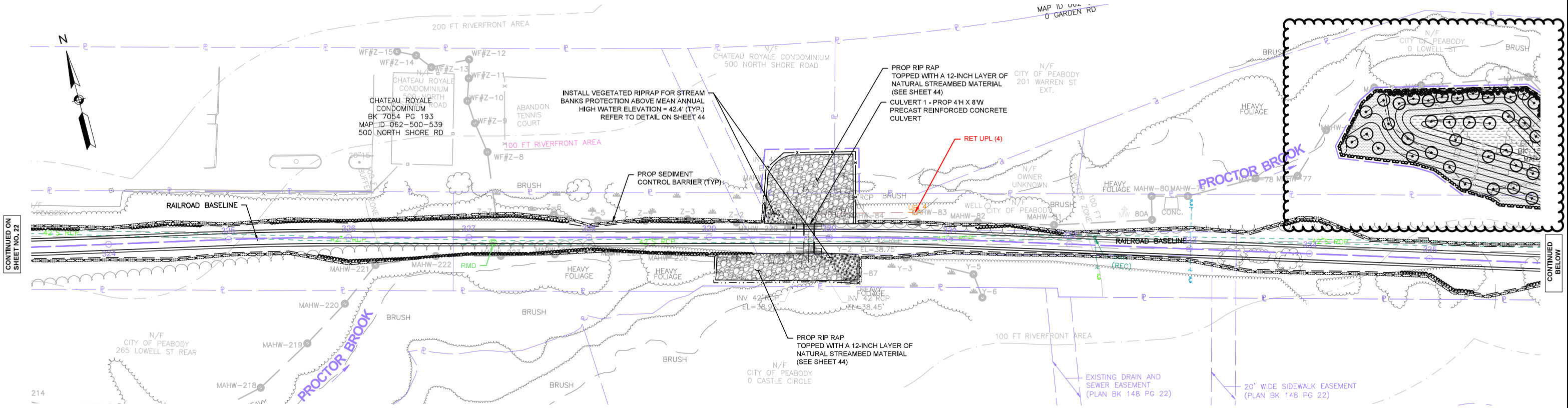
DRAINAGE DETAILS

SEE BELOW

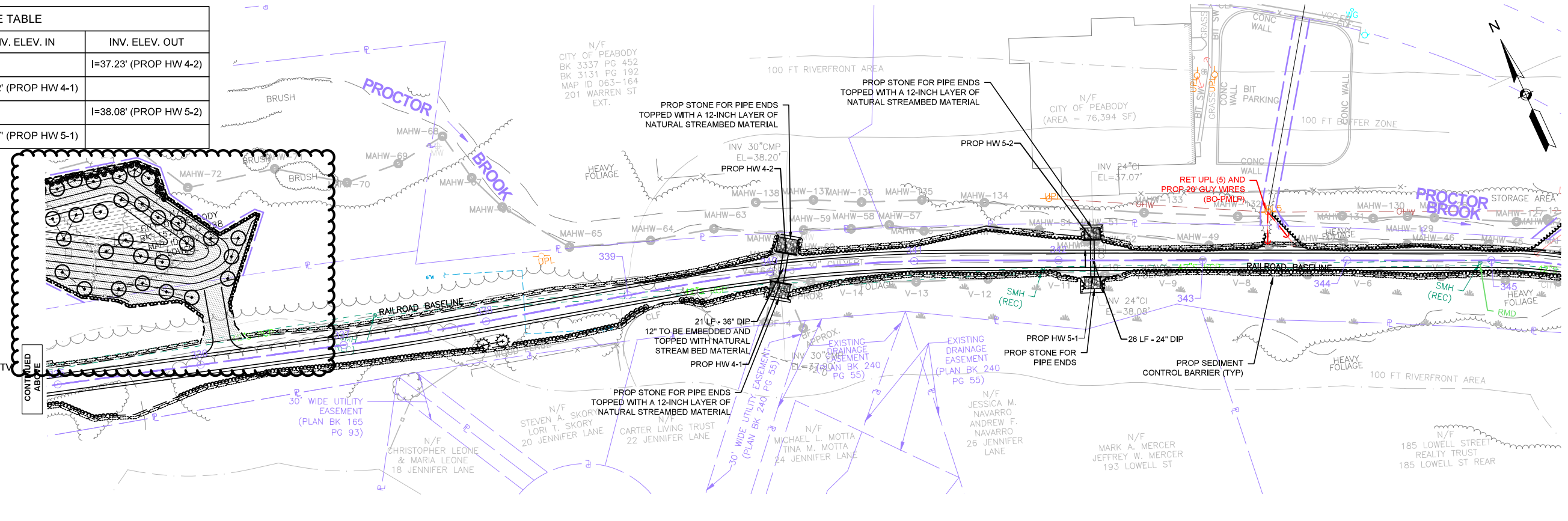
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	143
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 3
OOC AMENDMENT PLANS - 7/25/2024



DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 4-1	340+06.33	8.3 R	41.49		I=37.23' (PROP HW 4-2)
PROP HW 4-2	340+12.19	11.7 L	41.39	I=37.02' (PROP HW 4-1)	
PROP HW 5-1	342+23.80	11.4 R	39.75		I=38.08' (PROP HW 5-2)
PROP HW 5-2	342+23.48	14.2 L	39.62	I=37.07' (PROP HW 5-1)	



LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

WQC/ACOE PLAN SHEET 30 OF 63, REVISED 07/26/2024

Proposal No. 609211-132091

A00831 - 37

Plotted on: 25-Jul-2024 6:07 PM

SHT0095_HDI(DRAINAGE AND UTILITY PLANS).DWG

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	143
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 4
OOC AMENDMENT PLANS - 7/25/2024

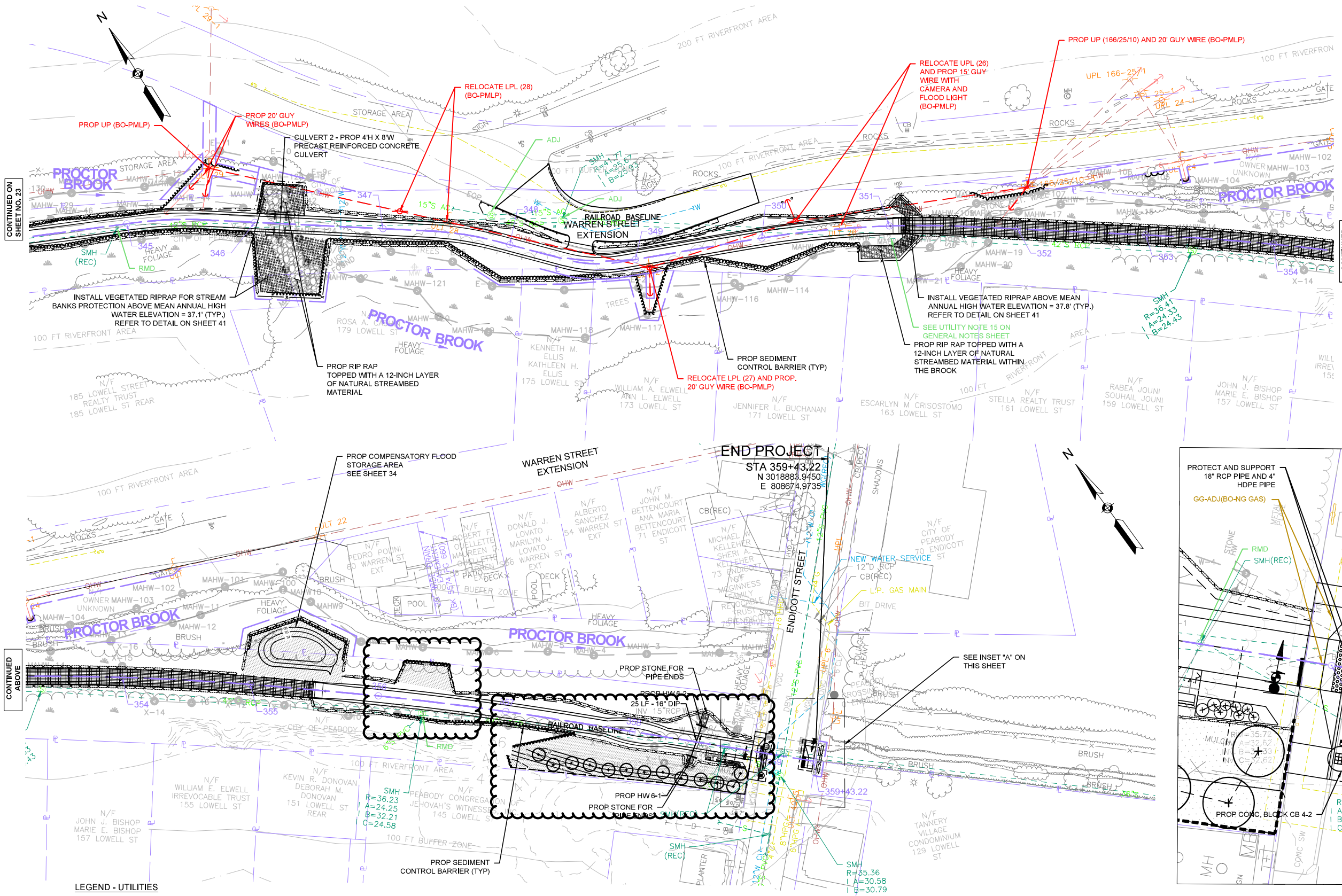
Plotted on 25-Jul-2024 6:09 PM
SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG

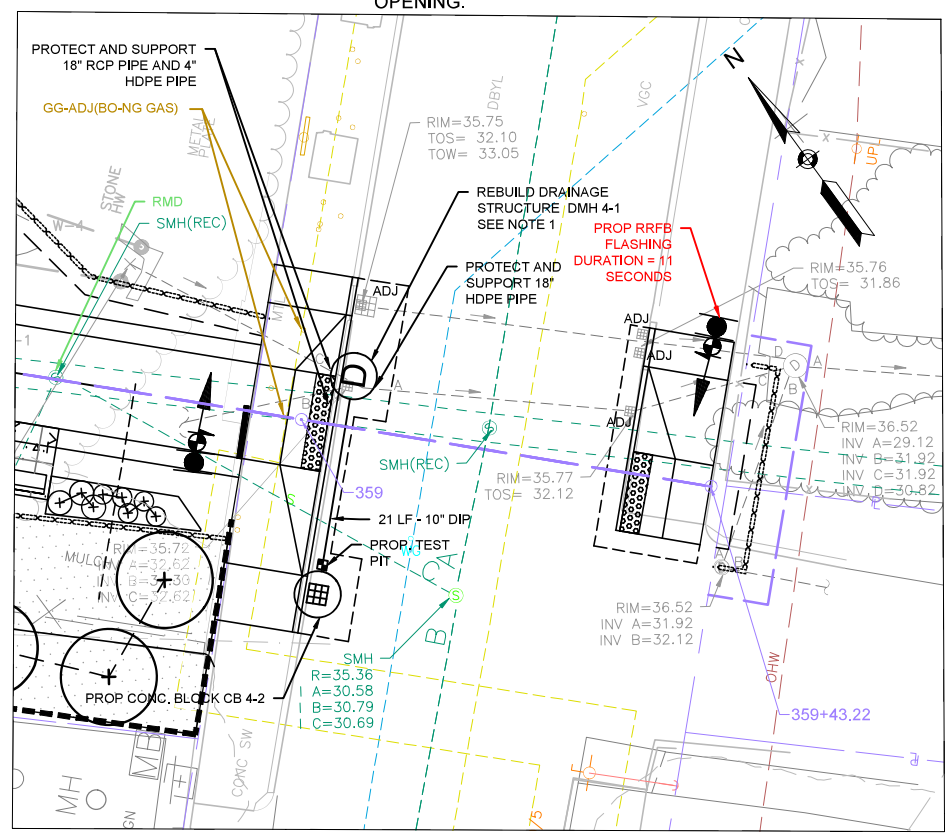
HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE BELOW





INSET "A"

NOTE:
1. REBUILD DRAINAGE STRUCTURE DMH 4-1 AS CONCRETE BLOCK STRUCTURE. REMOVE AND DISPOSE EXISTING FRAME AND GRATE AND REPLACE WITH 4" FRAME AND COVER. LOCATE FRAME AND COVER OUTSIDE OF CURB OPENING.

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

0 40 100 160
SCALE: 1" = 80'

0 10 25 40
SCALE: 1" = 20'

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 6-1	358+48.46	11.6 R	35.47		I=33.51' (PROP HW 6-2)
PROP HW 6-2	358+52.79	12.9 L	34.88	I=32.92' (PROP HW 6-1)	

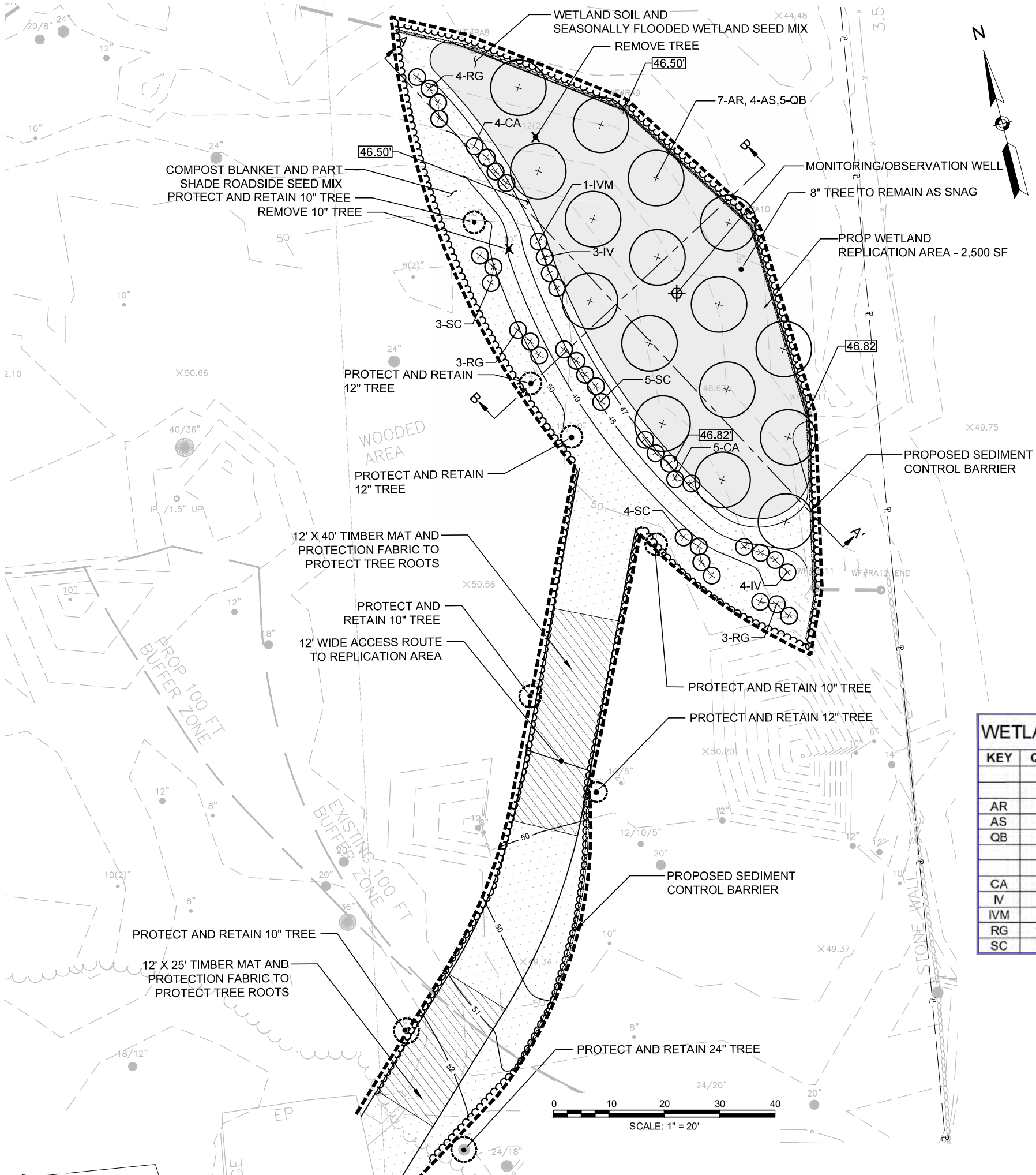
DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 4-2	359+04.67	17.6 R	35.63		I=33.50' (PROP DMH 4-1)
PROP DMH 4-1 (DRAINAGE STRUCTURE REBUILT)	359+04.67	5.3 L	34.76	I=33.29 (PROP CB 4-2) I=MATCH EXISTING	I=MATCH EXISTING

WQC/ACOE PLAN SHEET 31 OF 63, REVISED 07/26/2024

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	143
PROJECT FILE NO.	609211		

WETLAND REPLICATION PLAN



NOTES:

1. IMPACTS TO EXISTING TREES AND SOILS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
2. CONTACT THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION PRIOR TO THE START OF CONSTRUCTION. THE REPRESENTATIVE FOR THIS PROJECT IS MAXWELL R. MCNULTY MAXWELL.R.MCNULTY@DOT.STATE.MA.US.
3. FINAL GRADES TO BE TO MATCH ADJACENT WETLAND. MINOR ADJUSTMENTS IN FINAL GRADES SHALL BE MADE IN THE FIELD BY THE WETLAND SPECIALIST.
4. REPLICATION AREA SHALL BE EXCAVATED BELOW PROPOSED GRADES TO ALLOW FOR THE PLACEMENT OF WETLAND SOILS. THE DEPTH OF WETLAND SOILS SHALL BE 18" MAXIMUM AND SHALL MATCH THE DEPTH OF WETLAND SOIL IN THE ADJACENT WETLAND. DEPTH OF WETLAND SOIL SHALL BE DETERMINED BY THE WETLAND SPECIALIST. THE SALVAGED TOPSOIL MATERIAL AND B-HORIZON SUBSOIL MATERIAL EXCAVATED FROM THE WETLAND IMPACT AREAS SHALL BE PLACED IN SEPARATE STOCKPILES TO BE REUSED IN THE PROPOSED REPLICATION AREA IF SUITABLE.
5. REPLICATION AREA GRADES SHALL MATCH THE ELEVATIONS OF THE ABUTTING WETLAND TO MAINTAIN A HYDROLOGIC CONNECTION. WETLAND SPECIALIST SHALL INSPECT THE SUB-GRADE OF THE REPLICATION AREA TO ENSURE THAT THE PROPER HYDROLOGY HAS BEEN ESTABLISHED. MINOR MODIFICATIONS TO THIS GRADING PLAN MAY BE MADE IN THE FIELD BY THE QUALIFIED WETLAND SPECIALIST IN RESPONSE TO SUBSURFACE HYDROLOGIC CONDITIONS.
6. TREES AND SHRUBS IN THE REPLICATION AREA AND ADJACENT UPLAND AREA SHALL BE FIELD LOCATED BY THE WETLAND SPECIALIST.

PLANTING & SEEDING NOTES:

1. SEED SHALL BE MANUALLY BROADCAST. LIMITS SHOWN ARE APPROXIMATE. ACTUAL LIMITS SHALL BE AS DIRECTED BY THE WETLAND SPECIALIST.

LEGEND

- LIMIT OF WORK
- SEDIMENT BARRIER
- 100 EXISTING CONTOUR
- 44 PROPOSED CONTOUR
- PROPERTY LINE (FROM MASSGIS)
- LIMIT OF CLEARING
- 24.694 PROPOSED SPOT GRADE
- MONITORING/OBSERVATION WELL
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX
- PROPOSED SHRUB
- PROPOSED TREE
- EXISTING TREE ARMORING
- X TREE REMOVAL
- TIMBER MAT AND PROTECTION FABRIC

208 FT LENGTH OF SEDIMENT CONTROL BARRIER

3,736 SQ FT OF PART SHADE ROADSIDE SEED MIX

2,500 SQ FT WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

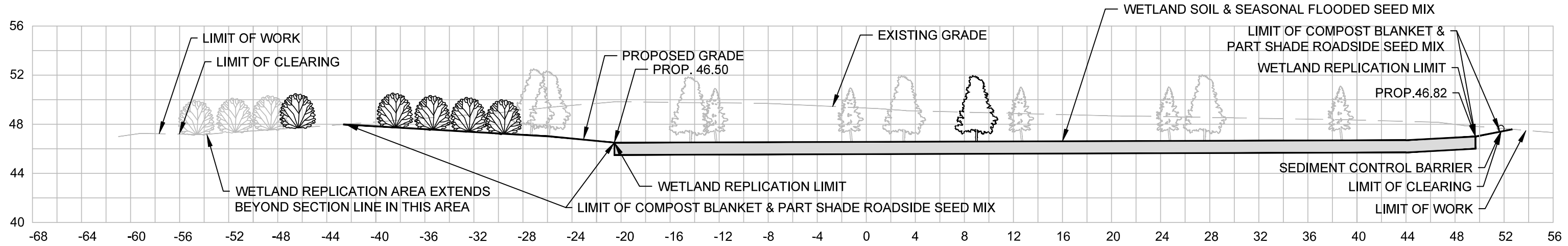
WETLAND REPLICATION PLANT LIST

KEY	QTY	WETLAND STAUS	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
			DECIDUOUS TREES			
AR	7	FAC	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	4	FACW	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
QB	5	FACW	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
			DECIDUOUS SHRUBS			
CA	9	FACW	CORNUS AMOMUM	SILKY DOGWOOD	2-3 FEET	#2 CONT.
IV	7	FACW	ILEX VERTICILATA	WINTERBERRY	2-3 FEET	#2 CONT.
IVM	1	FACW	ILEX VERTICILATA - MALE	MALE WINTERBERRY	2-3 FEET	#2 CONT.
RG	10	UPLAND	RHUS GLABRA	SMOOTH SUMAC	2-3 FEET	#2 CONT.
SC	12	FACW	SAMBUCUS CANADENSIS	COMMON ELDERBERRY	2-3 FEET	#2 CONT.

Proposal No. 609211-132091
A00831 - 39
SHTOXX_EWWETLAND REPLICATION PLAN.DWG
Plotted on 11-Jun-2024 9:58 AM

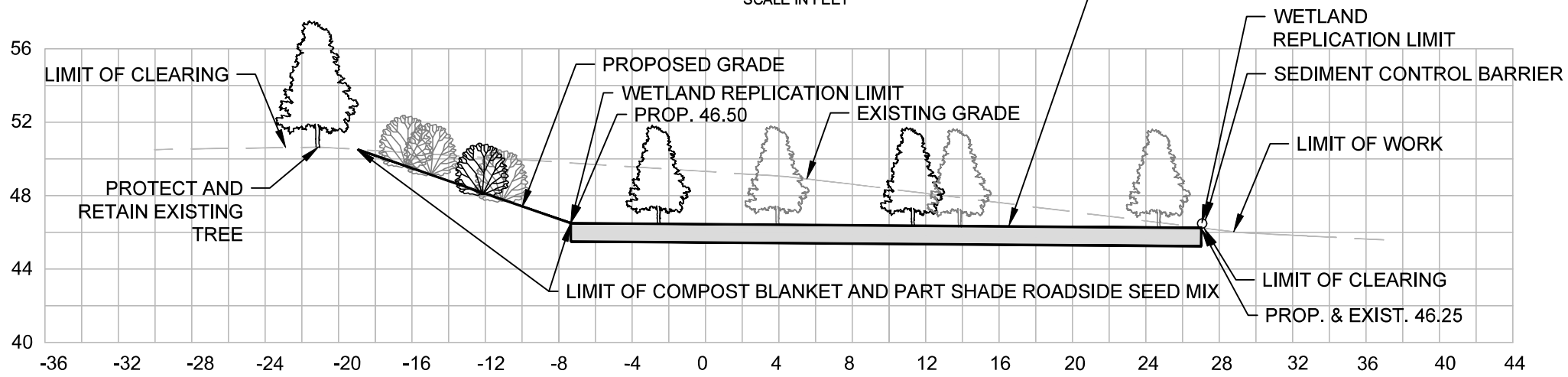
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	143
PROJECT FILE NO.	609211		

WETLAND REPLICATION SECTIONS
6/11/2024 WQC/NOI REVISIONS



SECTION (A-A')
(HOR. SCALE 1" = 8' , VERT. SCALE 1" = 8')

4 0 4 8
SCALE IN FEET



SECTION (B-B')
(HOR. SCALE 1" = 8' , VERT. SCALE 1" = 8')

4 0 4 8
SCALE IN FEET

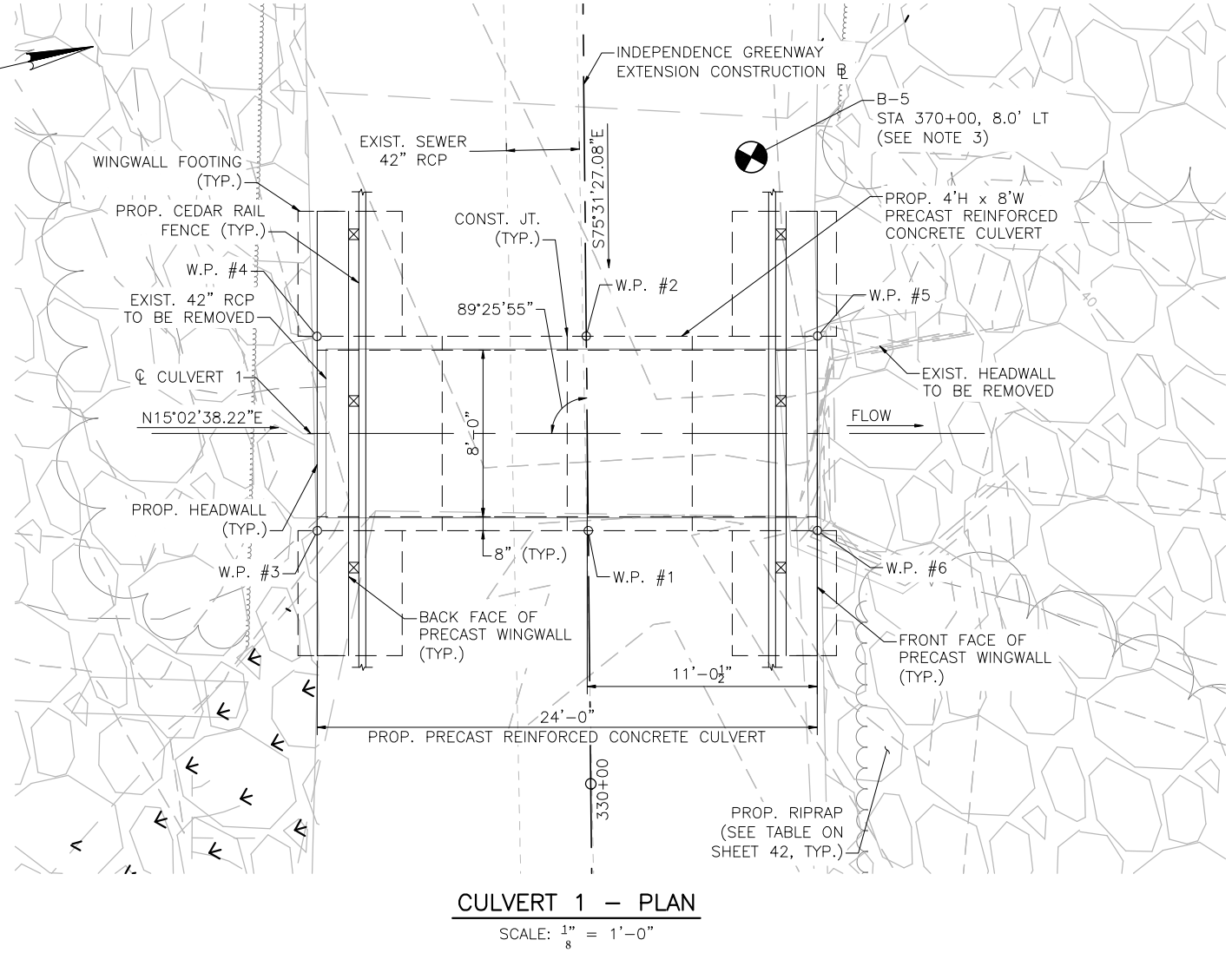
Proposal No. 609211-132091
A00831 - 40
SHT0XX_EV(WETLAND REPLICATION PLAN).DWG Plotted on 11-Jun-2024 10:01 AM

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	35	143
PROJECT FILE NO.	609211		

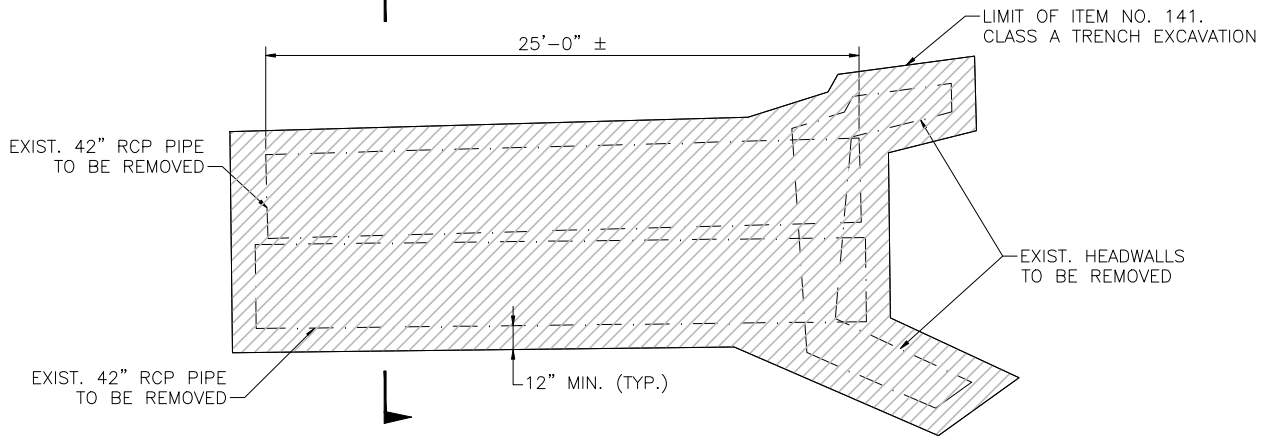
CULVERT 1 - PLAN AND LONGITUDINAL SECTION
6/11/2024 WQC/NOI REVISIONS

Proposal No. 609211-132091

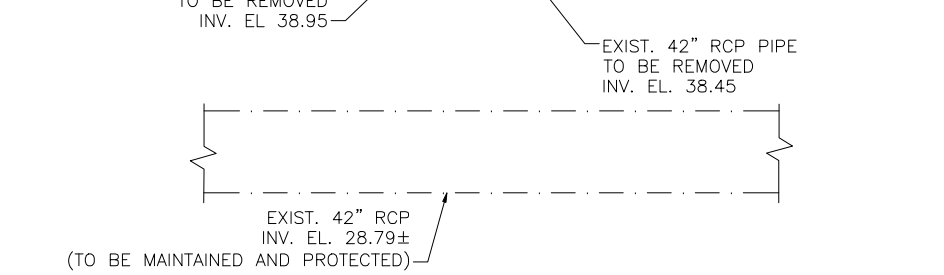
Plotted on 11-Jun-2024 8:58 AM
609211_BR01.DWG
A00831 - 41



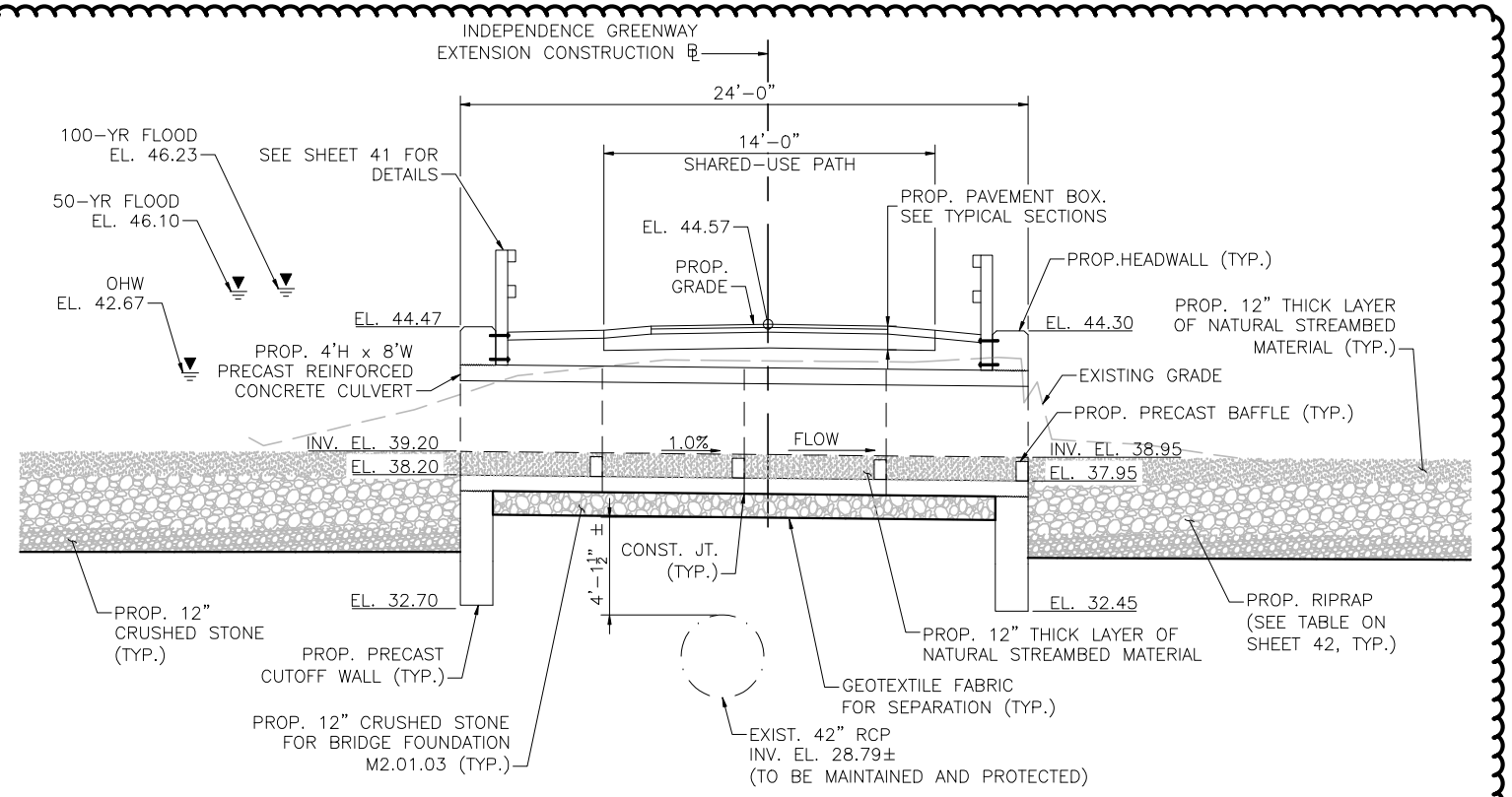
CULVERT 1 – PLAN
SCALE: ⅛" = 1'-0"



CULVERT 1 – DEMOLITION PLAN
SCALE: ¼" = 1'-0"



SECTION 1 –
SCALE: ⅛" = 1'-0"



CULVERT 1 – LONGITUDINAL SECTION
SCALE: ⅛" = 1'-0"

CULVERT NO.1 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
1	329+87.85	0.00 LT	3020223.57	806099.03
2	329+78.52	0.00 LT	3020225.91	806089.99
3	329+87.72	45.41 RT	3020211.01	806095.66
4	329+78.39	45.37 RT	3020213.43	806086.64
5	329+78.63	44.89 LT	3020236.61	806092.87
6	329+87.96	44.87 LT	3020234.18	806101.88

NOTES:

1. SEE SHEET 41 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'-0" MAXIMUM.
3. CONTRACTOR TO PERFORM DRIVE SAMPLE BORING (ITEM NO. 191.) FOR B-5 AS EARLY ACTION ITEM TO VERIFY SOIL CONDITIONS ASSUMED IN THE GEOTECHNICAL REPORT FOR CULVERT 1.
4. EXISTING 42" DIAMETER SEWER LINE TO BE MAINTAINED AND PROTECTED DURING CONSTRUCTION. PLEASE SEE SPECIAL PROVISION ITEM NO. 228. CLOSED CIRCUIT TV INSPECTION OF SEWER LINE FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

4 0 4 8
SCALE IN FEET

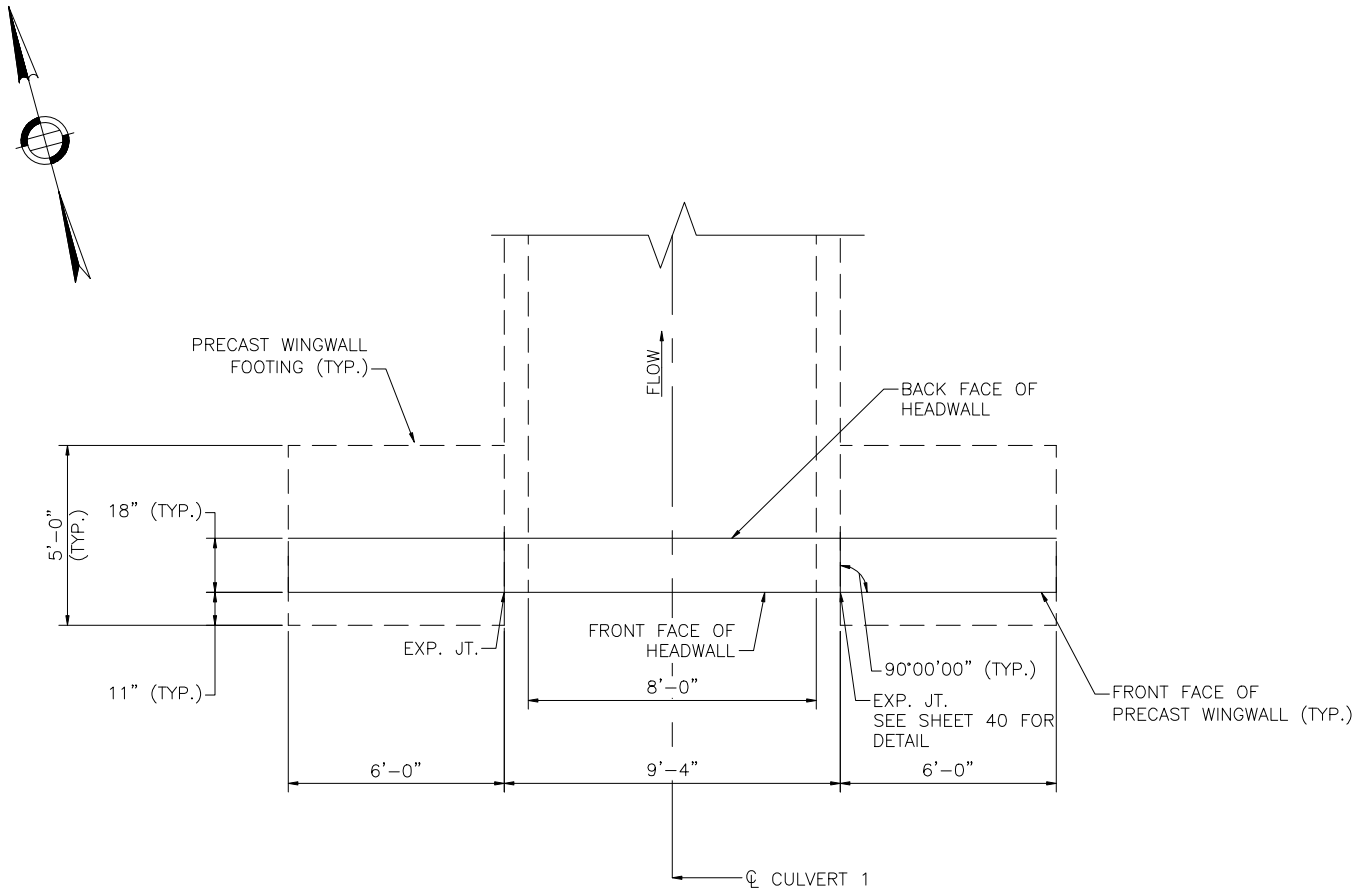
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	36	143
PROJECT FILE NO.	609211		

CULVERT 1 - HEADWALL ELEVATIONS
6/11/2024 WQC/NOI REVISIONS

Plotted on 11-Jun-2024 8:59 AM
609211_BR02.DWG

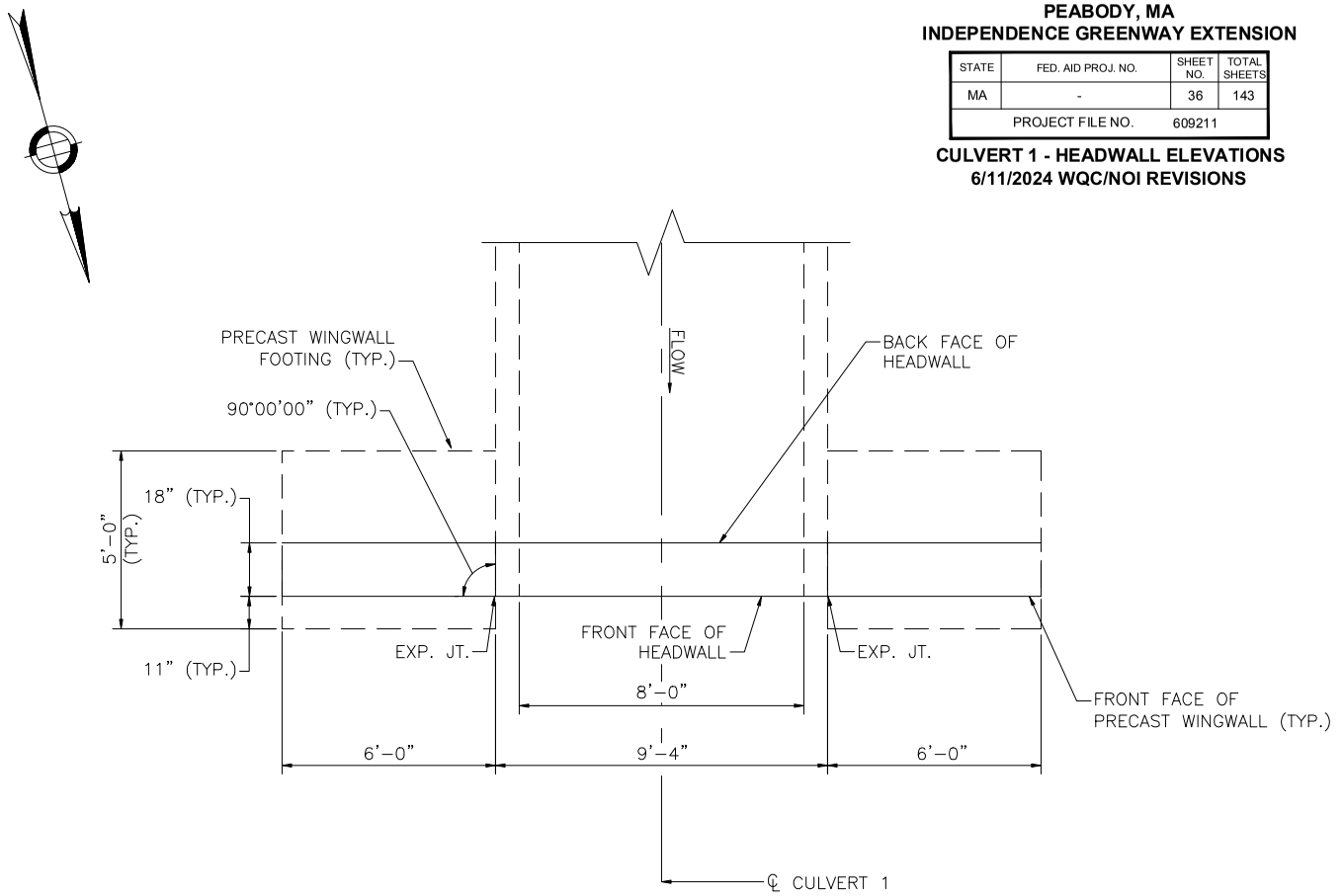
Proposal No. 609211-132091

A00831 - 42



CULVERT 1 – UPSTREAM PLAN

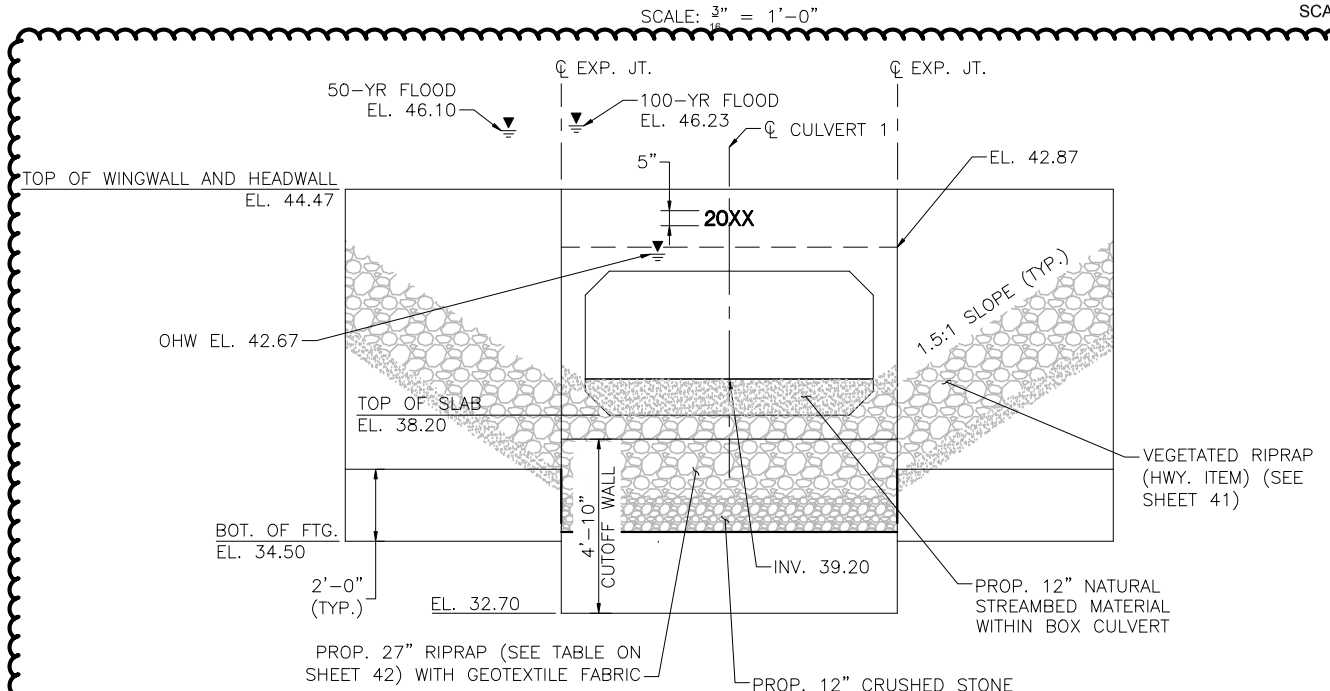
SCALE: 3/16" = 1'-0"



CULVERT 1 – DOWNSTREAM PLAN

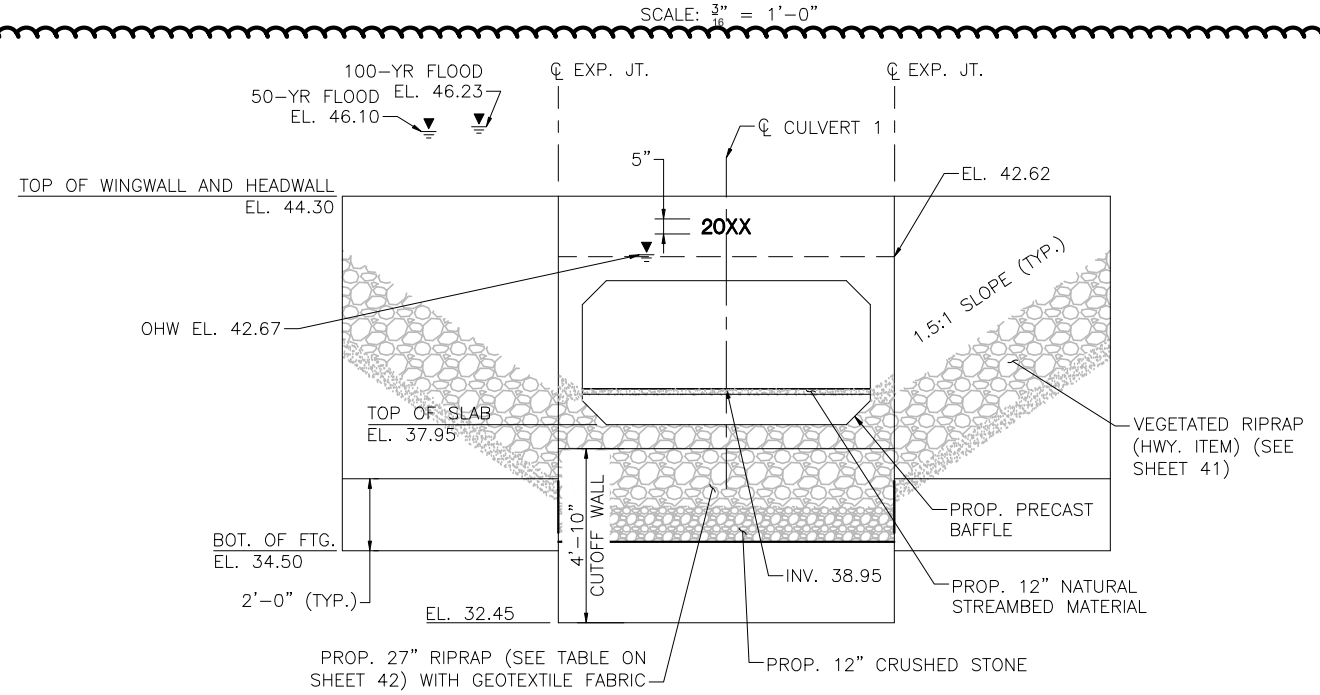
SCALE: 3/16" = 1'-0"

SCALE: 1" = 5'-4"



CULVERT 1 – UPSTREAM ELEVATION

SCALE: 3/16" = 1'-0"



CULVERT 1 – DOWNSTREAM ELEVATION

SCALE: 3/16" = 1'-0"

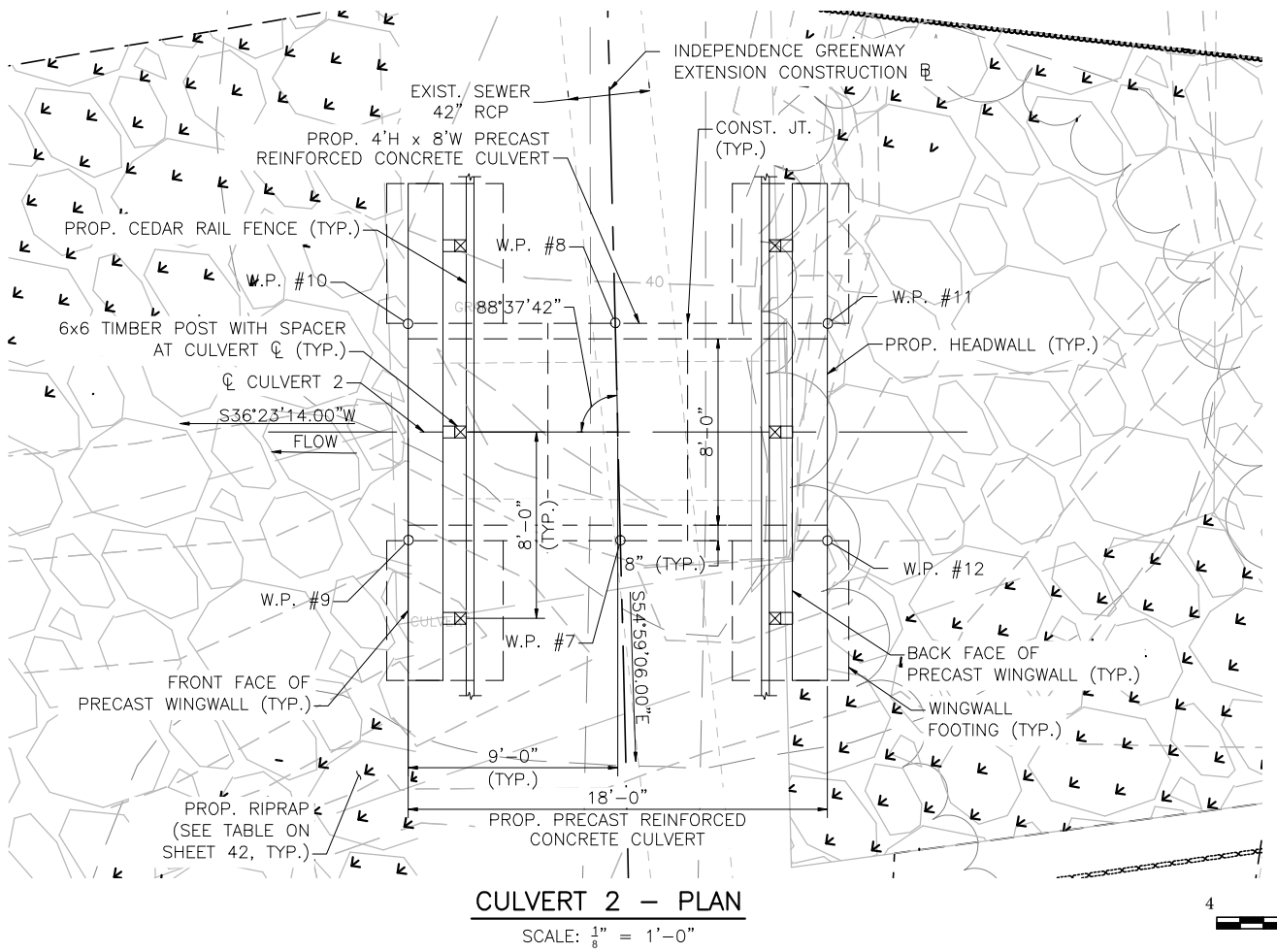
NOTES:

1. SEE SHEET 34 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	37	143
PROJECT FILE NO.	609211		

CULVERT 2 - PLAN AND LONGITUDINAL SECTION
6/11/2024 WQC/NOI REVISIONS

Proposal No. 609211-132091
600211_BR03.DWG Plotted on 11-Jun-2024 9:03 AM
A00831 - 43

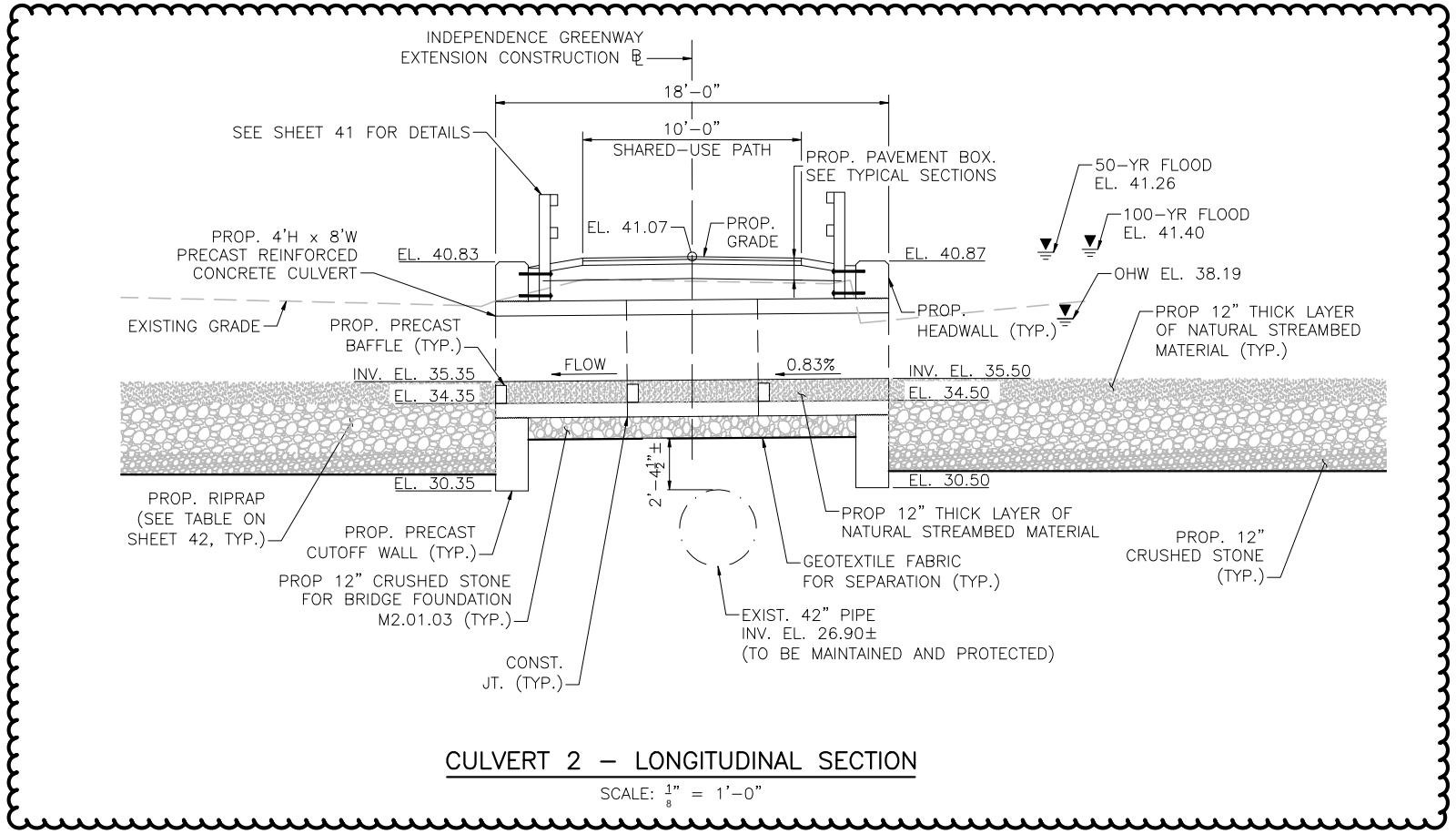


CULVERT 2 – PLAN

SCALE: 1/8" = 1'-0"

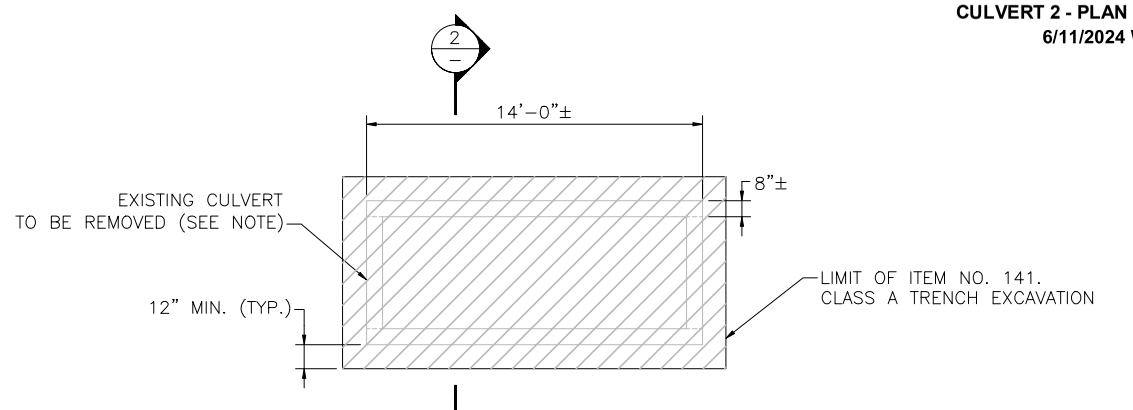
4 0 4 8

SCALE IN FEET



CULVERT 2 – LONGITUDINAL SECTION

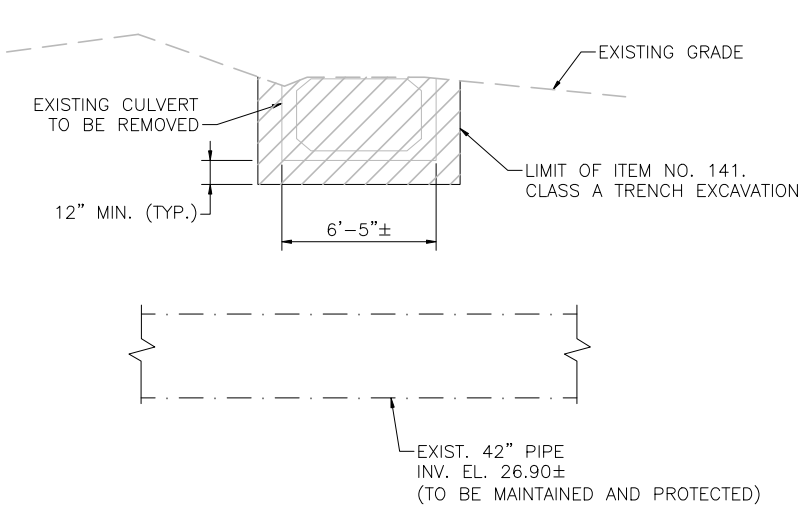
SCALE: 1/8" = 1'-0"



NOTE:
THE EXISTING CULVERT HAS FAILED AND THE REMNANTS REMAIN IN THE CHANNEL. ALL THE EXISTING REMNANTS OF THE EXISTING CULVERT TO BE REMOVED FROM THE CHANNEL. REMOVAL SHALL BE MEASURED AND PAID UNDER ITEM NO. 141. CLASS A TRENCH EXCAVATION.

CULVERT 2 – DEMOLITION PLAN

SCALE: 1/8" = 1'-0"



SECTION 2 –

SCALE: 1/8" = 1'-0"

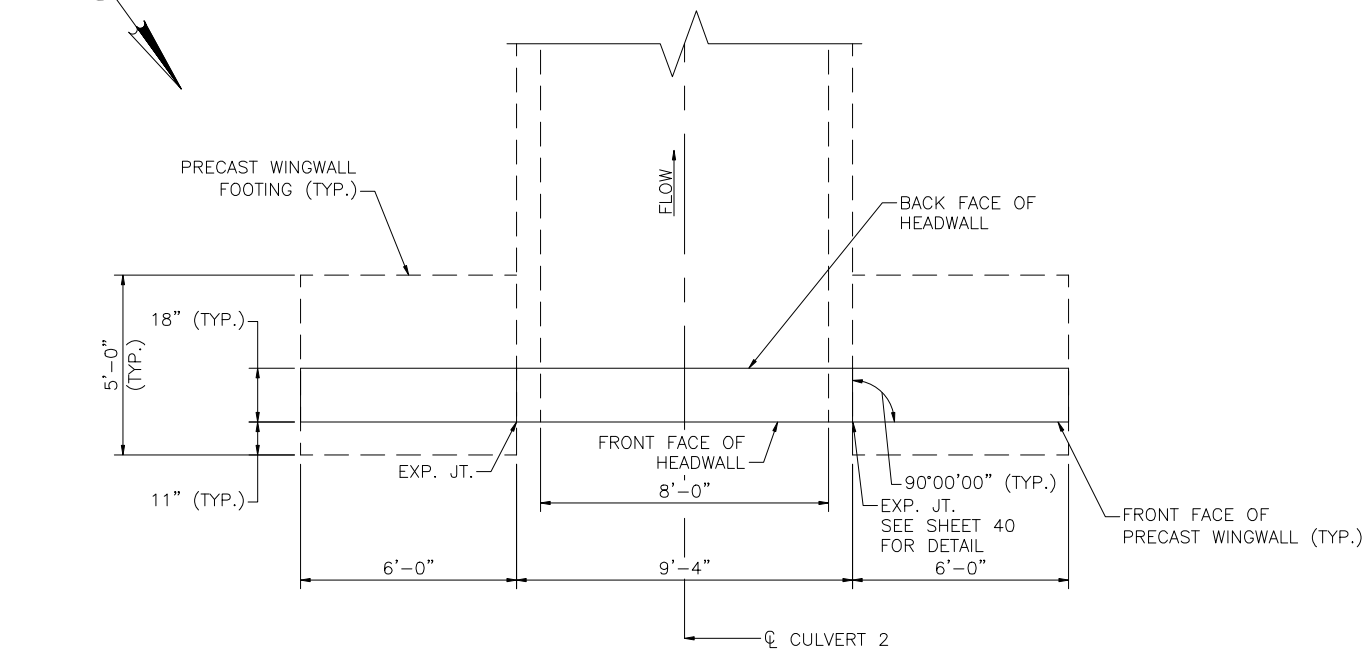
CULVERT NO.2 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
7	346+24.36	0.00 LT	3019677.22	807634.33
8	346+15.02	0.00 LT	3019682.58	807626.68
9	346+9.11	9.11 RT	3019677.35	807634.15
10	346+14.81	8.89 RT	3019682.70	807626.51
11	346+15.24	9.11 LT	3019689.92	807632.09
12	346+24.57	8.89 LT	3019677.10	807634.50

NOTES:
1. SEE SHEET 41 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'–0" MAXIMUM.
3. EXISTING 42" DIAMETER SEWER LINE TO BE MAINTAINED AND PROTECTED DURING CONSTRUCTION. PLEASE SEE SPECIAL PROVISION ITEM NO. 228. CLOSED CIRCUIT TV INSPECTION OF SEWER LINE FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

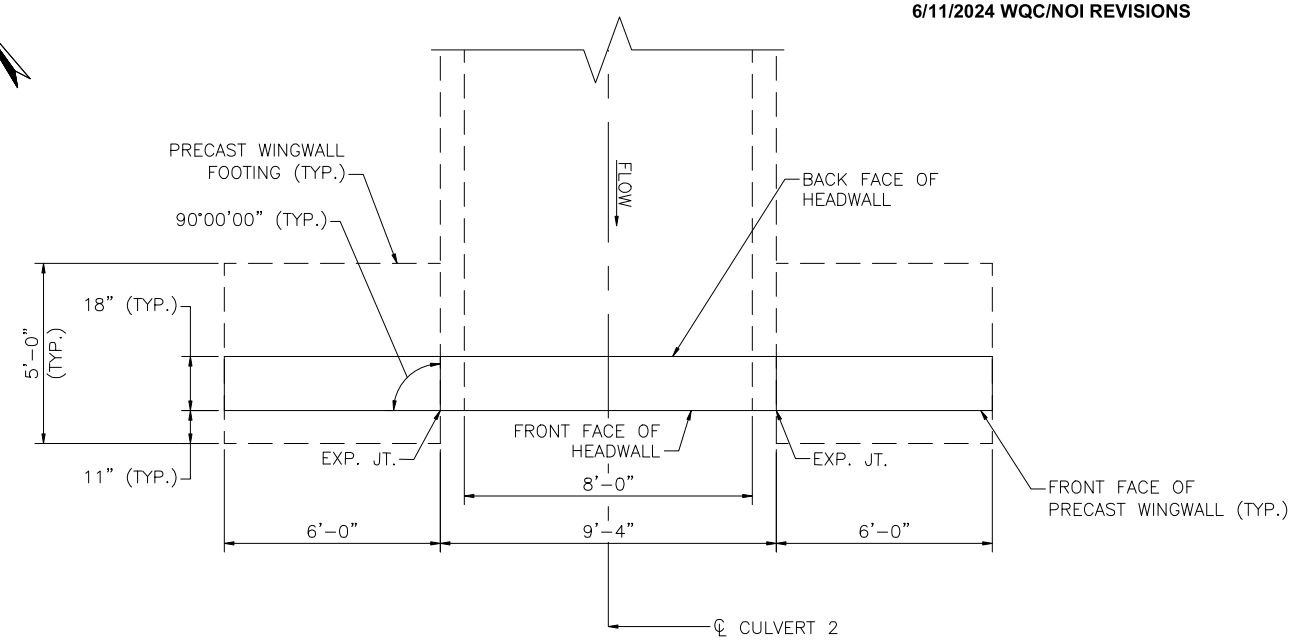
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	38	143
PROJECT FILE NO.	609211		

CULVERT 2 - HEADWALL ELEVATIONS
6/11/2024 WQC/NOI REVISIONS

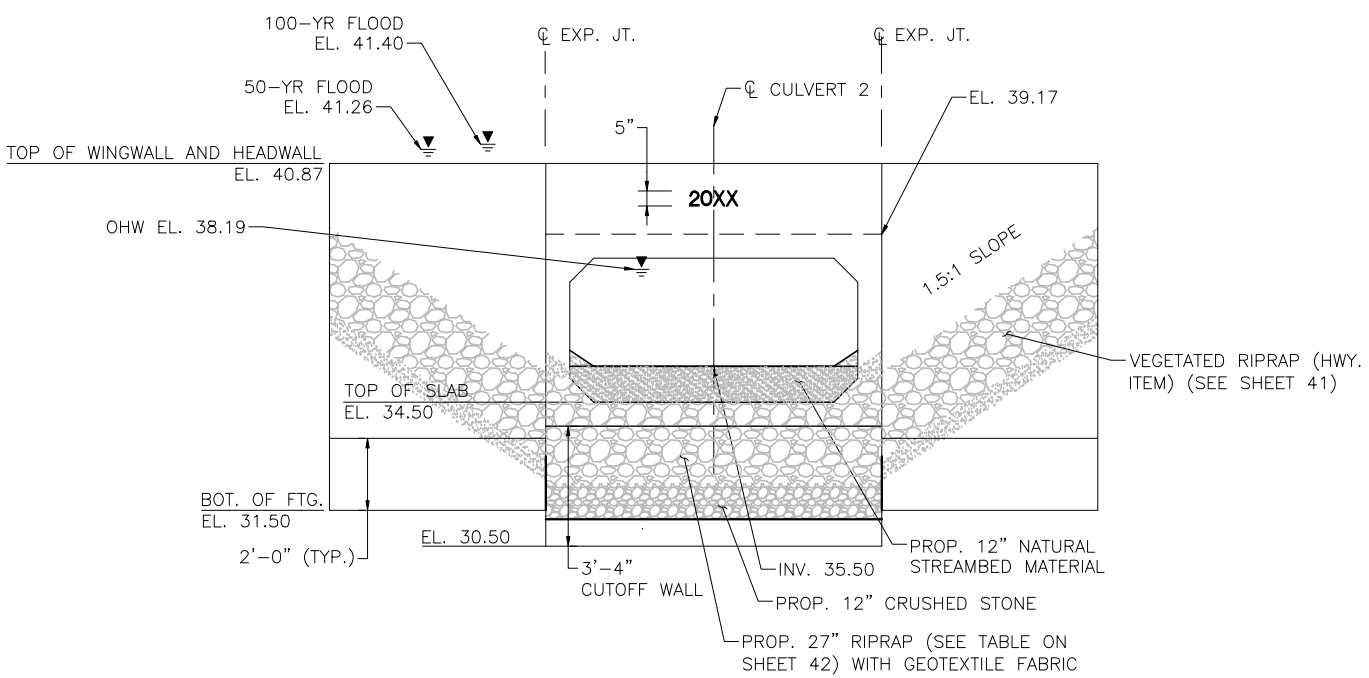


CULVERT 2 – UPSTREAM PLAN
SCALE: $\frac{3}{16}$" = 1'–0"

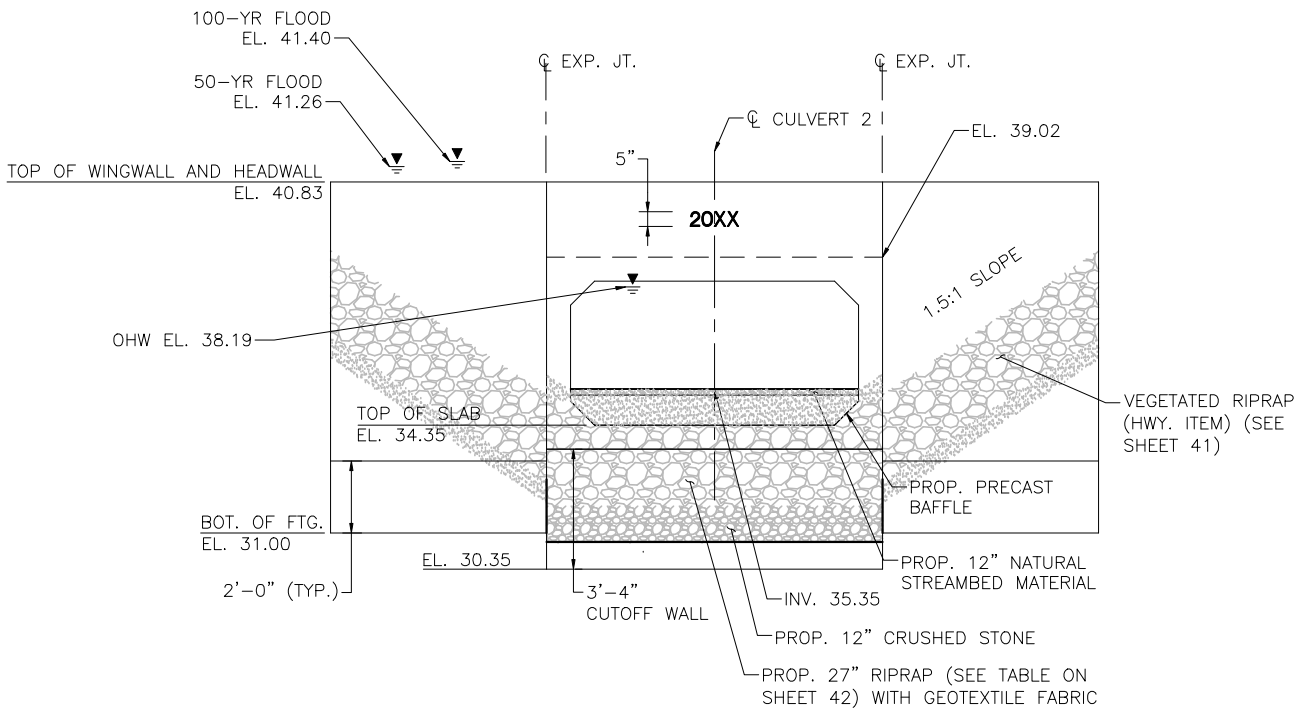
0 5'-4" 13'-4"
SCALE: 1" = 5'-4"



CULVERT 2 – DOWNSTREAM PLAN
SCALE: $\frac{3}{16}$" = 1'–0"



CULVERT 2 – UPSTREAM ELEVATION
SCALE: $\frac{3}{16}$" = 1'–0"



CULVERT 2 – DOWNSTREAM ELEVATION
SCALE: $\frac{3}{16}$" = 1'–0"

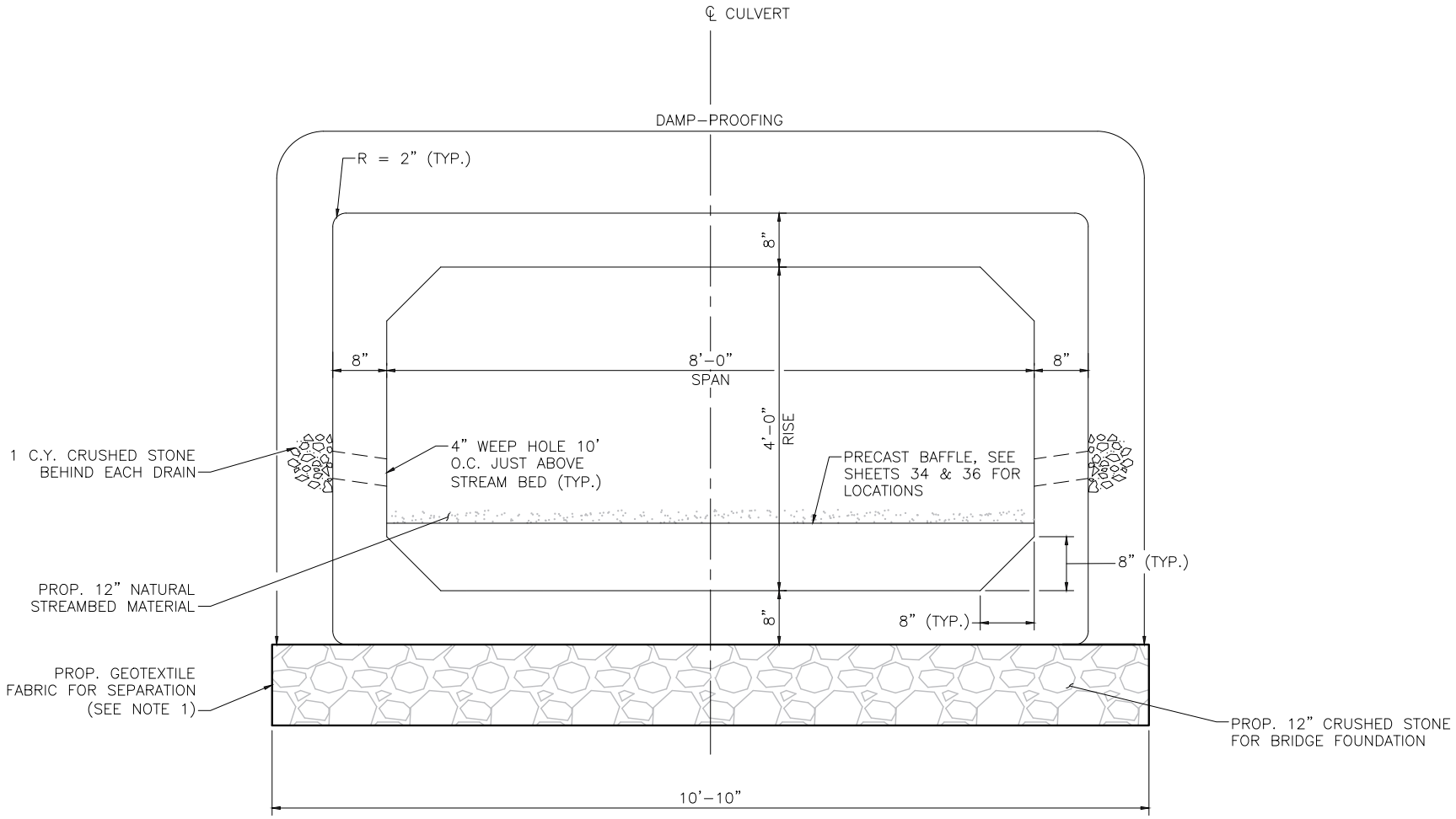
NOTES:

1. SEE SHEET 36 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

Proposal No. 609211-132091
600211_BR04.DWG Plotted on 11-Jun-2024 9:04 AM
A00831 - 44

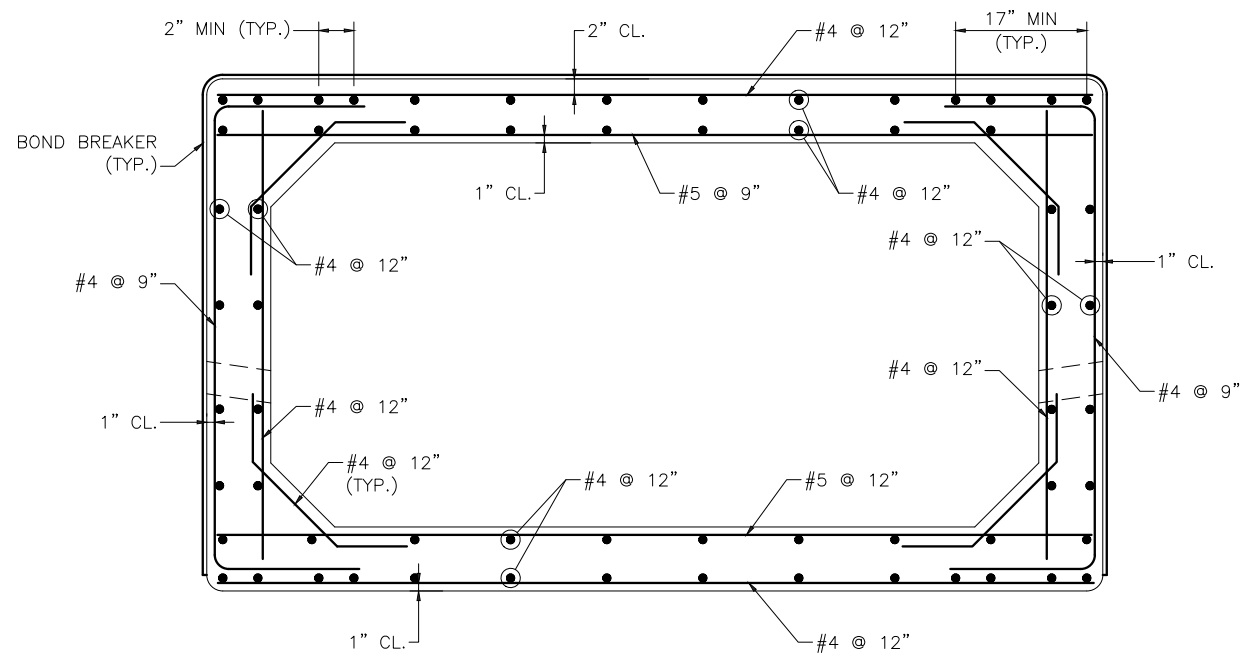
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	38	140
PROJECT FILE NO.	609211		

BOX CULVERT SECTIONS



BOX CULVERT TYPICAL SECTION

SCALE: 1" = 2'–0"



NOTE:

REINFORCING SHOWN IS CONCEPTUAL MINIMUM REQUIRED REINFORCEMENT FOR A DESIGN LIVE LOADING OF AASHTO HL–93 WITHOUT THE LANE LOAD. FINAL REINFORCEMENT SHALL BE DESIGNED AND DETAILED BY THE CONTRACTOR.

BOX CULVERT REINFORCING DETAILS

SCALE: 1" = 2'–0"

NOTES:

1. PROPOSED GEOTEXTILE FABRIC TO ENVELOP LIMITS OF 12" CRUSHED STONE FOR BRIDGE FOUNDATION WITH MINIMUM 2'–0" OVERLAP AT SEAM.
2. ALL CONCRETE TO BE 5000 PSI, ¾ IN, 685 HP CEMENT CONCRETE.
3. THE MAXIMUM FACTORED BEARING PRESSURE = 2.33 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. FACTORED BEARING RESISTANCE = 5.00 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.
4. TRANSVERSE REINFORCING SHALL BE PLACED NORMAL TO THE ℄ OF THE CULVERT.
5. ALL REINFORCING SHALL BE GRADE 60 EPOXY COATED.

1 0 1 2

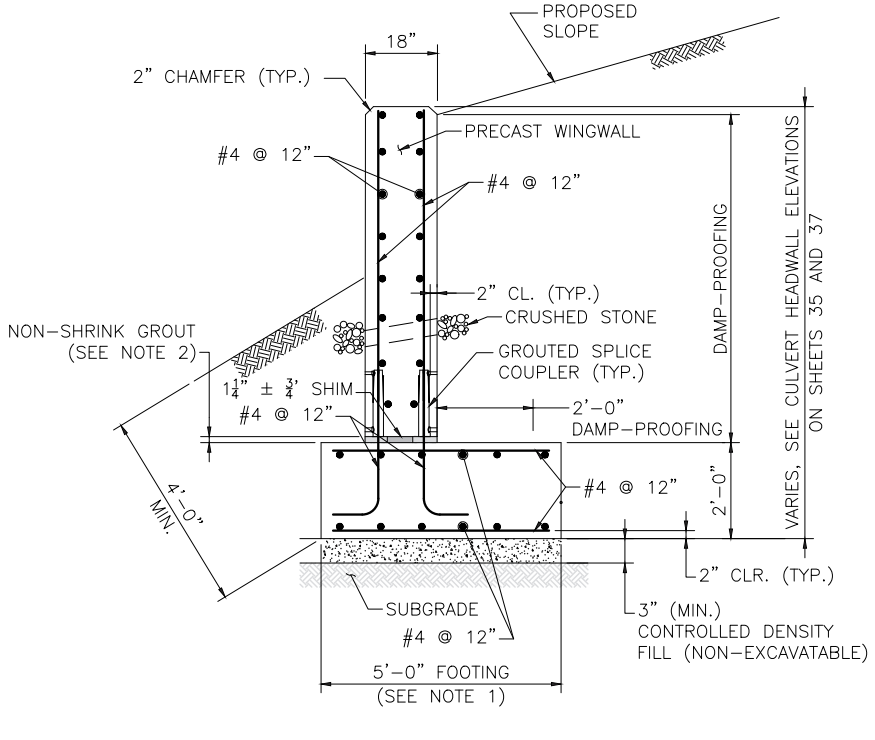
SCALE IN FEET

Proposal No. 609211-132091

A00831 - 45

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	39	140
PROJECT FILE NO.	609211		

HEADWALL AND MISCELLANEOUS DETAILS



NOTES:

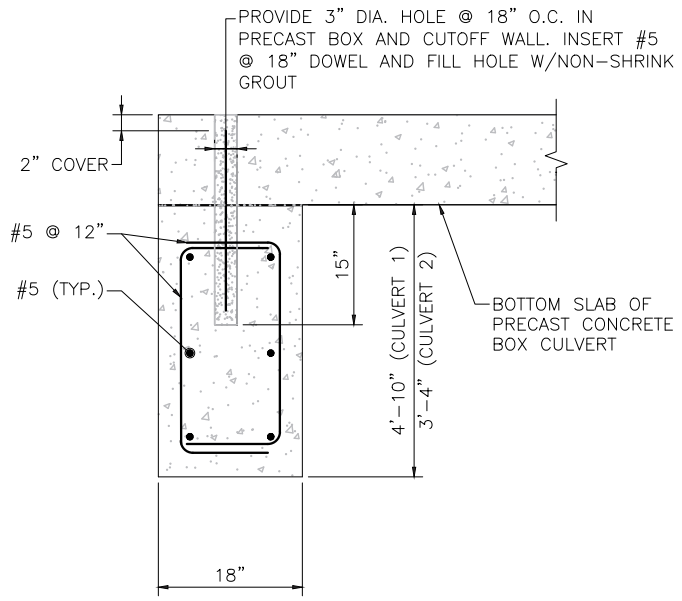
1. THE CONTRACTOR MAY ELECT TO USE PRECAST FOOTINGS, OR MODULAR WINGWALLS IN LIEU OF PRECAST WINGWALL STEMS DEPICTED HERE. DESIGN OF WINGWALLS AND FOOTINGS WHETHER PRECAST OR MODULAR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. PRE-BED PRECAST ELEMENT WITH NON-SHRINK GROUT WITH THICKNESS MORE THAN SHIM STACK.
3. TIMBER RAILING POST ATTACHMENT NOT SHOWN FOR CLARITY, SEE DETAIL ON THIS SHEET.

TYPICAL PRECAST WINGWALL SECTION

SCALE: ¼" = 1'-0"

2 0 2 4

SCALE IN FEET

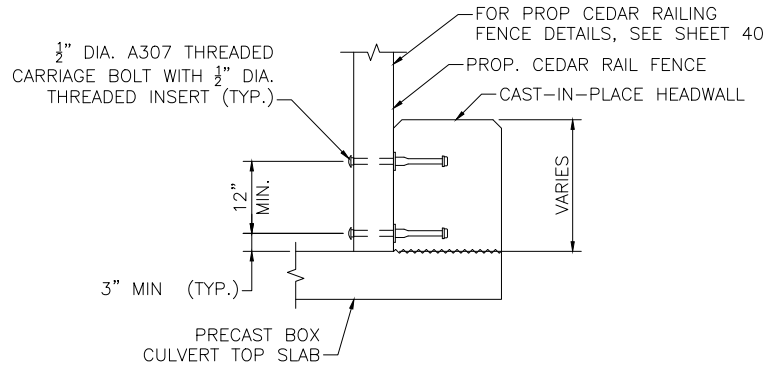


CUTOFF WALL DETAIL

SCALE: 1" = 2'-0"

1 0 1 2

SCALE IN FEET

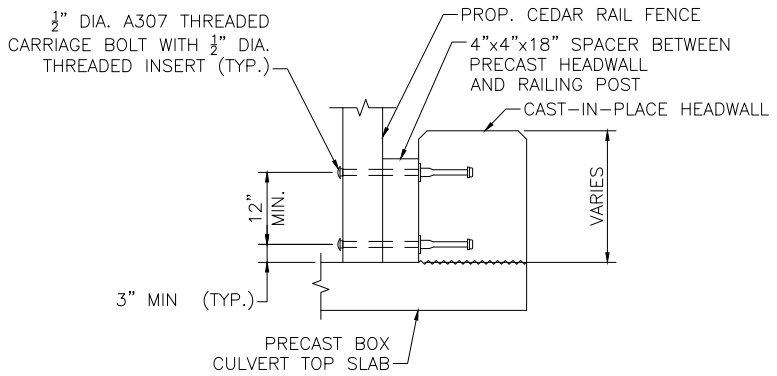


NOTES:

1. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR

CULVERT 1 HEADWALL – POST ATTACHMENT DETAIL

SCALE: ¾" = 1'-0"

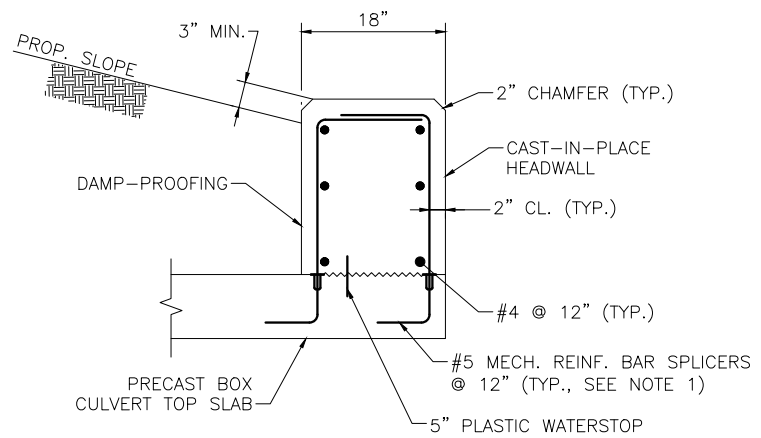


NOTES:

1. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR
3. PROPOSED TIMBER SPACER TO BE PROVIDED AND CUT ALONG SKEW AS NEEDED TO PROVIDE FLUSH ATTACHMENT OF POST.

CULVERT 2 HEADWALL – POST ATTACHMENT DETAIL

SCALE: ⅜" = 1'-0"

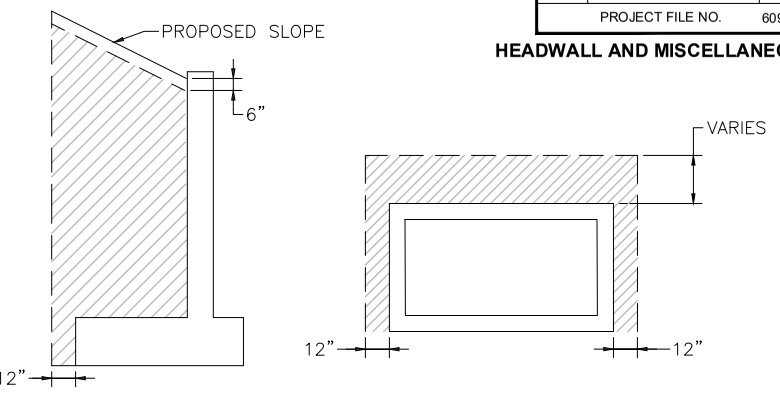


NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 ∫∫ DOWELS, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

TYPICAL CULVERT HEADWALL REINFORCEMENT DETAIL

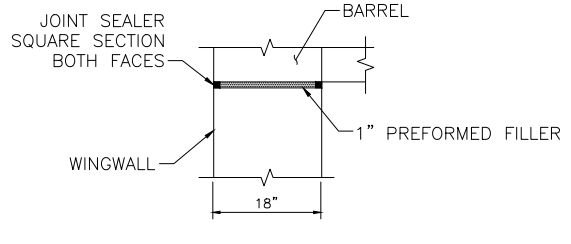
SCALE: 1" = 2'-0"



NOTE:
HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

SCALE: ¼" = 1'-0"

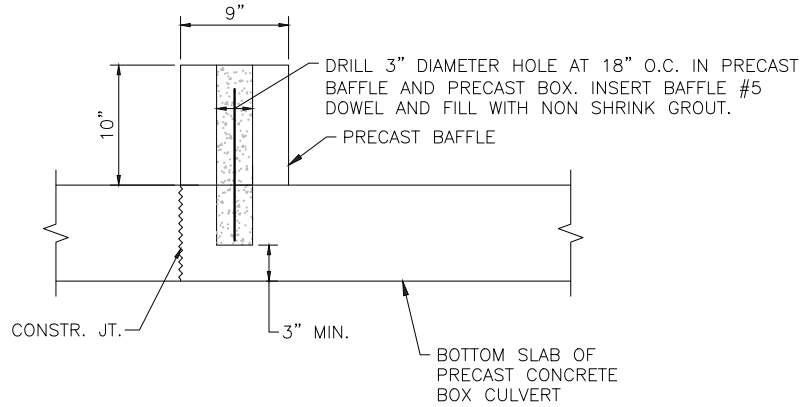


TYPICAL CULVERT EXPANSION JOINT DETAIL

SCALE: ⅜" = 1'-0"

1'-4" 0 1'-4" 2'-8"

SCALE IN FEET



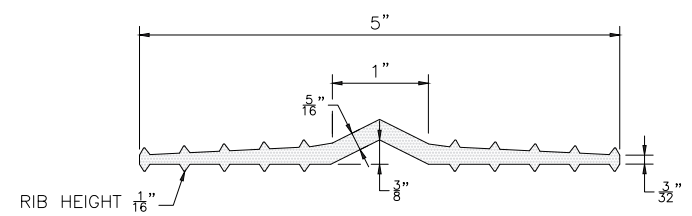
NOTE:
PRECAST BAFFLE AND ATTACHMENT MATERIALS ARE CONSIDERED INCIDENTAL TO THE CULVERT ITEMS.

TYPICAL PRECAST BAFFLE DETAIL

SCALE: ¾" = 1'-0"

8" 0 8" 1-4"

SCALE IN FEET



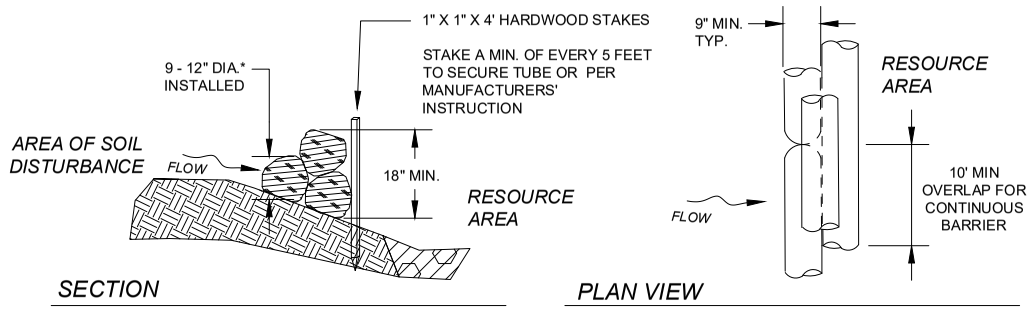
5" WATERSTOP

NOT TO SCALE

Proposal No. 609211-132091
A00831 - 46

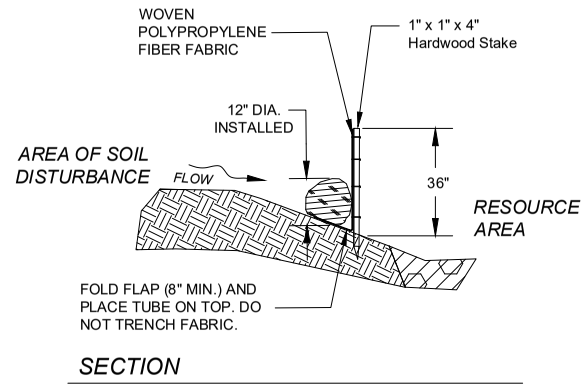
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	40	142
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 1



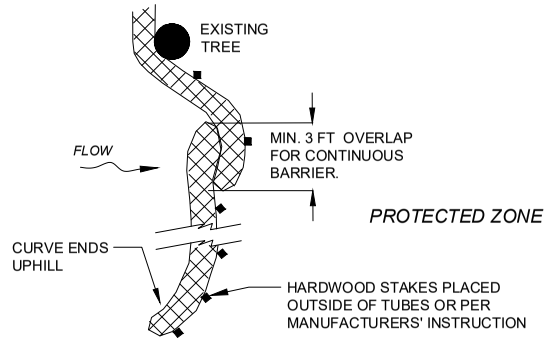
COMPOST FILTER TUBE BERM (SLOPES 2:1 OR STEEPER)

NOT TO SCALE



COMPOST FILTER TUBE & SILT FENCE

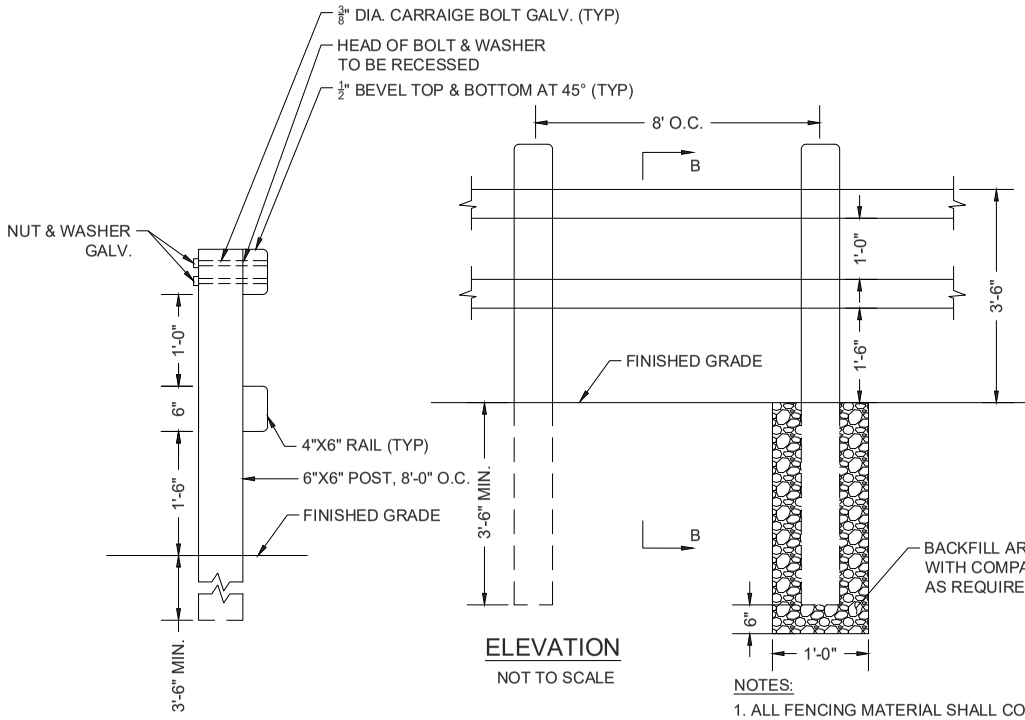
NOT TO SCALE



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

PLAN VIEW



SECTION B-B

NOT TO SCALE

ELEVATION

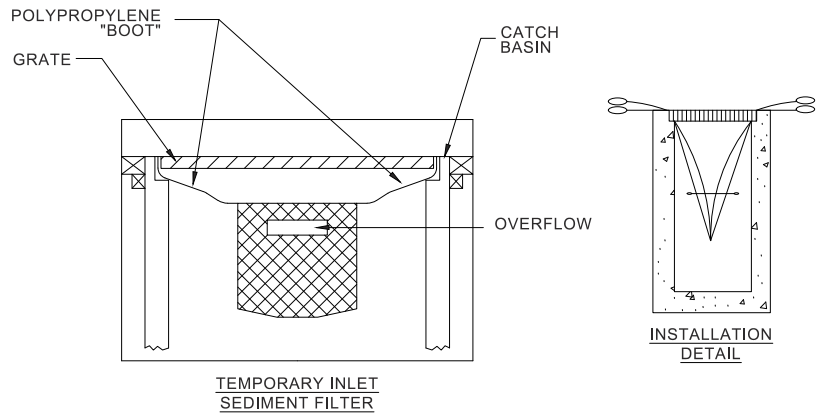
NOT TO SCALE

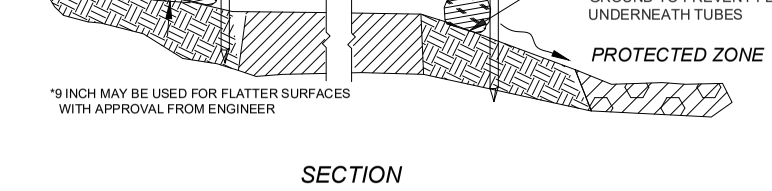
WOOD RAIL FENCE

NOT TO SCALE

NOTES:

1. ALL FENCING MATERIAL SHALL CONFORM TO THE STANDARD SPECIFICATIONS & SPECIAL PROVISIONS INCLUDED IN THE CONTRACT DOCUMENTS.
2. MOUNTING OF UPPER RAIL IS SHOWN ON SECTION B-B. MOUNT LOWER RAIL SIMILARLY.

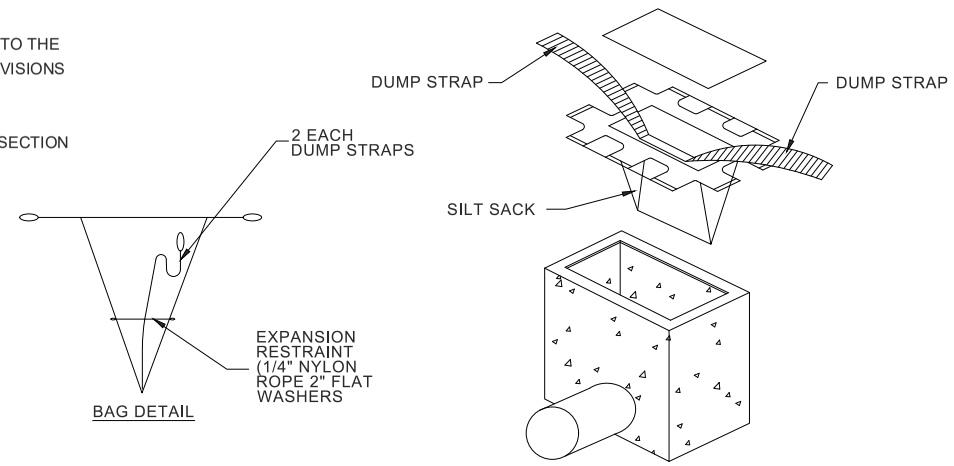




SECTION

SEDIMENT BARRIER - COMPOST FILTER TUBE

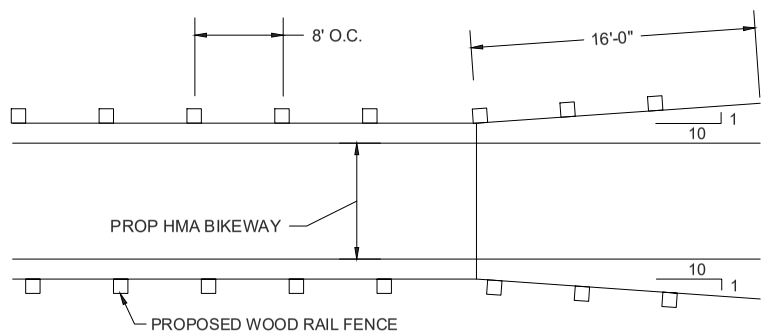
NOT TO SCALE



NOTE 1:
TEMPORARY INLET SEDIMENT FILTER TO BE INSTALLED ON ALL PAVED CATCH BASINS OR STORM INLETS.

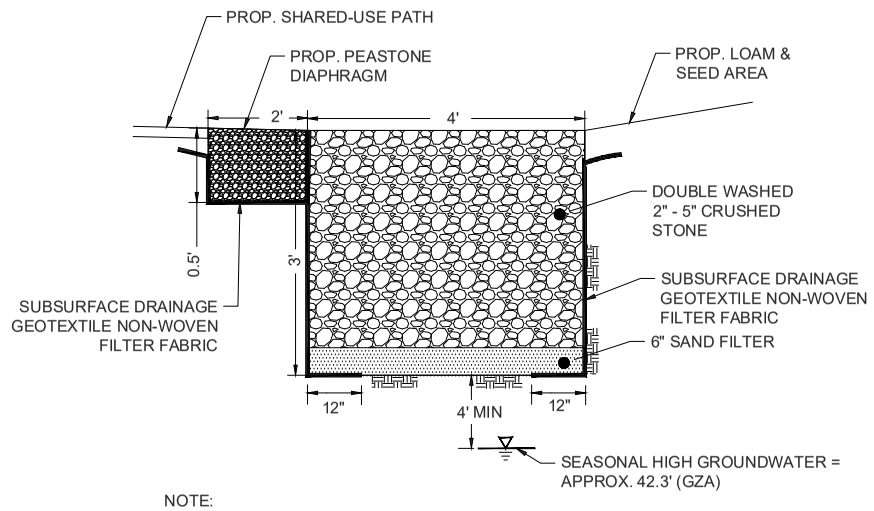
INLET PROTECTION SILT SACK

NOT TO SCALE



WOOD RAIL FENCE FLARED-END TREATMENT

NOT TO SCALE



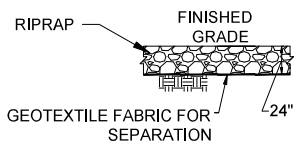
NOTE:

1. GROUNDWATER ELEVATION TAKEN AT 11:45 AM ON JANUARY 3, 2019

INFILTRATION TRENCH SECTION

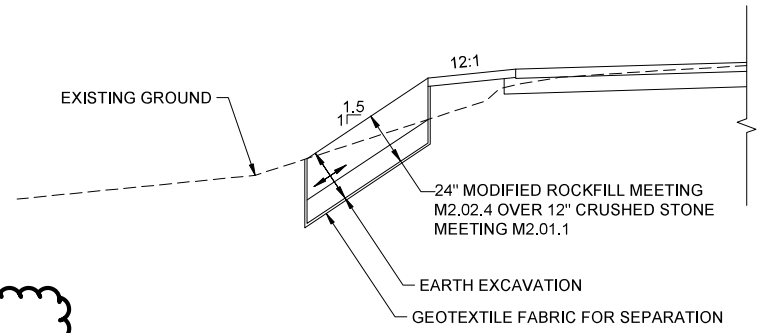
NOT TO SCALE

Proposal No. 609211-132091
A00831 - 47



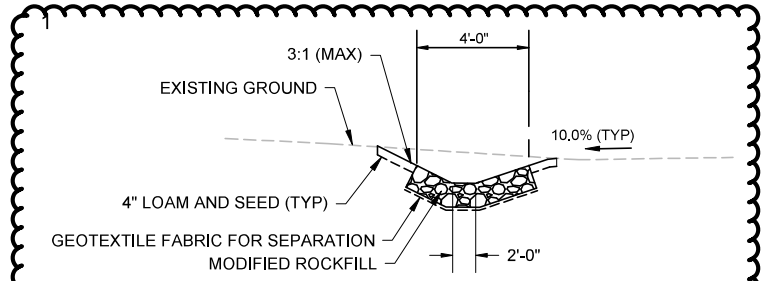
ABUTMENT ARMORING RIPRAP DETAIL

NOT TO SCALE



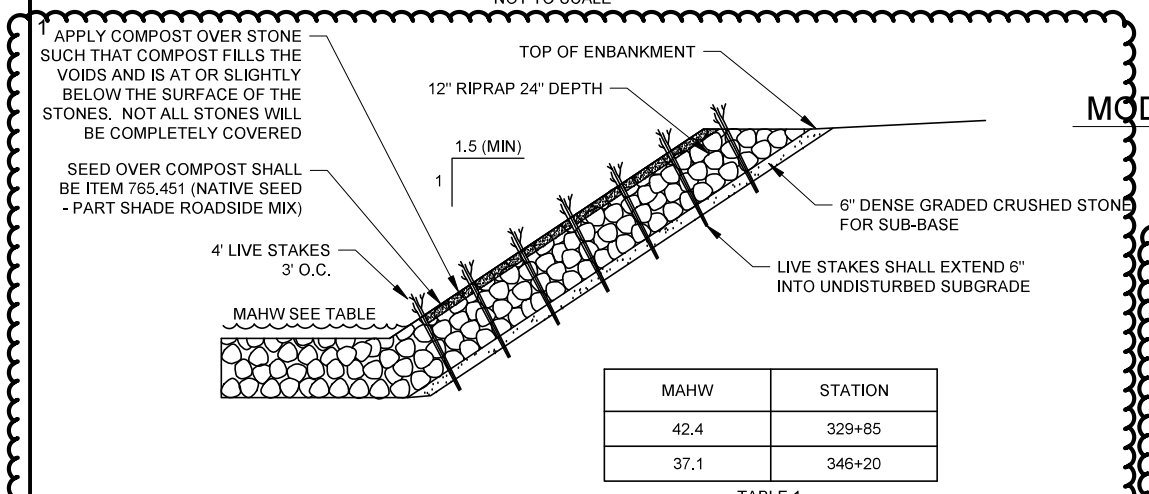
MODIFIED ROCKFILL FOR SLOPE STABILIZATION

NOT TO SCALE



STONE WATERWAY

NOT TO SCALE



MAHW	STATION
42.4	329+85
37.1	346+20

TABLE 1

NOTES:

1. DRIVE REBAR INTO VOIDS BETWEEN RIP RAP.
2. HOLES SHALL EXTEND 12" BELOW RIP RAP INTO SUBGRADE OR GRANULAR FILL LAYER.
3. LIVE STAKES SHALL BE PLACED IN HOLES SO THAT THEY EXTEND 6" INTO SUBGRADE.
4. LIVE STAKES SHALL BE LOCATED APPROXIMATELY 3 FEET ON CENTER STARTING 6" ABOVE MEAN HIGH WATER.

LIVE STAKES PLANT LIST				
QTY	BOTANICAL NAME	COMMON NAME	PLANT SIZE	SPACING
100	CORNUS RACEMOSA	GREY DOGWOOD	4 FEET LENGTH	3' O.C
100	SALIX DISCOLOR	PUSSY WILLOW	4 FEET LENGTH	3' O.C
100	CORNUS SERICEA	REDOSIER DOGWOOD	4 FEET LENGTH	3' O.C

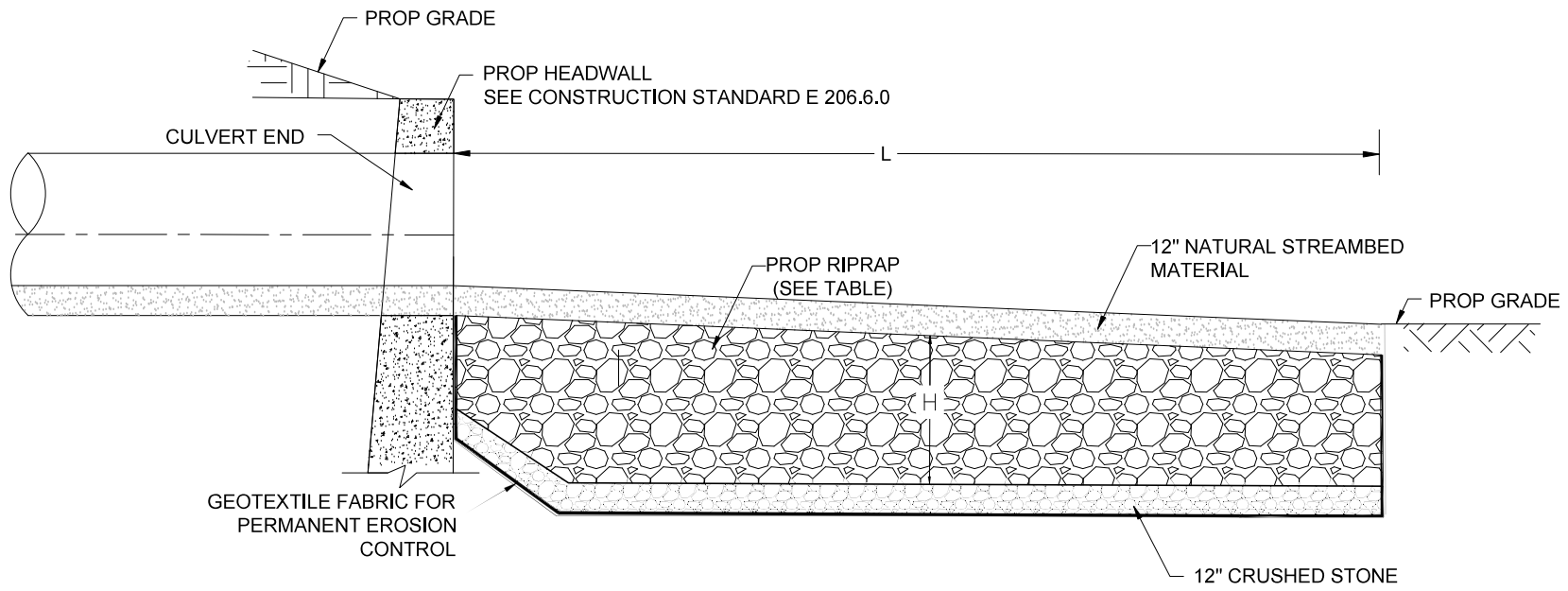
COMPOST AND SEED OVER VEGETATED RIPRAP

NOT TO SCALE

FHWA CLASS	LENGTH OF APRON L (FEET)	DEPTH OF APRON H (FEET)	WIDTH OF APRON (FEET)	MASSDOT RIPRAP SIZE	CULVERTS AT STATION
III	AS SHOWN IN PLANS	2.25	AS SHOWN IN PLANS	M2.02.0	329+85
II	10.0	2.0	13.5	M2.02.3	340+10
II	8.0	2.0	11.0	M2.02.3	342+25
III	AS SHOWN IN PLANS	2.25	AS SHOWN IN PLANS	M2.02.0	346+20
II	10.0	2.0	5.0	M2.02.3	358+51

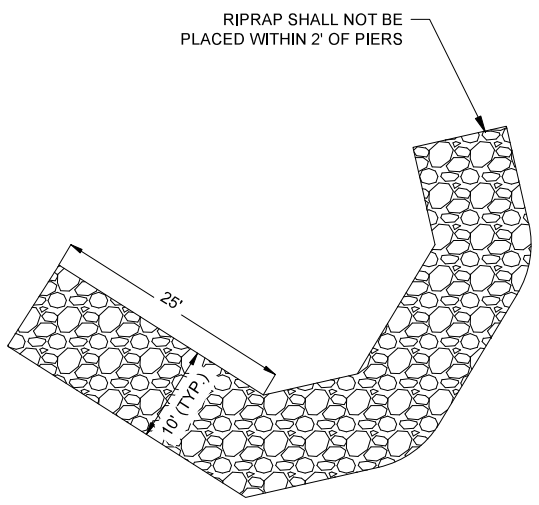
SOURCE:
FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 23
MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES

RIPRAP CLASSES AND APRON DIMENSIONS



RIPRAP APRON AT INLETS AND OUTLETS OF CULVERTS

NOT TO SCALE



PLAN
SCALE : 1"=10'

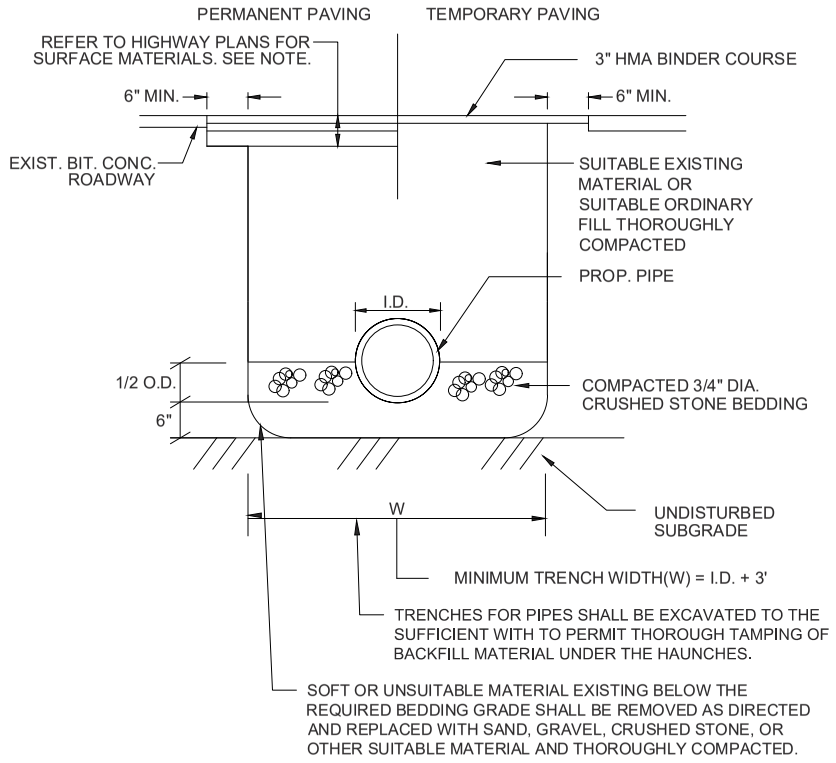
0 10 20 30 40
SCALE: 1" = 10'

ABUTMENT ARMORING RIPRAP PLAN

Proposal No. 609211-132091
SHT014_HD(CONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG
Plotted on 11-Jun-2024 9:14 AM
A00831 - 48

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	42	142
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 3

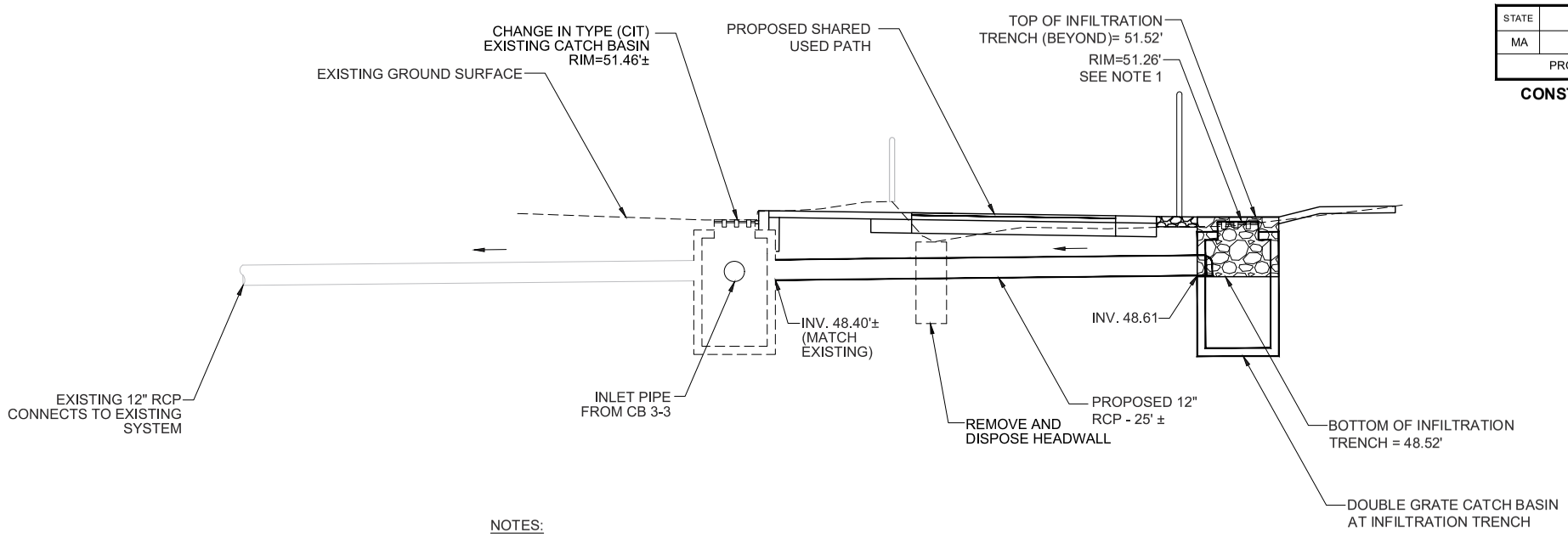


TYPICAL PIPE TRENCH

NOT TO SCALE

NOTE:

1. PERMANENT PAVING TO BE USED IN ALL AREAS OF MILL AND OVERLAY. MATERIALS SHALL MATCH CORRESPONDING FULL DEPTH SECTION. REFER TO TYPICAL ROADWAY SECTIONS.
2. HMA FOR PATCHING TO BE USED IN AREAS OF FUTURE FULL DEPTH CONSTRUCTION.
3. EXISTING MATERIAL OBTAINED FROM EXCAVATION THAT IS DETERMINED TO BE SUITABLE, AND APPROVED BY THE ENGINEER, OR SATISFACTORY BORROW SHALL BE USED. BACKFILL SHALL BE PLACED IN LAYERS NO MORE THAN 6 INCHES IN DEPTH AND THOROUGHLY COMPACTED. BACKFILLING TO A POINT 2 FEET OVER THE PIPE SHALL CONTAIN NO STONES LARGER THAN 3 INCHES.



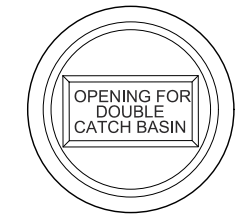
NOTES:

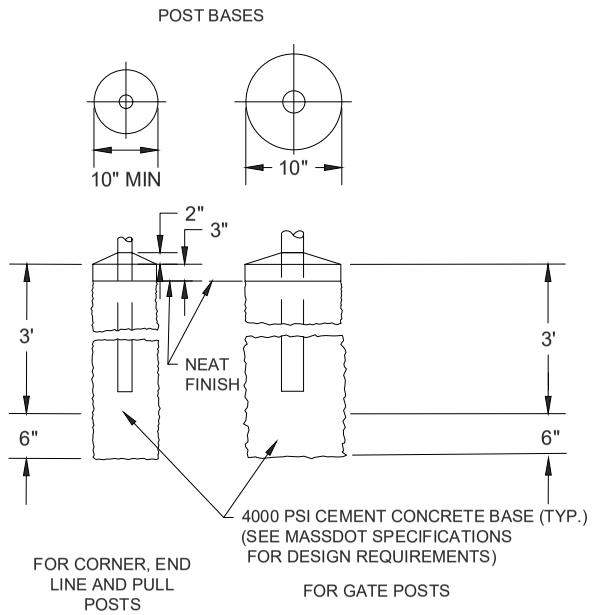
1. THE CRUSHED STONE SHALL BE PLACED AT A 3:1 SLOPE FROM THE GRATE TO THE TOP OF THE INFILTRATION TRENCH TO PREVENT DEBRIS FROM ENTERING THE GRATE

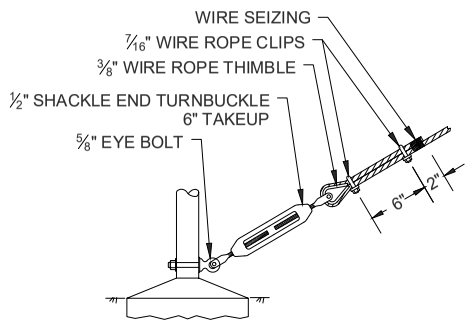
INFILTRATION TRENCH TO CULVERT DETAIL

SCALE: 1" = 8'

0 4 8 12 16





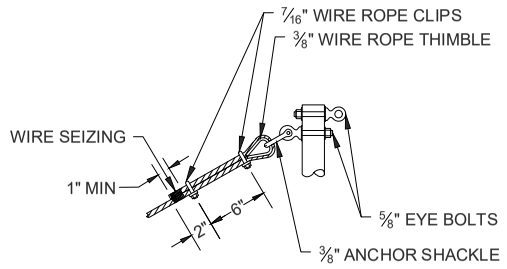


FOR FASTENING TO BASE OF POST

NOTE:

1. FOR EYE BOLT INSTALLATION THROUGH PIPE SECTIONS, USE 2 WASHERS ON "SHOULDER SIDE" AND 1 WASHER WITH LOCK WASHER ON "NUT SIDE" OF POSTS.

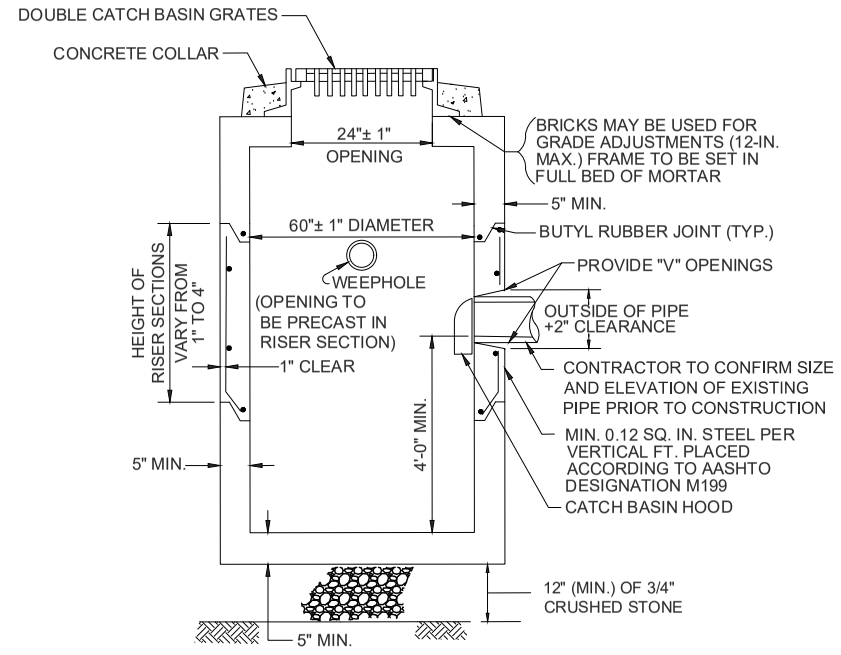
DETAILS OF CABLE ATTACHMENTS



FOR END PULL POST

CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS AND POST BASES

NOT TO SCALE



DOUBLE GRATE CATCH BASIN

NOT TO SCALE

Proposal No. 609211-132091
A00831 - 49

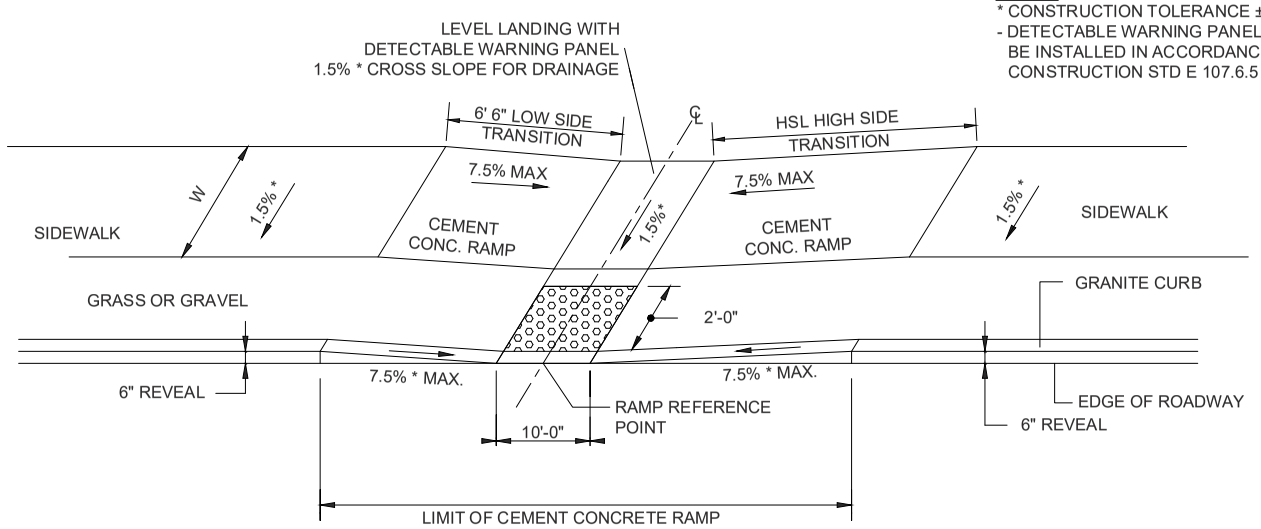
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	43	142
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 4

Proposal No. 609211-132091

A00831 - 50

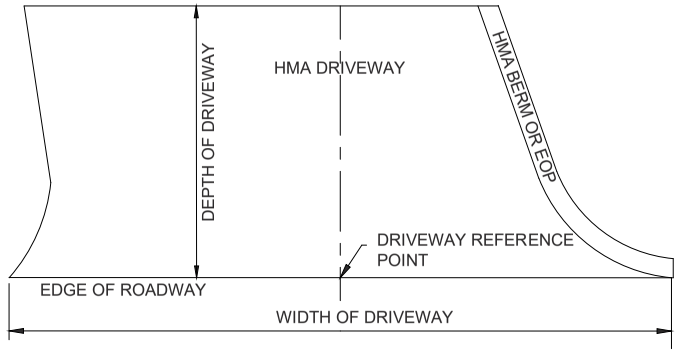
NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5



CURB CUT RAMP (NARROW SIDEWALK WITH GRASS STRIP)

NOT TO SCALE

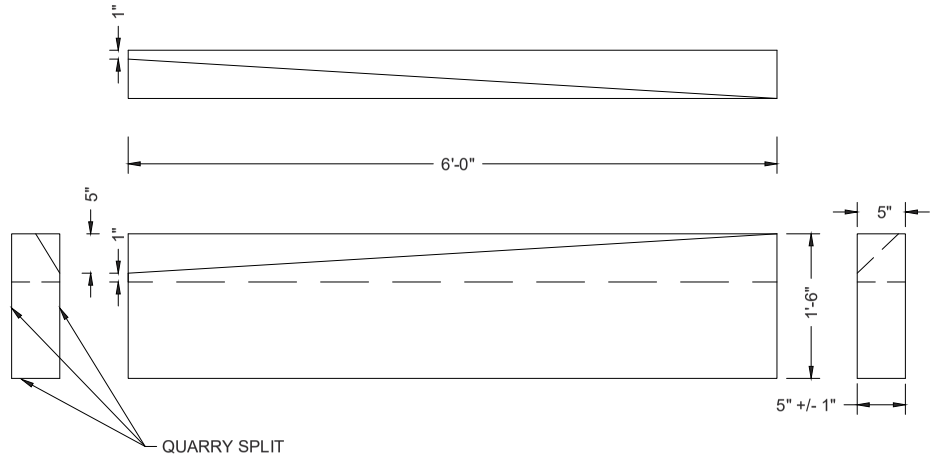
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		WIDTH OF RAMP (FT.)	WIDTH OF SIDEWALK (W) (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
5	NORTHSHORE RD	304+13	74.30 LT	5'-0"	5'-0"	+4.60	-	-
3	ESSEX CENTER DR	302+10	7.67 RT	10'-0"	10'-0"	-3.42	6'-6"	14'-0"
1	ESSEX CENTER DR	292+48.08	8.72 RT	10'-0"	10'-0"	-1.71	9'-0"	6'-6"

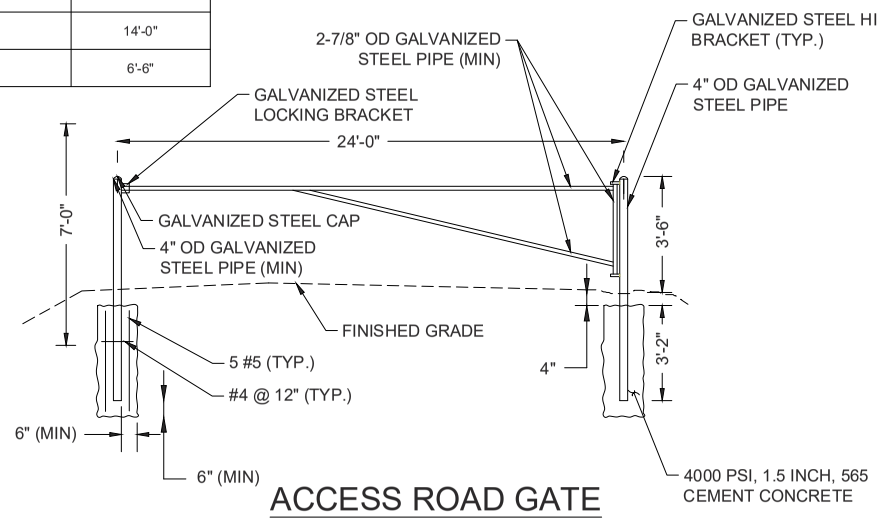


HMA DRIVEWAY WITHOUT SIDEWALK

NOT TO SCALE

CURB CUT DRIVEWAY DETAIL TABLE			
STATION	OFFSET	WIDTH OF DRIVEWAY	DEPTH OF DRIVEWAY
290+16.30	10.90 LT	31'-7"	10'-0"

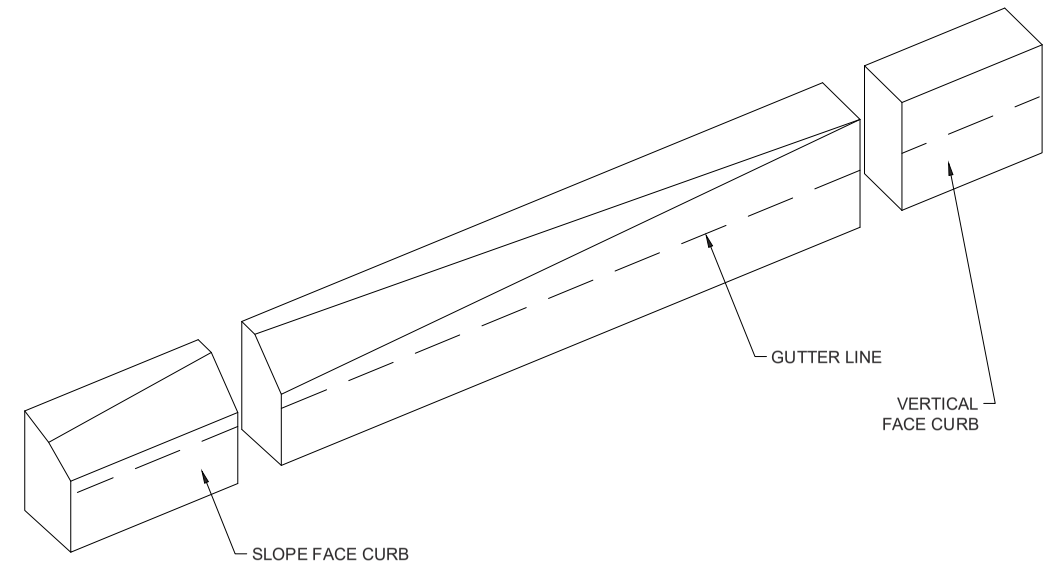




ACCESS ROAD GATE

NOT TO SCALE

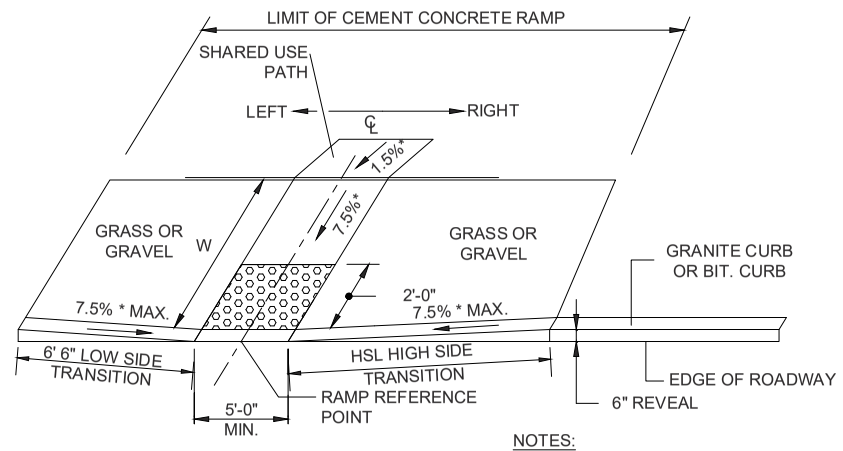
NOTE:
1. ALL GALVANIZED STEEL SHALL MEET GRADE B, Fy = 33,000 KSI AND SHALL BE IN ACCORDANCE WITH SUBSECTION 960.
2. THE GALVANIZED STEEL HINGE BRACKET AND GALVANIZED STEEL LOCKING BRACKET SHALL BE $\frac{1}{4}$" (MIN) COLD ROLLED GALVANIZED STEEL.
3. VENT HOLES SHALL BE INSTALLED IN GALVANIZED TUBES, PER MANUFACTURER'S RECOMMENDATIONS.
4. CONCRETE SHALL MEET THE REQUIREMENTS OF SUBSECTION 901 OF THE STANDARD SPECIFICATIONS.
5. STEEL REINFORCEMENT SHALL BE GRADE 60 REINFORCING LEVEL I.



GRANITE TRANSITION TYPE VB - SPLAYED END

NOT TO SCALE

NOTE:
1. TOP SURFACE AND SLOPED SURFACE TO BE DRESSED BY SAW. REMAINDER TO BE QUARRY SPLIT.
2. DETAIL SHOWS TRANSITION CURB FOR ONE DIRECTION. FOR OTHER DIRECTION USE OPPOSITE HAND.

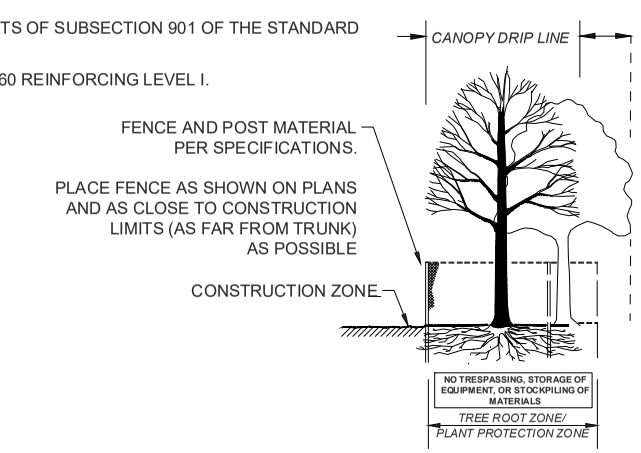


NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5
- PCR 9 LANDING TO BE CONSTRUCTED WITH HMA TO MATCH SHARED USE PATH
** TRANSITION LENGTHS FOR CURBS ONLY

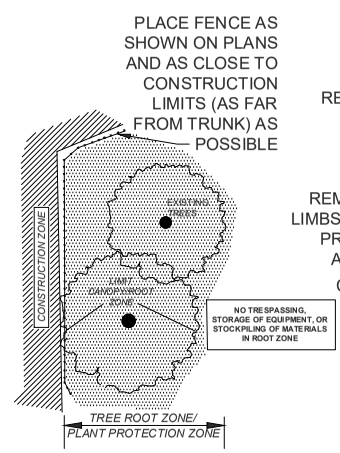
CORNER CURB CUT RAMP (ADJACENT TO SHARED USE PATH)

NOT TO SCALE

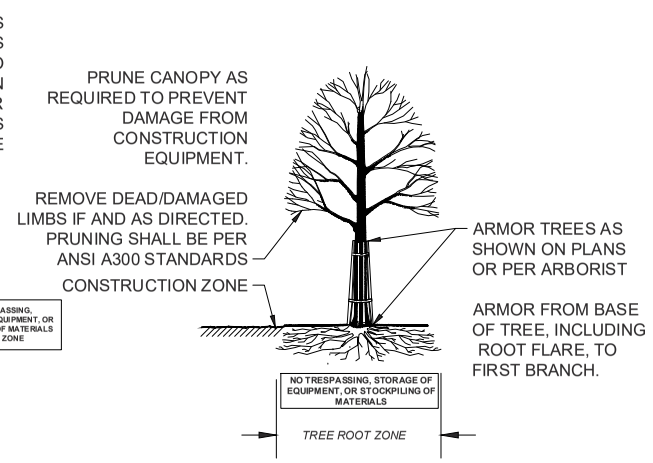
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		LENGTH OF RAMP (W) (FT.)	WIDTH OF RAMP (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
6	NORTHSHORE RD	304+19	5.00 RT	8'-0"	10'-0"	-0.86	7'-8"	6'-6"
8	NORTHSHORE RD	318+32	12.00 RT	9'-0"	10'-0"	+0.04	7'-8"	6'-6"
9	NORTHSHORE RD	318+45	0.00	4'-6"	10'-0"	-0.64	6'-6"***	7'-8"***



SECTION - FENCE PROTECTION OF ROOT ZONE



PLAN VIEW - FENCE PROTECTION OF ROOT ZONE



SECTION - TRUNK ARMORING & PRUNING

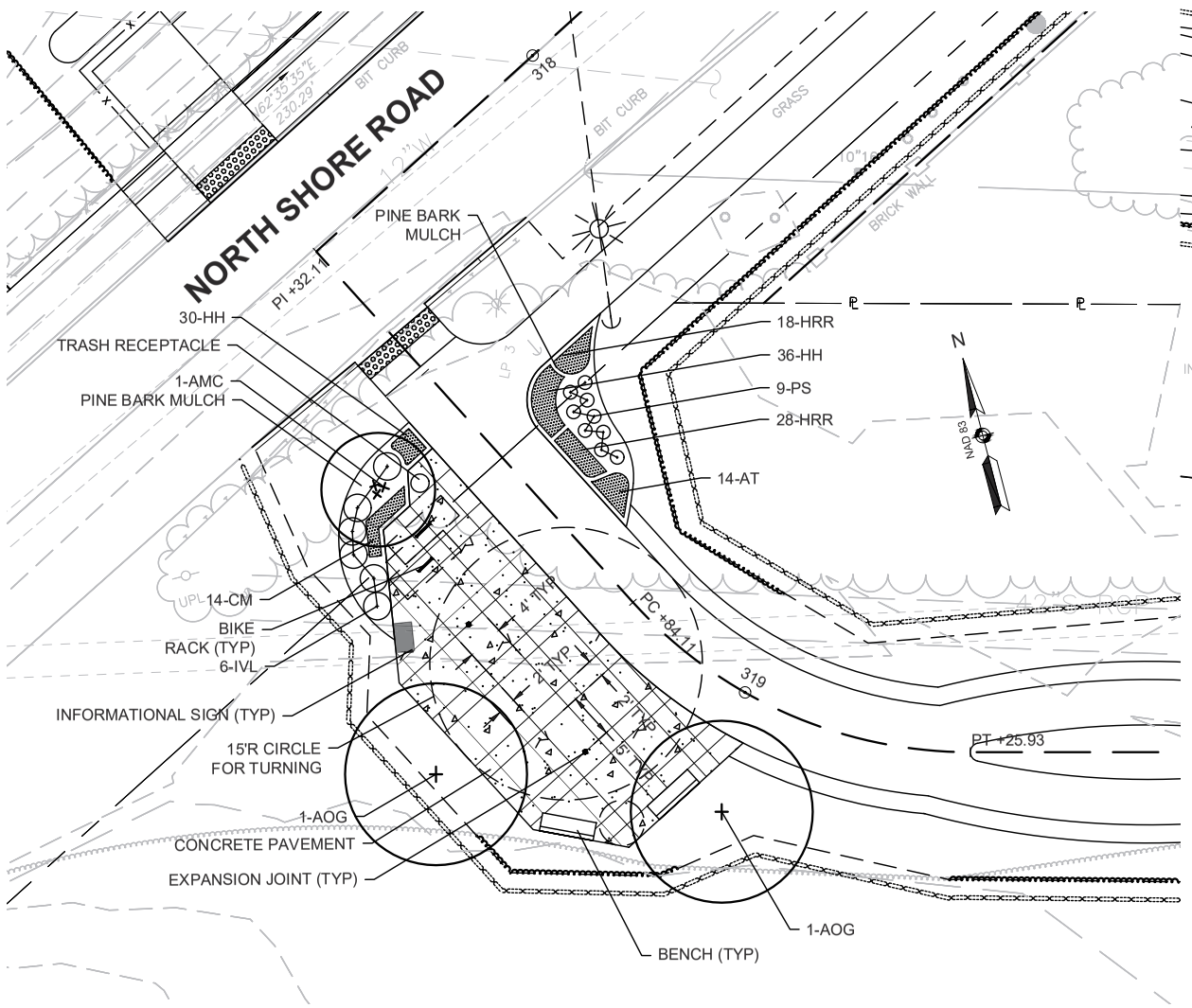
TREE PROTECTION DETAILS

NOT TO SCALE

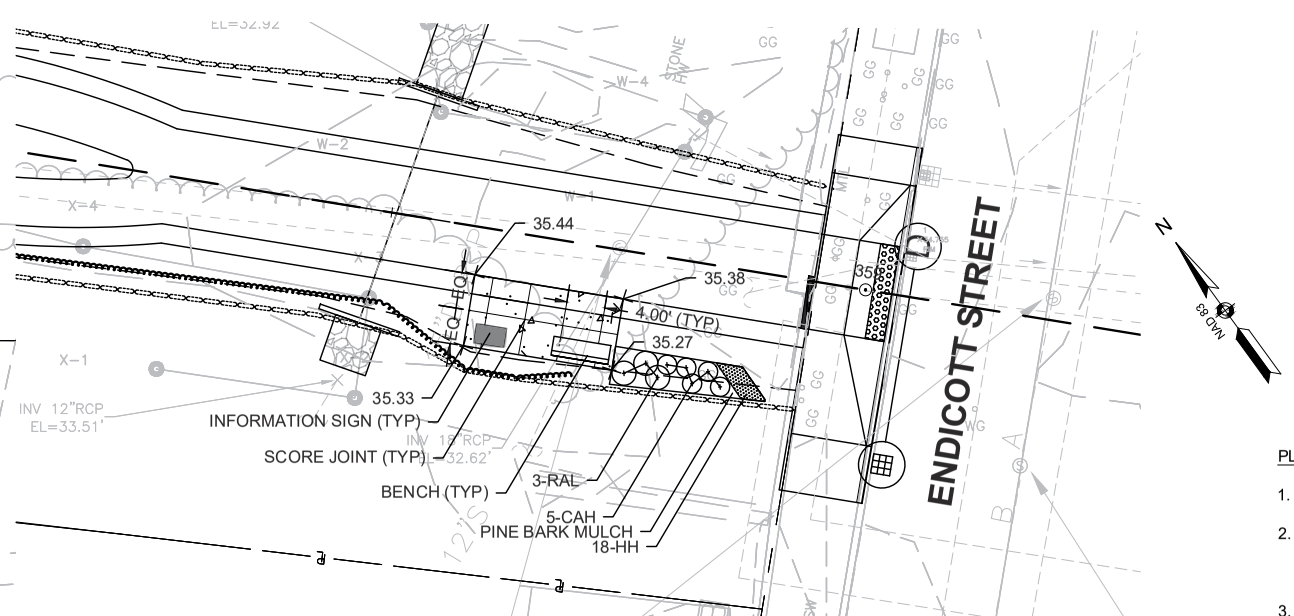
WQC/ACOE PLAN SHEET 43 OF 63

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	46	142
PROJECT FILE NO.	609211		

LANDSCAPE PLAN - 1



1 BLOW UP PLAN TRAILHEAD AT NORTHSHORE ROAD
SCALE 1" = 20'-0"



2 BLOW UP PLAN TRAILHEAD AT ENDICOTT STREET
SCALE 1" = 20'-0"

PLANTING NOTES

1. CONTRACTOR SHALL HAVE ALL SUBSURFACE UTILITIES MARKED PRIOR TO THE START OF WORK.
2. PLANT LOCATIONS ARE APPROXIMATE. PRIOR TO PLANTING, LOCATION OF ALL PLANT MATERIAL WILL BE APPROVED BY THE RESIDENT ENGINEER AND THE LANDSCAPE ARCHITECT.
3. ALL PLANT MATERIAL WILL HAVE TAGS INDICATING COMMON NAME, BOTANICAL NAME, CULTIVAR, & SIZE.
4. IMMEDIATELY AFTER ACCEPTANCE OF PLANTING, TAGS AND RIBBONS SHALL BE REMOVED.
5. ALL PLANTS WILL BE MULCHED PER PLANS AND SPECIFICATIONS.
6. ALL SHRUB AND PERENNIAL BEDS WILL BE WEEDED AND OTHERWISE NEATLY MAINTAINED FOR THE DURATION OF THE CONTRACT.
7. PLANTS AND PLANTING BEDS SHALL BE THOROUGHLY WATERED AS NECESSARY AND PER SPECIFICATIONS.

WATERING NOTES

1. IRRIGATION BAGS MAY BE USED FOR STREETSCAPE AND PARK PLANTINGS ONLY.
2. A SCHEDULE FOR FILLING AND REMOVAL SHALL BE SUBMITTED TO THE ENGINEER.
3. USE AND SCHEDULE MUST BE APPROVED BY THE MASSDOT LANDSCAPE ARCHITECT.
4. A MINIMUM OF 2 BAGS PER TREE SHALL BE USED. BAGS SHALL BE ATTACHED TO STAKES.
5. NO BAGS SHALL BE PLACED AROUND THE TREE TRUNK.
6. BAGS SHALL BE MAINTAINED FULL JUNE 1 - OCTOBER 1 OR AS APPROVED.
7. BAGS SHALL BE REMOVED AT THE END OF THE SEASON.

PLANT LIST - LANDSCAPE PLAN 1

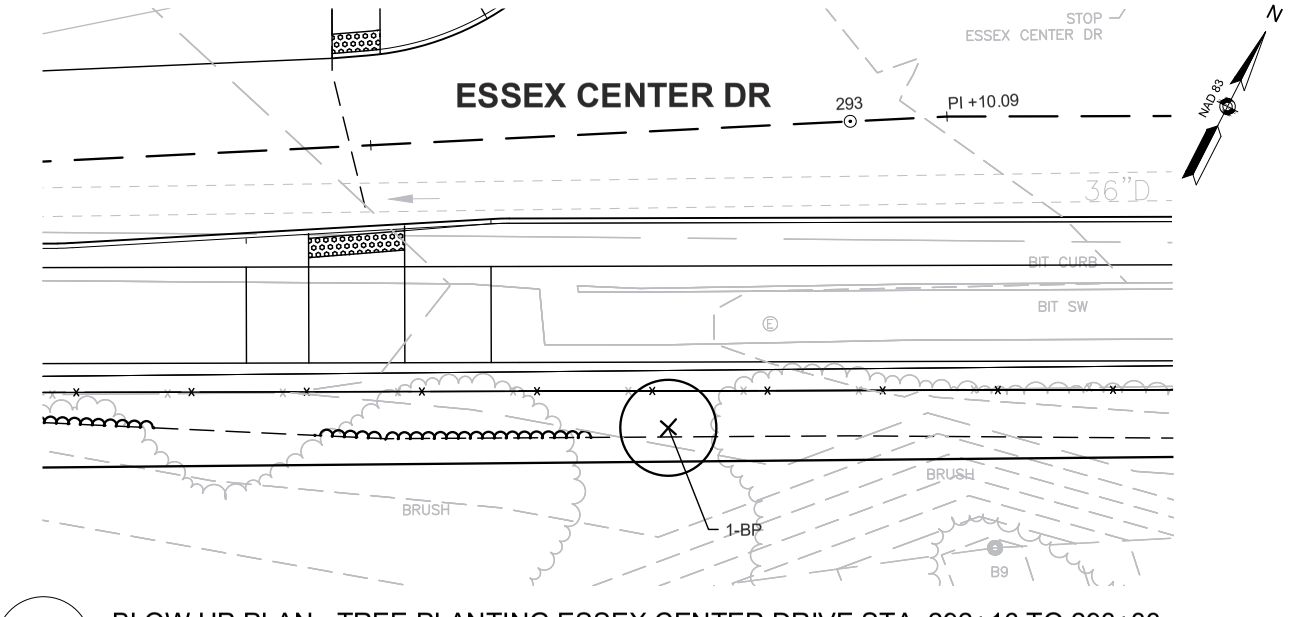
KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIER X GRANDIFLORA	'AUTUMN BRILLIANCE' SERVICEBERRY	4-5 FEET CLUMP	B&B	
ACO	2	ACER RUBRUM 'OCTOBER GLORY'	'OCTOBER GLORY' RED MAPLE	2-2 1/2" CAL	B&B	
		DECIDUOUS SHRUBS				
ML	6	ITEA VIRGINIANA 'SPRICH' LITTLE HENRY'	'LITTLE HENRY' SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAH	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	'HUMMINGBIRD' SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	'GRO-LOW' SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	14	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	'ICE DANCE' SEDGE	#1 CONT		12" O.C.
HH	84	HEMEROCALLIS 'HAPPY RETURNS'	'HAPPY RETURNS' DAYLILY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS 'ROSY RETURNS'	'ROSY RETURNS' DAYLILY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANDOAH'	'SHENANDOAH' SWITCH GRASS	#2 CONT		18" O.C.

0 10 20 30 40
SCALE: 1" = 20'

Proposal No. 609211-132091
A00831 - 51

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	47	142
PROJECT FILE NO.	609211		

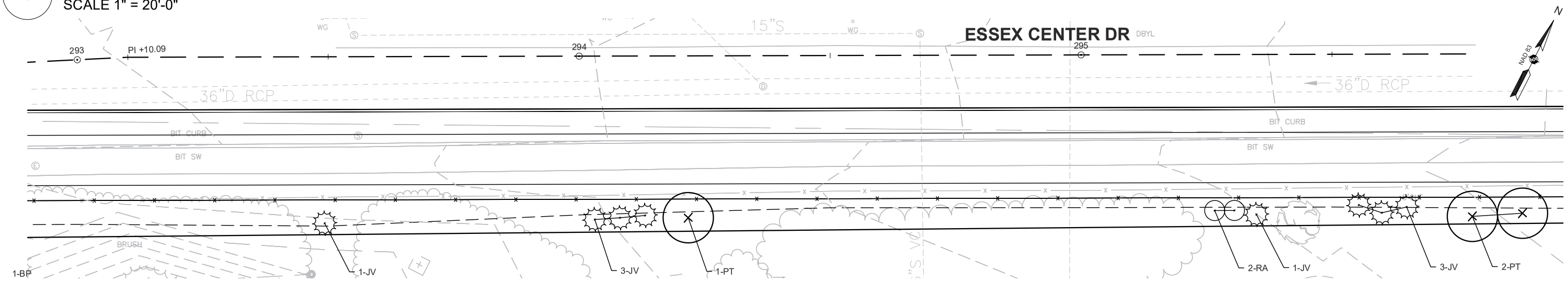
LANDSCAPE PLAN - 2



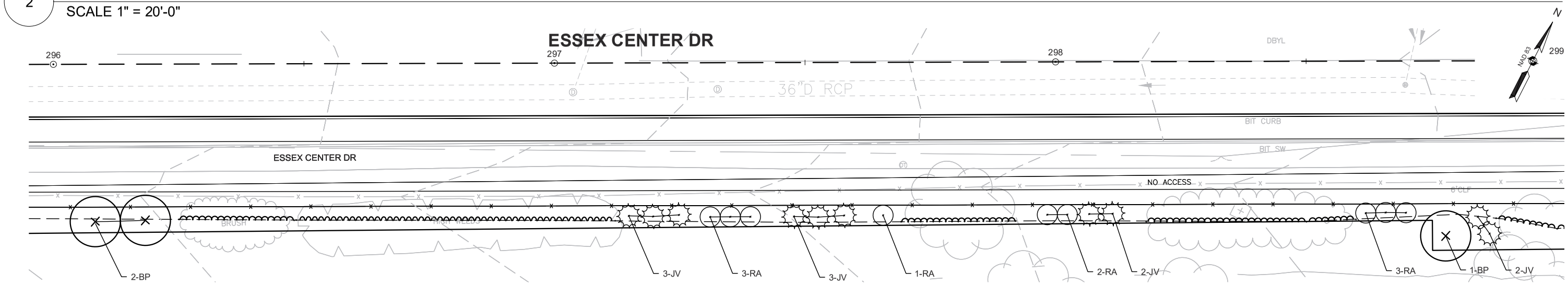
1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 292+16 TO 293+33
SCALE 1" = 20'-0"

PLANT LIST - LANDSCAPE PLAN 2

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	4	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	18	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT
		DECIDUOUS SHRUBS			
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 292+80 TO 296+00
SCALE 1" = 20'-0"



3 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 296+00 TO 299+00
SCALE 1" = 20'-0"

0 10 20 30 40
SCALE: 1" = 20'

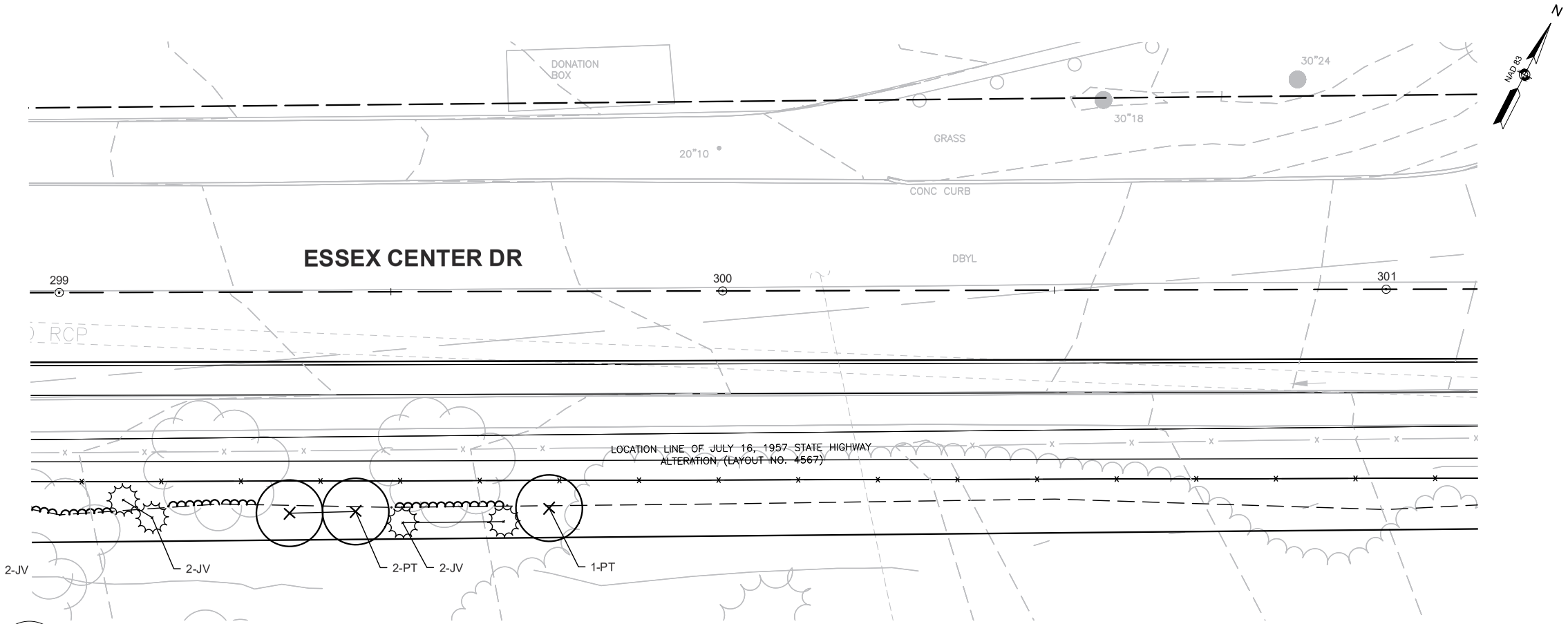
WQC/ACOE PLAN SHEET 45 OF 63

NOTE: SEE LANDSCAPE PLAN SHEET 1 FOR PLANT LIST

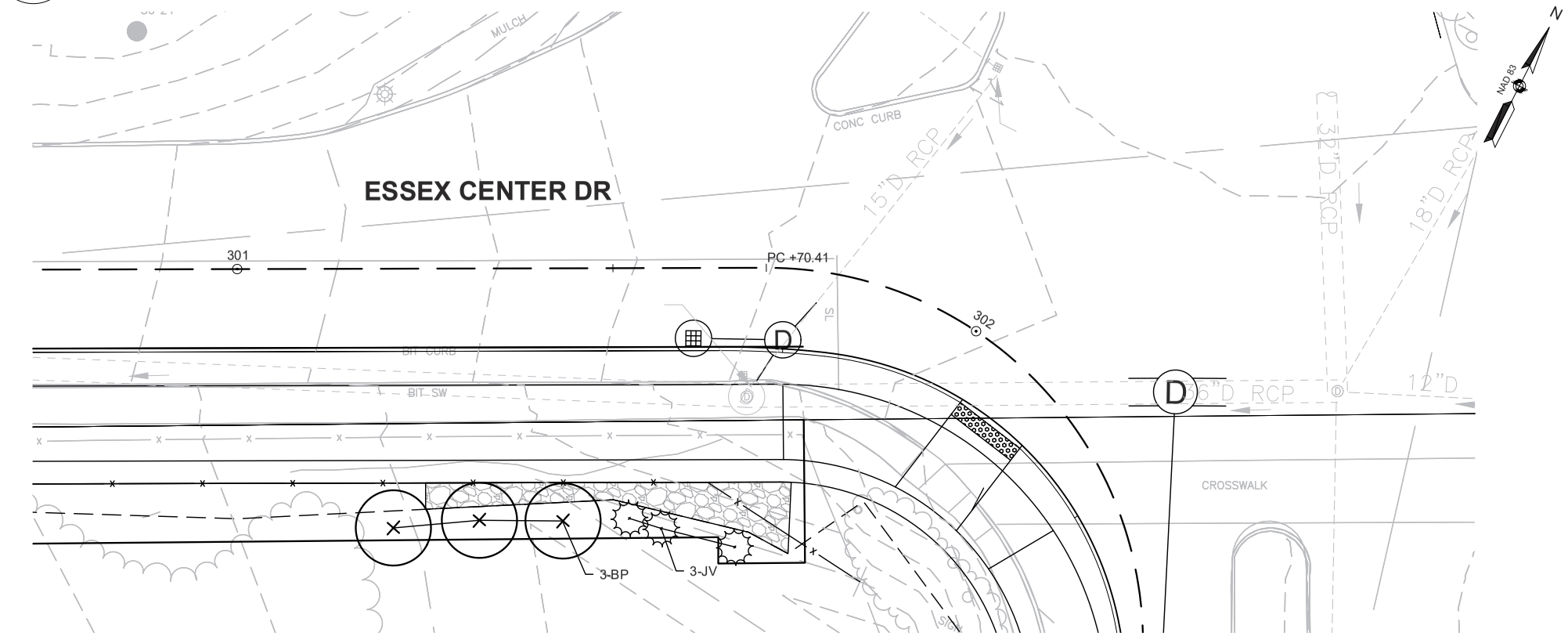
Proposal No. 609211-132091
A00831 - 52

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	48	142
PROJECT FILE NO.	609211		

LANDSCAPE PLAN - 3



1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 299+00 TO 300+14
SCALE 1" = 20'-0"



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 300+78 TO 301+97
SCALE 1" = 20'-0"

PLANT LIST - LANDSCAPE PLAN 3

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	3	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	7	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT

PLANT LIST - UPLAND PROJECT TOTAL

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIER X GRANDIFLORA	AUTUMN BRILLIANCE SERVICEBERRY	4-5 FEET CLUMP	B&B	
ACG	2	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	2-2 1/2" CAL	B&B	
BP	7	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT	
PT	6	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT	
		EVERGEEN TREES				
JV	25	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT	
		DECIDUOUS SHRUBS				
ML	6	ITEA VIRGINIANA 'SPRICH LITTLE HENRY'	LITTLE HENRY SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAT	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	HUMMINGBIRD SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	GRO-LOW SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT	3' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	11	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	ICE DANCE SEDGE	#1 CONT		12" O.C.
HH	94	HEMEROCALLIS 'HAPPY RETURNS'	'HAPPY RETURNS DAY LILLY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS 'ROSY RETURNS'	'ROSY RETURNS DAY LILLY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANDOAH'	SHENANDOAH SWITCH GRASS	#2 CONT		18"O.C

0 10 20 30 40
SCALE: 1" = 20'

WQC/ACOE PLAN SHEET 46 OF 63

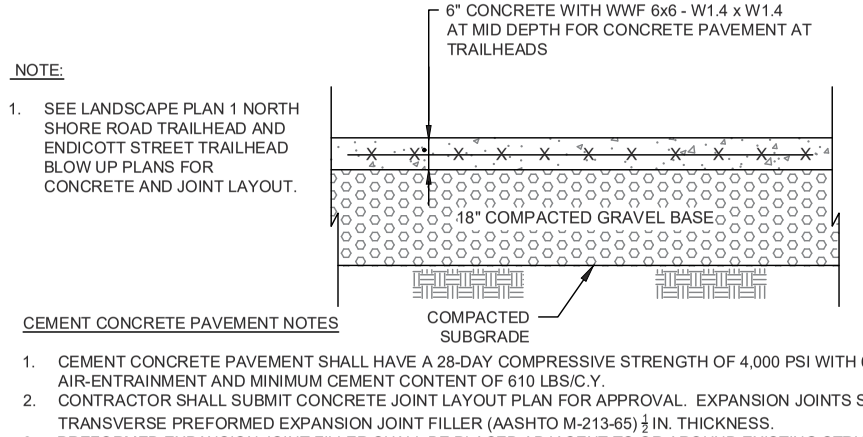
Proposal No. 609211-132091
A00831 - 53

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	49	142
PROJECT FILE NO.	609211		

LANDSCAPE DETAILS - 1

Proposal No. 609211-132091

A00831 - 54



NOTE:

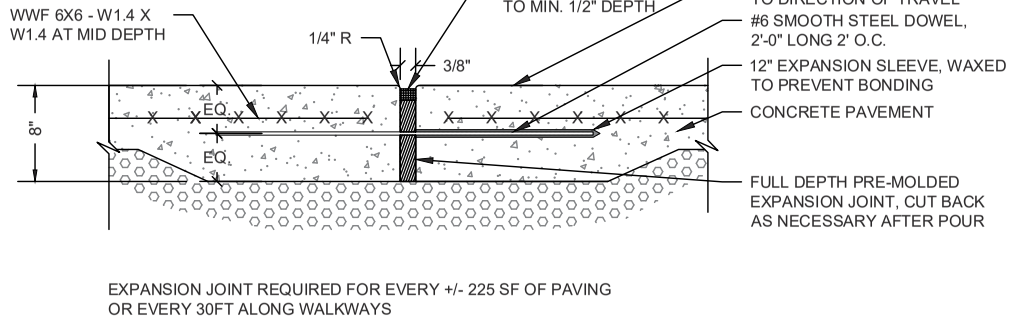
1. SEE LANDSCAPE PLAN 1 NORTH SHORE ROAD TRAILHEAD AND ENDICOTT STREET TRAILHEAD BLOW UP PLANS FOR CONCRETE AND JOINT LAYOUT.

CEMENT CONCRETE PAVEMENT NOTES

1. CEMENT CONCRETE PAVEMENT SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI WITH 6% AIR-ENTRAINMENT AND MINIMUM CEMENT CONTENT OF 610 LBS/C.Y.
2. CONTRACTOR SHALL SUBMIT CONCRETE JOINT LAYOUT PLAN FOR APPROVAL. EXPANSION JOINTS SHALL BE TRANSVERSE PREFORMED EXPANSION JOINT FILLER (AASHTO M-213-65) ½ IN. THICKNESS.
3. PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED ADJACENT TO OR AROUND EXISTING STRUCTURES AND WALKWAYS.
4. EXPANSION JOINTS SHALL BE CONSTRUCTED WITH DOWELS, AS INDICATED IN DETAIL 2 LANDSCAPE DETAIL SHEET 1.
5. AFTER CONSOLIDATION, CONCRETE DEPTH SHALL BE 6 INCHES IN DEPTH FOR TRAILHEADS.
6. ENSURE THAT NO BLED WATER OR WATER SHEEN EXISTS ON THE SURFACE OF THE CONCRETE AND THAT CONCRETE HAS STARTED TO STIFFEN BEFORE ANY FINISHING OPERATIONS ARE PERFORMED.
7. AFTER TROWELING, SURFACE SHALL BE BRUSHED BY DRAWING A SOFT-BRISTLED PUSHBROOM WITH A LONG HANDLE OVER THE SURFACE OF THE CONCRETE TO PRODUCE A NON-SLIP SURFACE.
8. THE FINISHING OF CONCRETE SURFACE SHALL BE DONE BY EXPERIENCED AND COMPETENT CEMENT CONCRETE FINISHERS.
9. FINISHING SHALL BE BROOM FINISH.
10. SAW CUT CONTROL JOINTS.
11. WHEN COMPLETED, CONCRETE SHALL BE KEPT MOIST AND PROTECTED FROM TRAFFIC AND WEATHER FOR AT LEAST 3 DAYS.
12. WELDED WIRE MESH SHALL BE 6"x6" No. 10 GAUGE AND SHALL BE SHEET MESH ONLY NOT ROLLED. MESH SHALL REST ON CONCRETE BLOCKS AND BE INSTALLED AT MID DEPTH IN CONCRETE.

1 CEMENT CONCRETE PAVEMENT AT TRAILHEADS

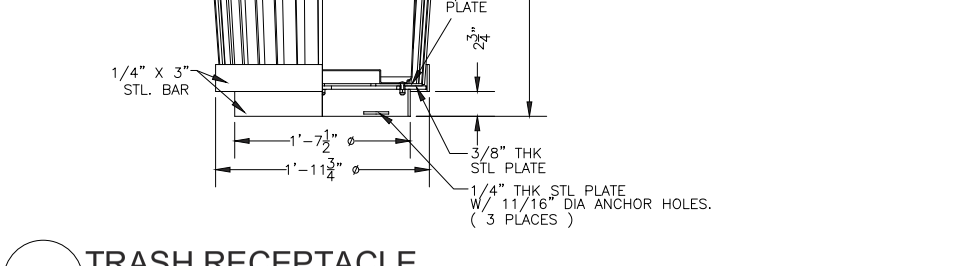
SCALE: N.T.S.



EXPANSION JOINT REQUIRED FOR EVERY +/- 225 SF OF PAVING OR EVERY 30FT ALONG WALKWAYS

EXPANSION JOINT NOTES:

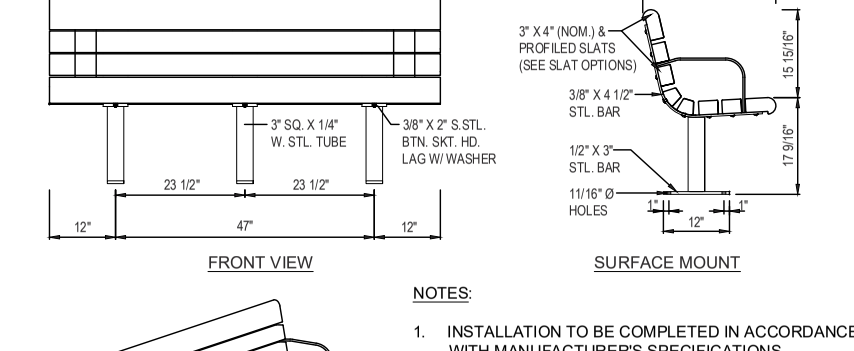
1. DOWEL IS TYPICAL AT ALL EXPANSION JOINTS EXCEPT AGAINST VERTICAL JOINTS WITH WALLS, CURBS OR SITE IMPROVEMENTS.



SAWCUT CONTROL JOINT REQUIRED FOR EVERY 36 SF OF PAVING.

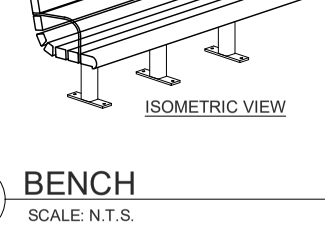
2 CONCRETE PAVEMENT JOINTS AT TRAILHEADS

SCALE: N.T.S.



FRONT VIEW

SURFACE MOUNT



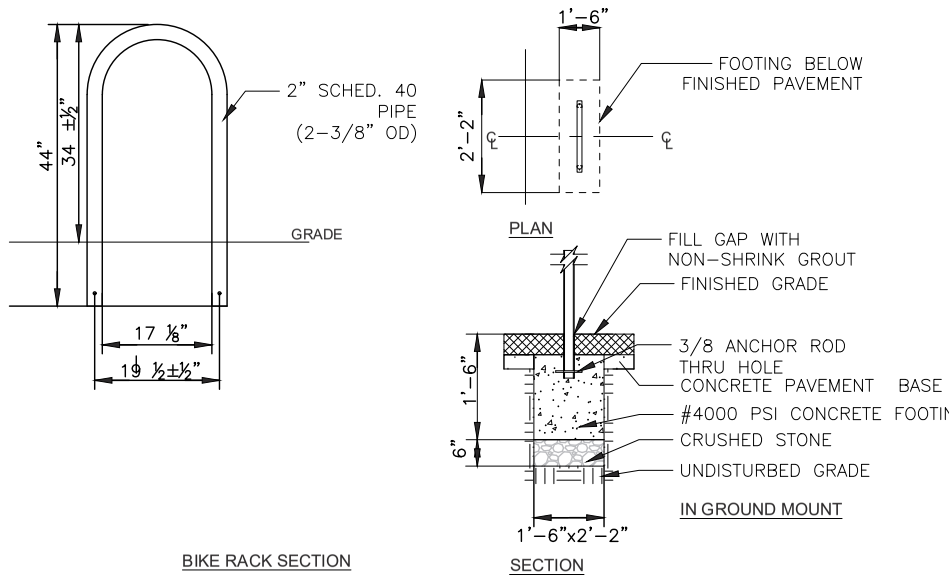
ISOMETRIC VIEW

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DRAWING NOT TO SCALE.
3. ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/POLYESTER POWDER COATING.
4. ½" x 3 ¾" EXPANSION ANCHOR BOLT 6 PER BENCH.
5. SUBMIT SHOP DRAWING FOR APPROVAL.
6. BENCH SHALL HAVE ARMREST ON BOTH ENDS.

3 BENCH

SCALE: N.T.S.



BIKE RACK SECTION

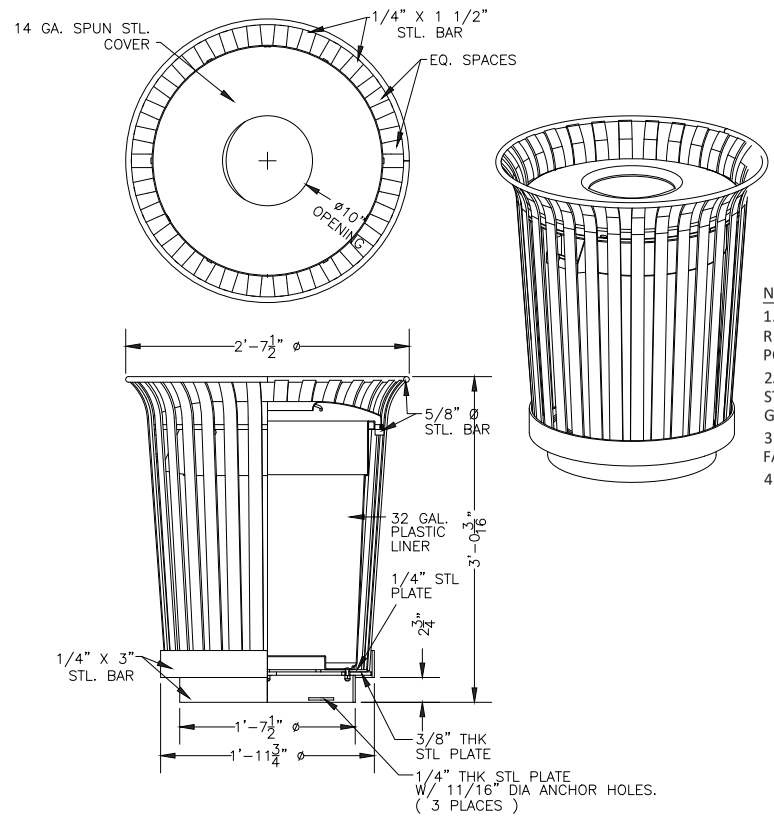
SECTION

NOTES:

1. INSTALL BIKE RACKS ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
2. SUBMIT SHOP DRAWING FOR APPROVAL.

4 BIKE RACK

SCALE: N.T.S.



NOTES:

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.

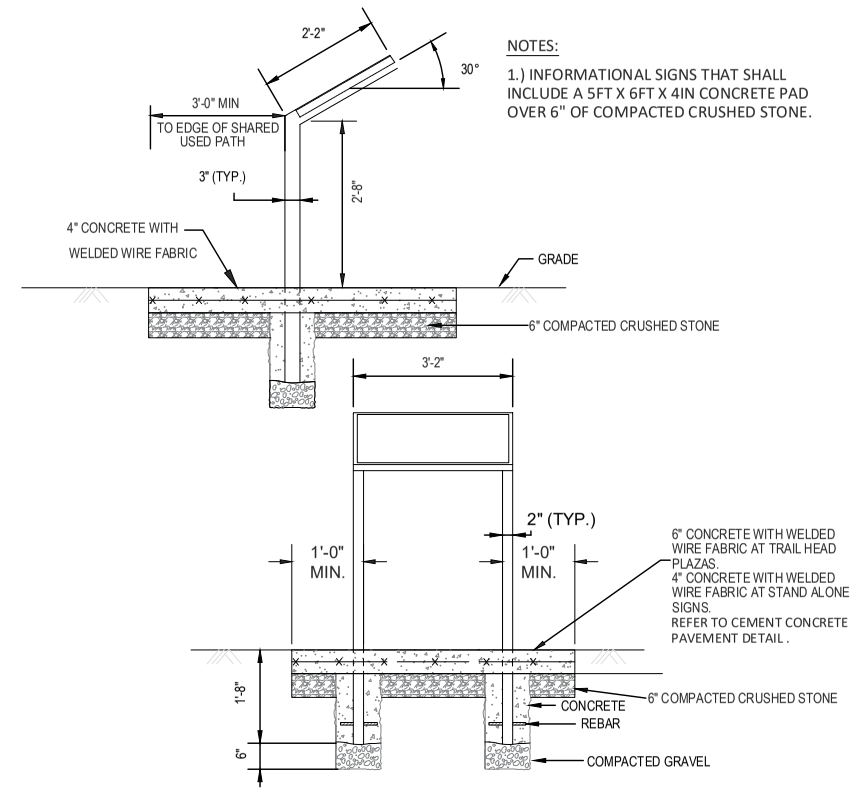
2.) ANCHOR BOLTS SHALL BE STAINLESS STEEL AND EXTENDED 3" BELOW FINISH GRADE.

3.) RECEPTACLE FULLY ASSEMBLED AT FACTORY.

4.) PROVIDE CABLE ATTACHMENT FOR LID

5 TRASH RECEPTACLE

SCALE: N.T.S.



NOTES:

1.) INFORMATIONAL SIGNS THAT SHALL INCLUDE A 5FT X 6FT X 4IN CONCRETE PAD OVER 6" OF COMPACTED CRUSHED STONE.

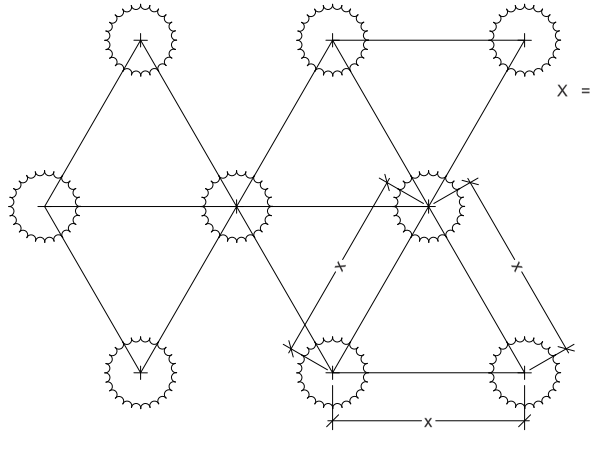
6 INFORMATIONAL SIGN

SCALE: N.T.S.

SIGN GRAPHIC CONTENT TO BE PROVIDED AND INSTALLED BY OTHERS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	50	142
PROJECT FILE NO.	609211		

LANDSCAPE DETAILS - 2

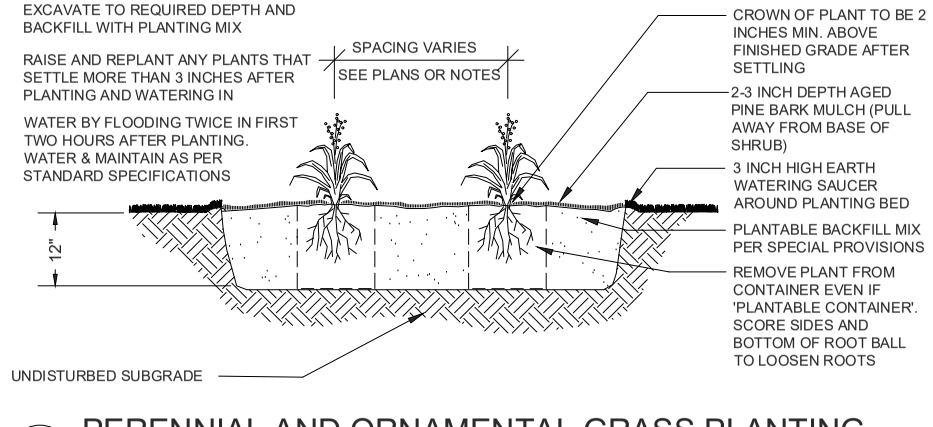


1 SHRUB, PERENNIAL AND ORNAMENTAL GRASS SPACING PLAN DETAIL

SCALE: N.T.S.

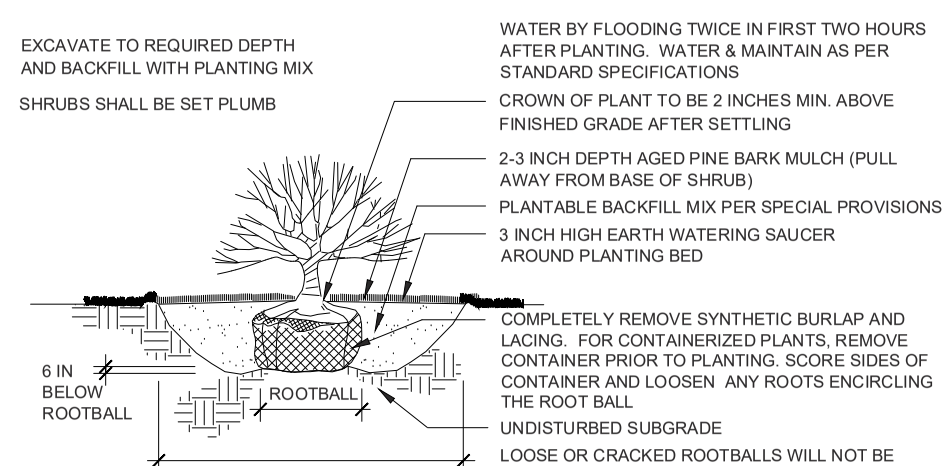
NOTE:

PINE BARK MULCH IN PERENNIAL AND SHRUB PLANTING BEDS SHALL BE PAID FOR IN PINE BARK MULCH ITEM. PINE BARK MULCH IN TREE PLANTING PITS AND SHRUBS NOT IN BEDS SHALL BE INCIDENTAL TO THOSE ITEMS.



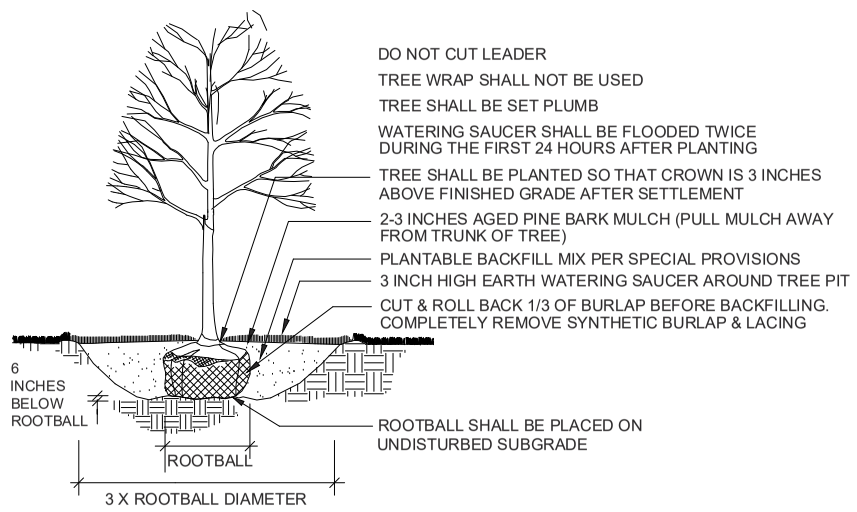
2 PERENNIAL AND ORNAMENTAL GRASS PLANTING

SCALE: N.T.S.



3 SHRUB PLANTING

SCALE: N.T.S.

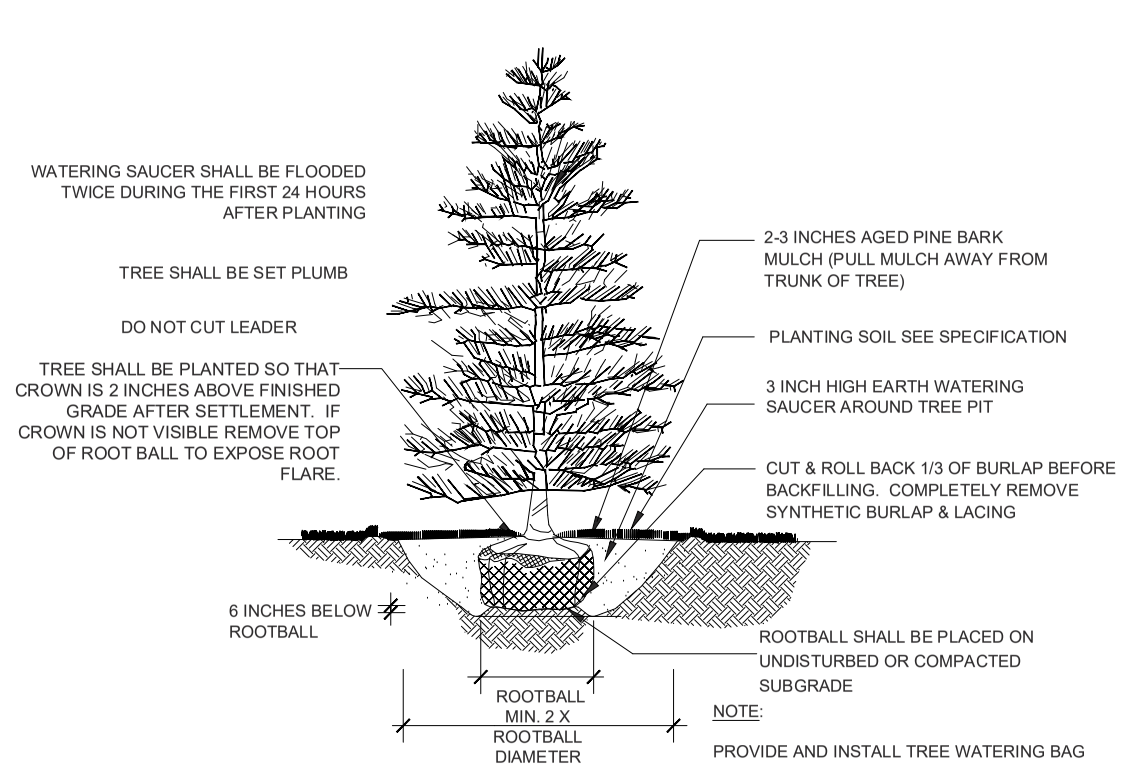


NOTE:

TREE TRUNK GUARDS SHALL BE INSTALLED AT ALL TREES. SEE SPECIAL PROVISION.

4 TREE PLANTING

SCALE: N.T.S.



NOTE:

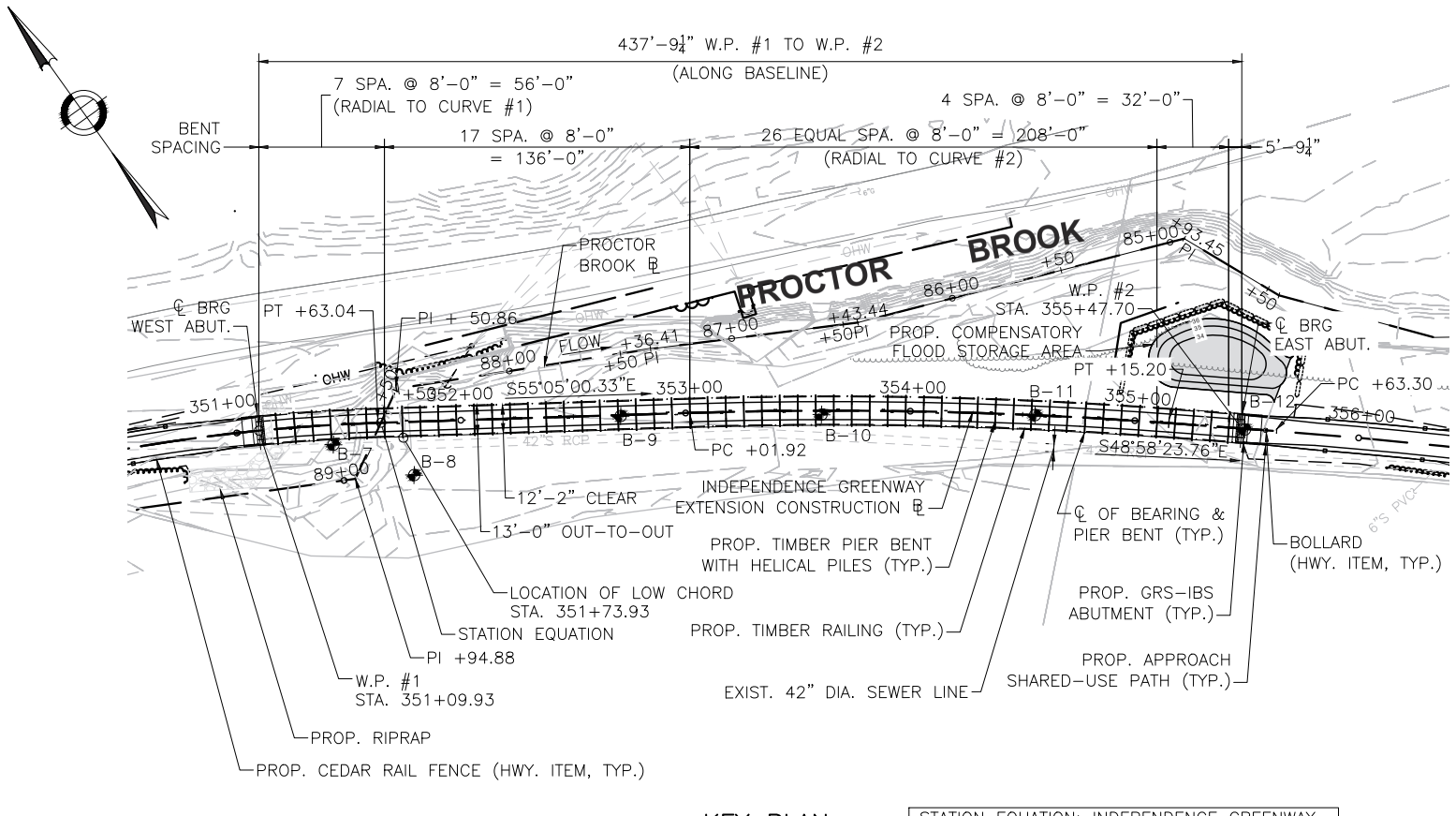
PROVIDE AND INSTALL TREE WATERING BAG

5 EVERGREEN TREE PLANTING

SCALE: N.T.S.

WQC/ACOE PLAN SHEET 48 OF 63

Proposal No. 609211-132091
A00831 - 55



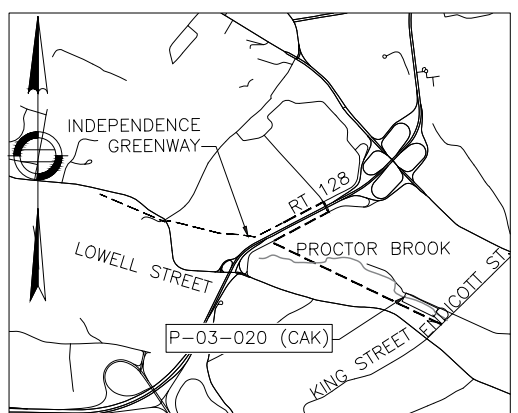
KEY PLAN

SCALE: 1" = 80'

40 0 40 80

SCALE IN FEET

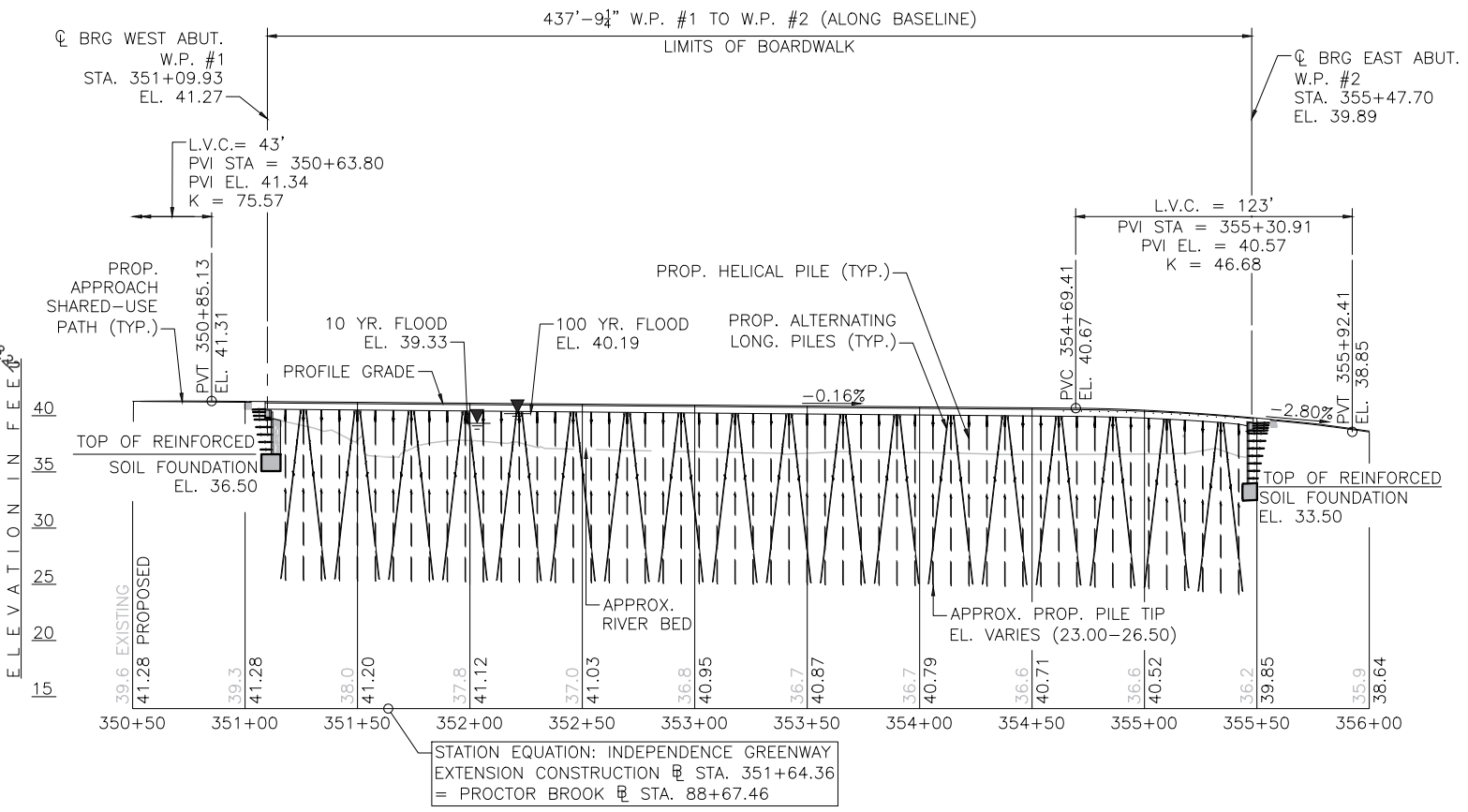
STATION EQUATION: INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄ STA. 351+64.36 = PROCTOR BROOK ℄ STA. 88+67.46



LOCUS

1" = 2000'

HORIZONTAL CURVE #1 DATA
PC = 349+89.58
PT = 351+63.04
Δ = 12°-25'-23"
R = 800.00'
L = 173.46'
T = 87.07'
HORIZONTAL CURVE #2 DATA
PC = 353+01.92
PT = 355+15.20
Δ = 6°-06'-37"
R = 2000.00'
L = 213.28'
T = 106.74'

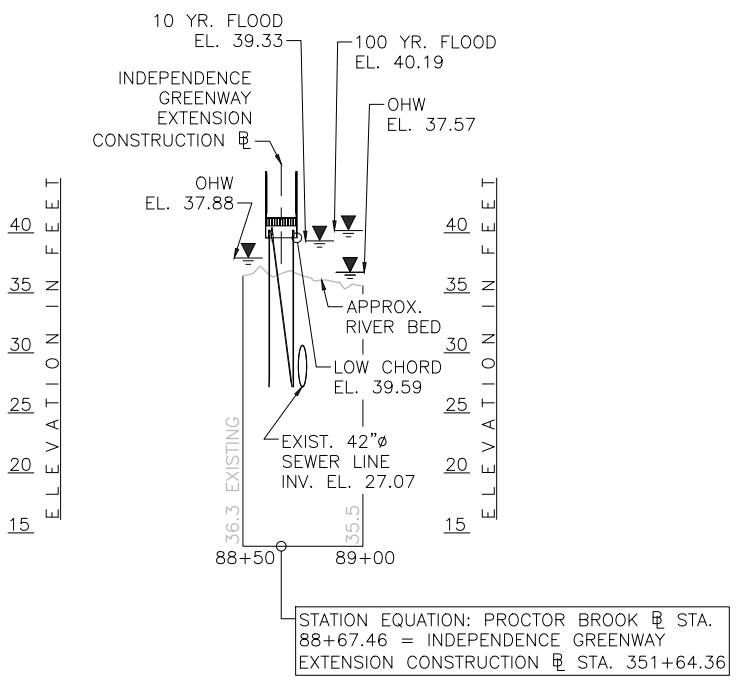


PROFILE-INDEPENDENCE GREENWAY EXTENSION

HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: 1" = 16'

8 0 8 16

SCALE IN FEET



PROFILE-PROCTOR BROOK

HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: 1" = 16'

WQC/ACOE PLAN SHEET 49 OF 63

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	#	60	142
PROJECT FILE NO.		609211	

KEY PLAN PROFILE AND LOCUS

ESTIMATED QUANTITIES (NOT GUARANTEED)	
BRIDGE EXCAVATION	40 CY
TEST PIT FOR EXPLORATION	19 CY
CLASS B ROCK EXCAVATION	5 CY
CRUSHED STONE FOR BRIDGE FOUNDATIONS	15 TON
GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL	55 SY
HELICAL PILE AND BRACKET ASSEMBLY	3700 FT
PRE-DRILLING FOR PILE OBSTRUCTIONS	80 FT
HELICAL PILE VERIFICATION LOAD TEST	3 EA
RIPRAP	145 TON
NATURAL STREAMBED MATERIAL	75 SY
CONTROL OF WATER - STRUCTURE NO. P-03-020	1 LS
BRIDGE STRUCTURE, BRIDGE NO. P-03-020 (CAK)	1 LS

INDEX OF DRAWINGS

TITLE	SHEET NO.
KEY PLAN PROFILE AND LOCUS	1
GENERAL NOTES	2
BORING LOGS 1 OF 3	3
BORING LOGS 2 OF 3	4
BORING LOGS 3 OF 3	5
GENERAL PLAN AND ELEVATION 1 OF 2	6
GENERAL PLAN AND ELEVATION 2 OF 2	7
HELICAL PILE LAYOUT PLAN 1 OF 2	8
HELICAL PILE LAYOUT PLAN 2 OF 2	9
HELICAL PILE LAYOUT TABLE	10
HELICAL PILE DETAILS	11
WEST ABUTMENT PLAN AND ELEVATION	12
EAST ABUTMENT PLAN AND ELEVATION	13
FRAMING PLAN 1 OF 2	14
FRAMING PLAN 2 OF 2	15
TYPICAL SECTION AND TIMBER CONNECTION DETAILS	16
CONNECTION DETAILS	17

MMMM DD, YYYY | ISSUED FOR CONSTRUCTION

MassDOT Highway Division

PROPOSED BRIDGE

PEABODY

INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
10 PARK PLAZA BOSTON, MASS

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS
TEWKSBURY, MASSACHUSETTS

STATE BRIDGE ENGINEER

CHIEF ENGINEER

SHEET 1 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

Proposal No. 609211-132091

A00831 - 56

GENERAL NOTES

DESIGN:
IN ACCORDANCE WITH THE 2009 AASHTO LRFD GUIDE SPECIFICATION FOR DESIGN OF PEDESTRIAN BRIDGES WITH 2015 INTERIM REVISIONS, FOR 90 PSF DESIGN PEDESTRIAN LOADING.

MASSDOT BENCH MARK:
ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

BENCHMARK: 9 – MAG NAIL SET UP #28 ON WARREN ROAD
STATION: 347+49.19 – 8.971 LT
NORTHING: 3019612.4266
EASTING: 807741.8898
ELEVATION: 41.17'

BENCHMARK: 11 – MAG NAIL SET ABOUT 1' ABOVE GROUND AT LP#6 ON ENDICOTT STREET
STATION: 359+34.38 – 79.411 LT
NORTHING: 3018945.6274
EASTING: 808725.6506
ELEVATION: 37.33'

MASSDOT SURVEY:
THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULTS OF AN AERIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.

SCALES:
SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR HALF–SIZE PRINTS.

FOUNDATIONS:
FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIAL:
ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

GEOTECHNICAL REPORT:
REFER TO GEOTECHNICAL REPORT, DATED MAY 2023, PREPARED BY GZA GEO ENVIRONMENTAL.

EXISTING CONDITIONS:
CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENTS AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUACY THEREOF, AND SHALL NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

STRUCTURAL WOOD NOTES:
ALL DIMENSIONAL LUMBER SHALL BE SOUTHERN PINE STAMPED BY A MEMBER OF THE WWPA AND KILN DRIED TO 19% MAXIMUM MOISTURE CONTENT. ALL STRUCTURAL LUMBER SHALL BE SELECT STRUCTURAL GRADE. IN ACCORDANCE WITH AASHTO TABLE 8.4.1.1.4–1 AND THE 2018 NATIONAL DESIGN SPECIFICATIONS (NDS) FOR WOOD CONSTRUCTION ALL PROPOSED TIMBER ELEMENTS SHALL HAVE A MINIMUM MODULUS OF ELASTICITY OF 1800 KSI.

STRINGERS AND PIER BENTS SHALL NOT BE NOTCHED EXCEPT WHERE SHOWN IN DETAILS. OBTAIN STRUCTURAL ENGINEER'S APPROVAL FOR ANY HOLES THROUGH OR NOTCHES IN THE TOP OF HORIZONTAL MEMBERS.

FOR BLACK LOCUST DECKING MATERIAL REQUIREMENTS PLEASE REFER TO THE SPECIAL PROVISIONS.

PROPOSED WOOD SCREWS FOR TIMBER FRAMING ELEMENTS SHALL COMPLY WITH ASME B18.6 REQUIREMENTS AND SHALL BE GALVANIZED UNLESS OTHERWISE NOTED. WOOD SCREW SIZES AND LENGTHS SHALL BE AS SHOWN ON THE PLANS.

SEE SHEET 17 FOR CONNECTION HARDWARE NOTES.

GRS–IBS MATERIALS
SEE SPECIAL PROVISIONS FOR DETAILED REQUIREMENTS.

CONCRETE MASONRY UNIT (CMU) FACING ELEMENTS
FACING ELEMENTS CONSISTING OF SPLIT–FACE CMU BLOCK UNITS SHALL MEET ASTM C90–11B AND THE REQUIREMENTS OF THE SPECIAL PROVISIONS, WITH A MINIMUM REQUIRED COMPREHENSIVE STRENGTH OF 4000 PSI AND A MAXIMUM WATER ABSORPTION RATE OF 5 PERCENT AFTER 24 HOURS.

CONSTRUCTION JOINTS
CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

BACKFILL MATERIALS

A. GEOSYNTHETIC REINFORCED SOIL (GRS) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 30 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
B. REINFORCED SOIL FOUNDATION (RSF) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.4 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 38 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
C. INTEGRATED APPROACH BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.1.
D. LEVELING COURSE BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6.

GEOSYNTHETICS
FURNISH GEOSYNTHETICS CONSISTING OF GEOTEXTILE FOR THE GRS ABUTMENT, RSF AND INTEGRATED APPROACH. THE GEOSYNTHETIC MATERIAL SHALL BE MANUFACTURED FROM POLYPROPYLENE, HIGH–DENSITY POLYETHYLENE, OR POLYESTER AND MEET THE REQUIREMENTS OF THE SPECIAL PROVISIONS.

A. GEOSYNTHETIC REINFORCED SOIL SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
B. REINFORCED SOIL FOUNDATION SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
C. INTEGRATED APPROACH SOIL SHALL INCLUDE A CLASS 2 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	61	142
PROJECT FILE NO.	609211		

GENERAL NOTES

TRAFFIC DATA	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	N/A	
AVERAGE DAILY TRAFFIC – PRESENT	N/A	
AVERAGE DAILY TRAFFIC – DESIGN YEAR	N/A	
DESIGN HOURLY VOLUME	N/A	
DIRECTIONAL DISTRIBUTION	N/A	
TRUCK PERCENTAGE – AVERAGE DAY	N/A	
TRUCK PERCENTAGE – PEAK HOUR	N/A	
DESIGN SPEED	N/A	
DIRECTIONAL DESIGN HOURLY VOLUME	N/A	

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000
DESIGN SPECTRA	
As	0.133
SDs	0.263
SD1	0.096
SITE CLASS	D
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	3.52
DESIGN FLOOD DISCHARGE (C.F.S.)	240
DESIGN FLOOD FREQUENCY (YEARS)	10
DESIGN FLOOD VELOCITY (F.P.S.)	5.97
DESIGN FLOOD ELEVATION (FEET, NAVD)	39.33
BASE (100–YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	420
BASE FLOOD ELEVATION (FEET, NAVD)	40.19
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	25
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	1.95
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	1.17
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	2.28
CHECK FLOOD PIER SCOUR DEPTH (FEET)	1.22
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	N/A
FREQUENCY (IF KNOWN, YEARS)	N/A
MAXIMUM ELEVATION (FEET, NAVD)	N/A
DATE (MM/YYYY)	N/A
HISTORY OF ICE FLOES	N/A
EVIDENCE OF SCOUR AND EROSION	N/A

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	175
DESIGN FLOOD FREQUENCY (YEARS)	2
DESIGN FLOOD VELOCITY (F.P.S.)	5.56
DESIGN FLOOD ELEVATION (FEET, NAVD)	38.99,88

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091

A00831 - 57

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	62	142
PROJECT FILE NO.	609211		

BORING LOGS 1 OF 3

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire
Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N: 3019395.2599, E: 808062.9728
Ground Surface Elev. (ft.): 38.5
Final Boring Depth (ft.): 36
Date Start - Finish: 1/4/2019 - 1/4/2019
H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)				
Date	Time	Water Depth	Casing	Stab. Time
1/4/19	1300	2.8	24	10 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
35.70 ▼ (1/04/19)		S-1	0-2	24	14	2 5 7 4	12	S-1: Medium dense, dark brown, fine to coarse SAND, little Gravel, little Silt, trace Wood, trace Roots.	1 2				
		S-2	2-4	24	9	2 2 3 1	5	S-2: Loose, gray-brown to dark brown, fine to medium SAND, little Silt, little Gravel, trace Roots.	3			FILL/TOPSOIL	
		S-3	4-6	24	9	3 2 4 4	6	S-3: Loose, gray-brown, fine to medium SAND, little Gravel, little Silt, 3/4" seam of Clayey Silt 4" from bottom.			4		34.5'
		S-4	6-8	24	12	2 3 3 3	6	S-4: (Top 5") Brown, fine to coarse SAND, some Silt, little Gravel. (Bottom 7") Gray, fine to medium SAND, little Gravel, little Silt.					
		S-5	8-10	24	12	5 5 6 6	11	S-5: Medium dense, brown to gray with orange, fine to medium SAND, some Gravel, little Silt. Silt observed 5-6" from bottom.				SAND AND GRAVEL	
		S-6	14-16	24	9	6 9 11 11	20	S-6: Medium dense, light brown, fine to medium SAND, some Gravel, little (-) Silt.	4 5 6				
											17.5	SILT & CLAY	21.0'
		S-7	19-21	24	14	21 23 21 22	44	S-7: (Top 3") Light brown, SILT & CLAY, trace fine Sand, trace Gravel. (Bottom 11") Light brown, fine to medium SAND, some Gravel, some Silt.	R		19.3		19.2'
											23.8	GLACIAL DEPOSIT	14.7'
		S-8	24-24.2	2	2	100/2"		S-8: Very dense, gray, GRAVEL, little fine Sand, little Clayey Silt.	7		25	WEATHERED BEDROCK	13.5'
	min/ft 2:00 1:30 2:30 2:30 2:45	C-1	26-31	60	56			C-1: Hard to medium hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, subhorizontal to subvertical joints/fractures. RQD=20%	8			BEDROCK	
	2:30 2:45 2:30 2:45 3:00 3:00 2:45	C-2	31-36	60	60			C-2: Hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, moderately dipping to subvertical joints/fractures. RQD=35%				BEDROCK	
								Bottom of boring at 36 feet.	9		36		2.5'

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 5.5 feet south of staked location due to restricted access and overhead wires.
3. Continuous sampling performed from sampling depths 0 to 10 feet below ground surface (bgs). Driller advanced 4-inch casing down as sampling advanced. The casing was advanced to 14 feet bgs following sampling of S-5.
4. Standard sampling performed from sample depths 14 to 24.2 feet bgs.
5. Driller advanced 4-inch casing from 14 to 24 feet bgs.
6. Clayey Silt observed in drill cuttings from 17.5 to 19 feet bgs.
7. Weathered Bedrock fragments and increased drill effort observed at 23.8 feet bgs.
8. Cored bedrock with a downward pressure of 500 psi at 1,350 rpm in 3rd gear using an NX core barrel.
9. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

ELEVATION IN FEET: 40, 30, 20, 10, 0, -10

PROP. TOP OF REINFORCED SOIL FOUNDATION WEST ABUTMENT EL. 36.50

APPROX. PROP. PILE TIP VARIES EL. 23.00–25.50

B–7
SCALE: 1/8" = 1'–0"

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N: 3019362.9337, E: 808083.6438
Ground Surface Elev. (ft.): 37.8
Final Boring Depth (ft.): 41
Date Start - Finish: 1/15/2019 - 1/15/2019
H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Safety Hammer

Groundwater Depth (ft.)				
Date	Time	Water Depth	Casing	Stab. Time
1/15/19	1520	5.8	29.5	10 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
32.00 ▼ (1/15/19)		S-1	0-2	24	11	6 4 4 6	8	S-1: (Top 6") Brown to light brown, fine to medium SAND, some Gravel, trace Silt, trace Roots. (Bottom 5") Dark brown, Organic CLAY & SILT, some fine to medium Sand, little Brick, trace Roots, trace Glass.	1 2 3				
		S-2	2-4	24	5	21 18 14 28	32	S-2: Hard, dark brown, CLAY & SILT, some fine to medium Sand, little Gravel, trace Roots.				FILL	
		S-3	4-6	24	7	18 15 18 12	33	S-3: Dense, gray-brown, fine to coarse SAND, some Gravel, some Clayey Silt.			4		33.8'
		S-4	6-8	24	15	17 16 13 14	29	S-4: Medium dense, light brown to gray, fine to coarse SAND, some Clayey Silt, some Gravel.					
		S-5	8-10	24	8	16 11 13 13	24	S-5: Dense, light brown, fine to medium SAND, some Gravel, little Silt.				SAND AND GRAVEL	
		S-6	14-16	24	7	6 10 9 10	19	S-6: Medium dense, light brown, fine to medium SAND, little Silt, trace (+) Gravel.					
		S-7	19-21	24	12	6 6 6 7	12	S-7: (Top 2") Light brown, fine to medium SAND, little Silt. (Bottom 10") Brown-gray, SILT & CLAY, trace fine Sand.			19.2		18.6'
											22.5	SILT & CLAY	15.3'
		S-8	24-26	24	6	26 22 18 23	40	S-8: Dense, gray-brown, fine to coarse SAND, some Silt, some Gravel.				GLACIAL DEPOSIT	
	min/ft 3:00 3:45 4:30 5:15 4:15 4:45 5:15 4:30 4:30 3:30	S-9	29-29.4	5	5	100/5"	R	S-9: Very dense, gray, GRAVEL, some fine to coarse Sand, little (-) Silt.	4		30		7.8'
		C-1	31-36	60	42			C-1: Hard, slightly to moderately weathered, coarse to medium grained, gray with purple, GRANITE, rough, irregular to planar, very close, subvertical to subhorizontal joints/fractures. RQD=0%	5			BEDROCK	
		C-2	36-41	60	60			C-2: Hard, slightly weathered, coarse to medium grained, gray with pink and purple, GRANITE, rough, irregular to planar, very close, subhorizontal to subvertical joints/fractures. RQD=0%	6				
								Bottom of boring at 41 feet.	7		41		-3.2'

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 3.5 feet south due to restricted access.
3. Advanced boring using 4-inch casing from sample depths 0 to 29 feet below ground surface (bgs).
4. Consistent coarse sand-sized rock fragments observed in drill cuttings from sample depths 30 to 31 feet bgs.
5. Drill rig did not have a downward pressure or RPM gauge. Cored bedrock in 3rd gear using an NX core barrel.
6. Core barrel jammed with no loss of water at sample depths 35.1 and 38.3 feet bgs.
7. Borehole backfilled to approximate ground surface with drill cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

B–8
SCALE: 1/8" = 1'–0"

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B–#
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.
6. B–7 AND B–8 WERE MADE IN JANUARY 2019 AND B–9 THROUGH B–12 WERE MADE IN FEBRUARY 2022.
7. BORINGS WERE MADE BY NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH, 03038.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

4 0 4 8
SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

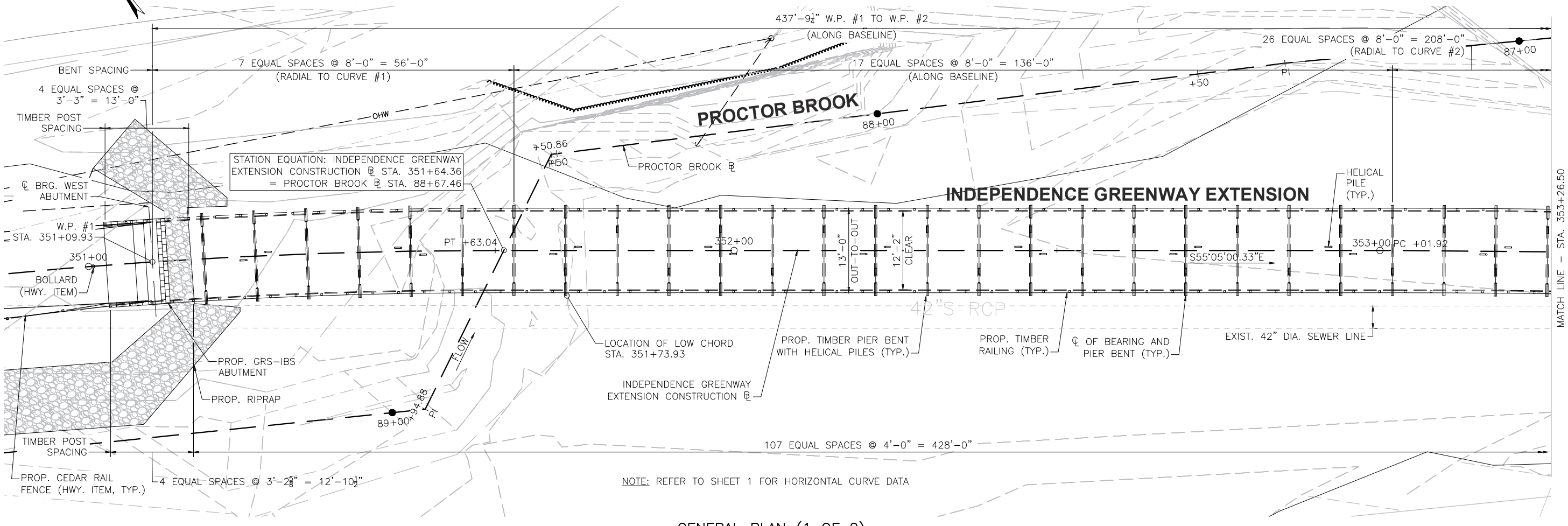
WQC/ACOE PLAN SHEET 51 OF 63

SHEET 3 OF 17 SHEETS BRIDGE NO. P–03–020 (CAK)

PEABODY
INDEPENDENCE GREENWAY EXTENSION

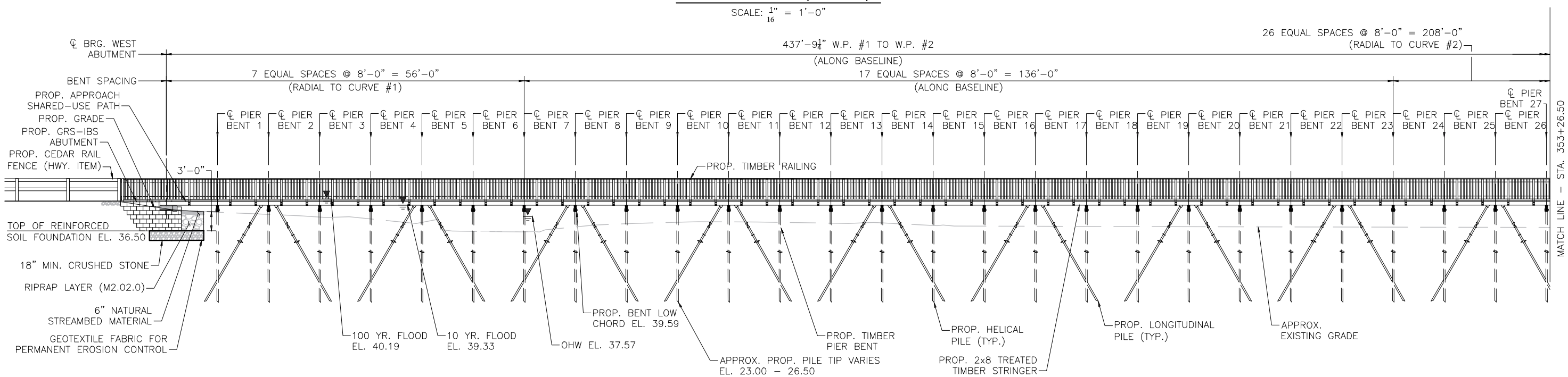
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	65	142
PROJECT FILE NO.	609211		

GENERAL PLAN AND ELEVATION 1 OF 2



GENERAL PLAN (1 OF 2)

SCALE: $\frac{1}{16}$" = 1'-0"



TYPICAL ELEVATION (1 OF 2)

SCALE: $\frac{1}{16}$" = 1'-0"

8 0 8 16

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 52 OF 63

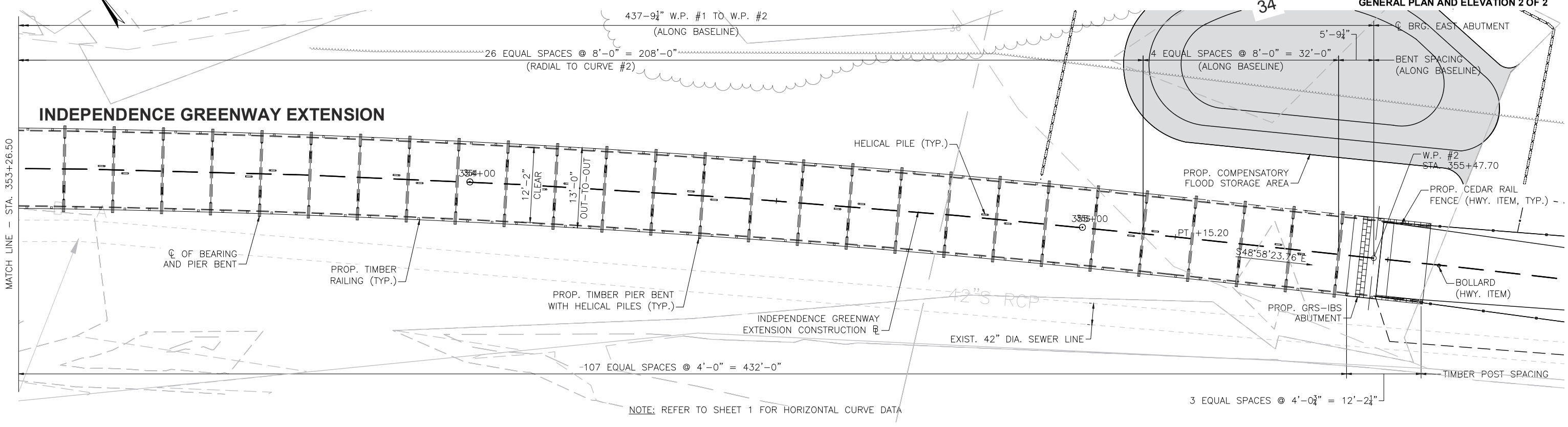
SHEET 6 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

Proposal No. 609211-132091

A00831 - 59

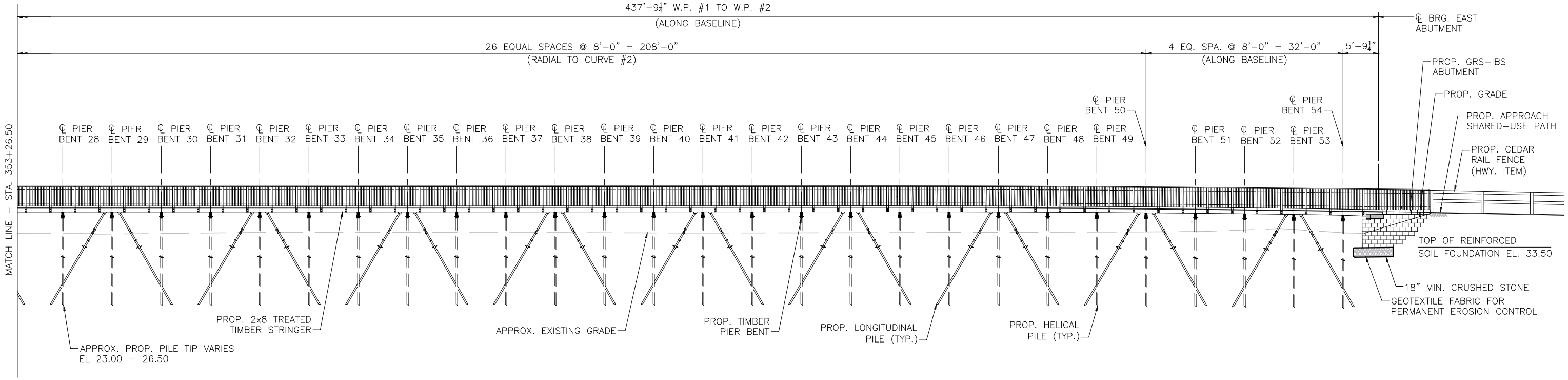
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

GENERAL PLAN AND ELEVATION 2 OF 2



GENERAL PLAN (2 OF 2)

SCALE: 1/16" = 1'-0"



TYPICAL ELEVATION (2 OF 2)

SCALE: 1/16" = 1'-0"

8 0 8 16

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

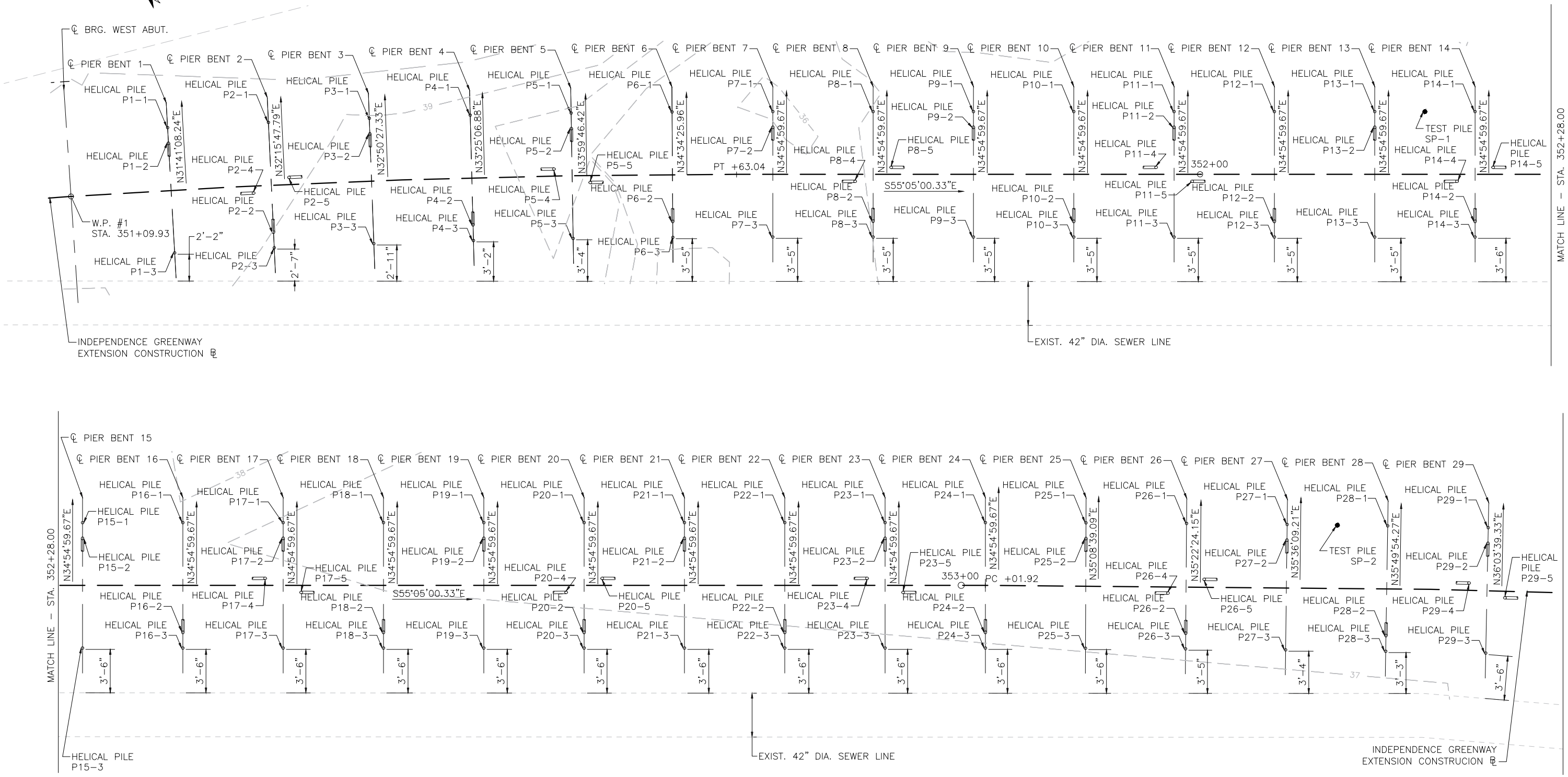
WQC/ACOE PLAN SHEET 53 OF 63

Proposal No. 609211-132091
A00831 - 60

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	67	142
PROJECT FILE NO.		609211	

HELICAL PILE LAYOUT PLAN 1 OF 2



NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'-6" TO THE TOP HELICE FOR ALL P#-3 LOCATIONS WITH AN OFFSET LESS THAN 3'-6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
6. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
7. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

LEGEND:

- ◦ HELICAL PILE P#-#
- ● TEST PILE SP-#

HELICAL PILE LAYOUT PLAN 1

SCALE: $\frac{1}{8}$" = 1'-0"

4 0 4 8

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 54 OF 63

SHEET 8 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

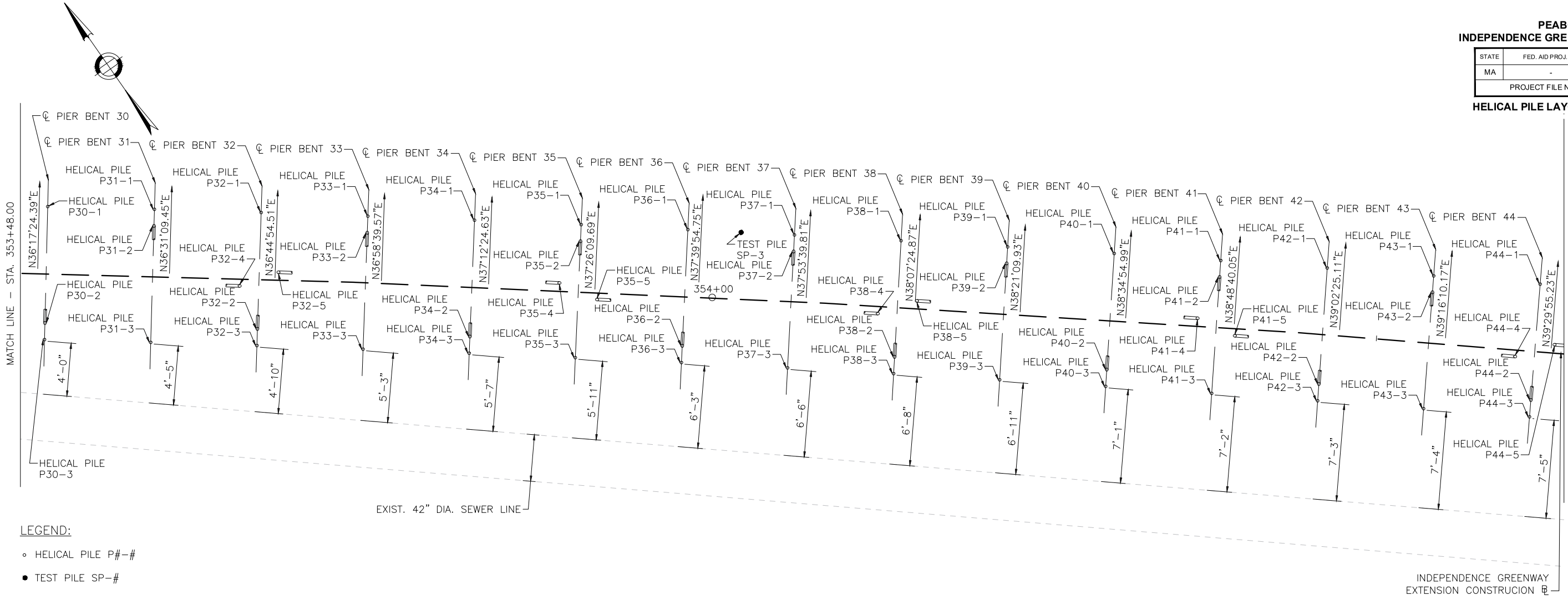
Proposal No. 609211-132091

A00831 - 61

PEABODY
INDEPENDENCE GREENWAY EXTENSION

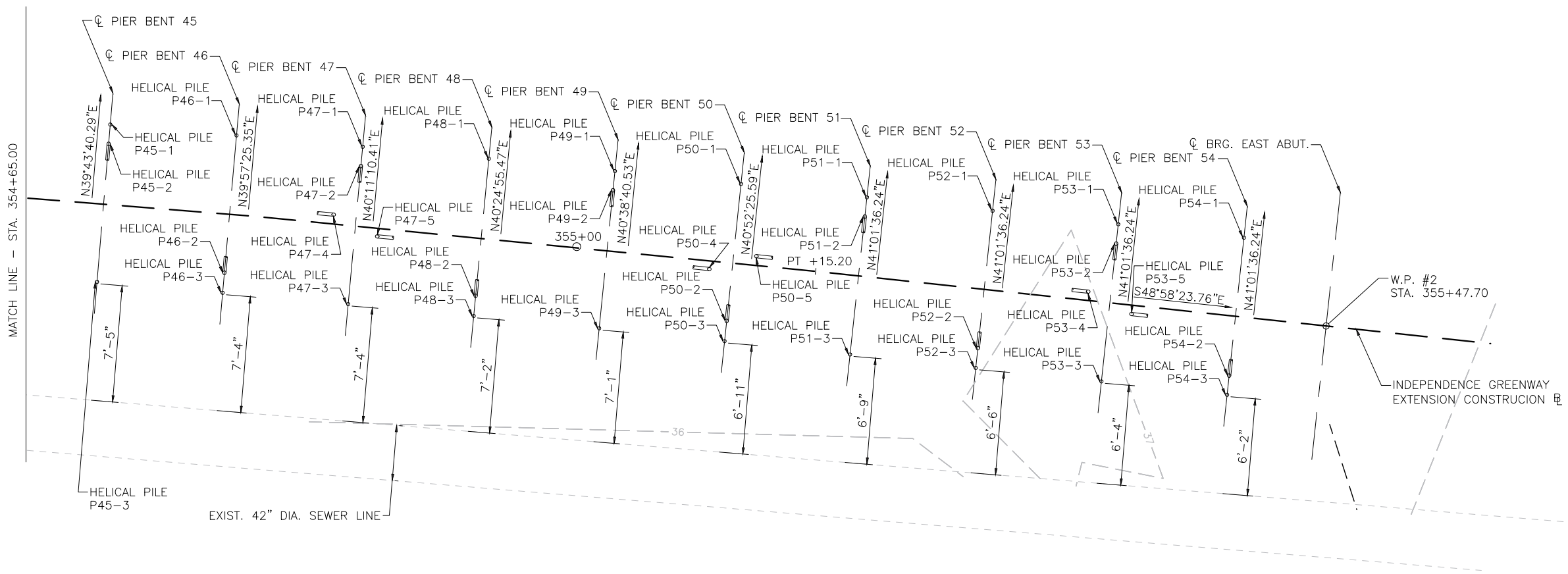
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	68	142
PROJECT FILE NO.	609211		

HELICAL PILE LAYOUT PLAN 2 OF 2



LEGEND:

- ∘ HELICAL PILE P#–#
- ● TEST PILE SP–#



NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'–6" TO THE TOP HELICE FOR ALL P#–3 LOCATIONS WITH AN OFFSET LESS THAN 3'–6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
5. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
6. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

4 0 4 8
SCALE IN FEET

HELICAL PILE LAYOUT PLAN 2
SCALE: $\frac{1}{8}$" = 1'–0"

WQC/ACOE PLAN SHEET 55 OF 63

Proposal No. 609211-132091
A00831 - 62

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	69	142
PROJECT FILE NO.	609211		

HELICAL PILE LAYOUT TABLE

HELICAL PILE	STATION	OFFSET
P1–1	351+17.93	5.00 LT
P1–2	351+17.93	3.75 LT
P1–3	351+17.93	5.00 RT
P2–1	351+25.93	5.00 LT
P2–2	351+25.93	3.75 RT
P2–3	351+25.93	5.00 RT
P3–1	351+33.93	5.00 LT
P3–2	351+33.93	3.75 LT
P3–3	351+33.93	5.00 RT
P4–1	351+41.93	5.00 LT
P4–2	351+41.93	3.75 RT
P4–3	351+41.93	5.00 RT
P5–1	351+49.93	4.99 LT
P5–2	351+49.93	3.76 LT
P5–3	351+49.93	5.01 RT
P6–1	351+57.93	4.99 LT
P6–2	351+57.93	3.74 RT
P6–3	351+57.93	5.01 RT
P7–1	351+65.93	5.00 LT
P7–2	351+65.93	3.75 LT
P7–3	351+65.93	5.00 RT
P8–1	351+73.93	5.00 LT
P8–2	351+73.93	3.73 RT
P8–3	351+73.93	5.00 RT
P9–1	351+81.93	5.00 LT
P9–2	351+81.93	3.75 LT
P9–3	351+81.93	5.00 RT
P10–1	351+89.93	5.00 LT
P10–2	351+89.93	3.75 RT
P10–3	351+89.93	5.00 RT
P11–1	351+97.93	5.00 LT
P11–2	351+97.93	3.75 LT
P11–3	351+97.93	5.00 RT
P12–1	352+05.93	5.00 LT
P12–2	352+05.93	3.75 RT
P12–3	352+05.93	5.00 RT
P13–1	352+13.93	5.00 LT
P13–2	352+13.93	3.75 LT
P13–3	352+13.93	5.00 RT
P14–1	352+21.93	5.00 LT
P14–2	352+21.93	3.75 RT
P14–3	352+21.93	5.00 RT
P15–1	352+29.93	5.00 LT
P15–2	352+29.93	3.75 LT
P15–3	352+29.93	5.00 RT
P16–1	352+37.93	5.00 LT
P16–2	352+37.93	3.75 RT
P16–3	352+37.93	5.00 RT
P17–1	352+45.93	5.00 LT
P17–2	352+45.93	3.75 LT
P17–3	352+45.93	5.00 RT
P18–1	352+53.93	5.00 LT
P18–2	352+53.93	3.75 RT
P18–3	352+53.93	5.00 RT
P19–1	352+61.93	5.00 LT
P19–2	352+61.93	3.75 LT
P19–3	352+61.93	5.00 RT
P20–1	352+69.93	5.00 LT
P20–2	352+69.93	3.75 RT
P20–3	352+69.93	5.00 RT

HELICAL PILE	STATION	OFFSET
P21–1	352+77.93	5.00 LT
P21–2	352+77.93	3.50 LT
P21–3	352+77.93	5.00 RT
P22–1	352+85.93	5.00 LT
P22–2	352+85.93	3.75 RT
P22–3	352+85.93	5.00 RT
P23–1	352+93.93	5.00 LT
P23–2	352+93.93	3.75 LT
P23–3	352+93.93	5.00 RT
P24–1	353+01.93	5.00 LT
P24–2	353+01.93	3.75 RT
P24–3	353+01.93	5.00 RT
P25–1	353+09.93	5.00 LT
P25–2	353+09.93	3.75 LT
P25–3	353+09.93	5.00 RT
P26–1	353+17.93	5.00 LT
P26–2	353+17.93	3.75 RT
P26–3	353+17.93	5.00 RT
P27–1	353+25.93	5.00 LT
P27–2	353+25.93	3.75 LT
P27–3	353+25.93	5.00 RT
P28–1	353+33.93	5.00 LT
P28–2	353+33.93	3.75 RT
P28–3	353+33.93	5.00 RT
P29–1	353+41.93	5.00 LT
P29–2	353+41.93	3.75 LT
P29–3	353+41.93	5.00 RT
P30–1	353+49.93	5.00 LT
P30–2	353+49.93	3.75 RT
P30–3	353+49.93	5.00 RT
P31–1	353+57.93	5.00 LT
P31–2	353+57.93	3.75 LT
P31–3	353+57.93	5.00 RT
P32–1	353+65.93	5.00 LT
P32–2	353+65.93	3.75 RT
P32–3	353+65.93	5.00 RT
P33–1	353+73.93	5.00 LT
P33–2	353+73.93	3.75 LT
P33–3	353+73.93	5.00 RT
P34–1	353+81.93	5.00 LT
P34–2	353+81.93	3.74 RT
P34–3	353+81.93	5.00 RT
P35–1	353+89.93	5.00 LT
P35–2	353+89.93	3.76 LT
P35–3	353+89.93	5.00 RT
P36–1	353+97.93	5.00 LT
P36–2	353+97.93	3.74 RT
P36–3	353+97.93	5.00 RT
P37–1	354+05.93	5.00 LT
P37–2	354+05.93	3.76 LT
P37–3	354+05.93	5.00 RT
P38–1	354+13.93	5.00 LT
P38–2	354+13.93	3.74 RT
P38–3	354+13.93	5.00 RT
P39–1	354+21.93	5.00 LT
P39–2	354+21.93	3.76 LT
P39–3	354+21.93	5.00 RT
P40–1	354+29.93	5.00 LT
P40–2	354+29.93	3.74 RT
P40–3	354+29.93	5.00 RT

HELICAL PILE	STATION	OFFSET
P41–1	354+37.93	5.00 LT
P41–2	354+37.93	3.76 LT
P41–3	354+37.93	5.00 RT
P42–1	354+45.93	5.00 LT
P42–2	354+45.93	3.73 RT
P42–3	354+45.93	5.00 RT
P43–1	354+53.93	5.00 LT
P43–2	354+53.93	3.77 LT
P43–3	354+53.93	5.00 RT
P44–1	354+61.93	5.00 LT
P44–2	354+61.93	3.73 RT
P44–3	354+61.93	5.00 RT
P45–1	354+69.93	5.00 LT
P45–2	354+69.93	3.77 LT
P45–3	354+69.93	5.00 RT
P46–1	354+77.93	5.00 LT
P46–2	354+77.93	3.73 RT
P46–3	354+77.93	5.00 RT
P47–1	354+85.93	5.00 LT
P47–2	354+85.93	3.78 LT
P47–3	354+85.93	5.00 RT
P48–1	354+93.93	5.00 LT
P48–2	354+93.93	3.72 RT
P48–3	354+93.93	5.00 RT
P49–1	355+01.93	5.00 LT
P49–2	355+01.93	3.78 LT
P49–3	355+01.93	5.00 RT
P50–1	355+09.93	5.00 LT
P50–2	355+09.93	3.72 RT
P50–3	355+09.93	5.00 RT
P51–1	355+17.93	5.00 LT
P51–2	355+17.93	3.78 LT
P51–3	355+17.93	5.00 RT
P52–1	355+25.93	5.00 LT
P52–2	355+25.93	3.74 RT
P52–3	355+25.93	5.00 RT
P53–1	355+33.93	5.00 LT
P53–2	355+33.93	3.77 LT
P53–3	355+33.93	5.00 RT
P54–1	355+41.93	5.00 LT
P54–2	355+41.93	3.78 RT
P54–3	355+41.93	5.00 RT

HELICAL PILE	STATION	OFFSET
P2–4	351+24.49	0.56 RT
P2–5	351+27.37	0.56 LT
P5–4	351+48.48	0.56 LT
P5–5	351+51.37	0.56 RT
P8–4	351+72.49	0.56 RT
P8–5	351+75.37	0.56 LT
P11–4	351+96.49	0.56 LT
P11–5	351+99.37	0.56 RT
P14–4	352+20.49	0.56 RT
P14–5	352+23.37	0.56 LT
P17–4	352+44.50	0.56 LT
P17–5	352+47.37	0.56 RT
P20–4	352+68.50	0.56 RT
P20–5	352+71.37	0.56 LT
P23–4	352+92.49	0.56 LT
P23–5	352+95.37	0.56 RT
P26–4	353+16.50	0.56 RT
P26–5	353+19.37	0.56 LT
P29–4	353+40.50	0.56 LT
P29–5	353+43.37	0.56 RT
P32–4	353+64.49	0.56 RT
P32–5	353+67.37	0.56 LT
P35–4	353+88.50	0.56 LT
P35–5	353+91.38	0.56 RT
P38–4	354+12.50	0.56 RT
P38–5	354+15.38	0.56 LT
P41–4	354+36.50	0.56 LT
P41–5	354+39.38	0.56 RT
P44–4	354+60.51	0.56 RT
P44–5	354+63.38	0.56 LT
P47–4	354+84.51	0.56 LT
P47–5	354+87.38	0.56 RT
P50–4	355+8.49	0.56 RT
P50–5	355+11.37	0.56 LT
P53–4	355+32.50	0.56 LT
P53–5	355+35.37	0.56 RT

SACRIFICIAL HELICAL TEST PILE	STATION	OFFSET
SP–1	352+17.93	5.00 LT
SP–2	353+29.93	5.00 LT
SP–3	354+01.93	5.00 LT

NOTE:

SEE SHEETS 8 AND 9 FOR PILE LAYOUT AND ADDITIONAL NOTES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

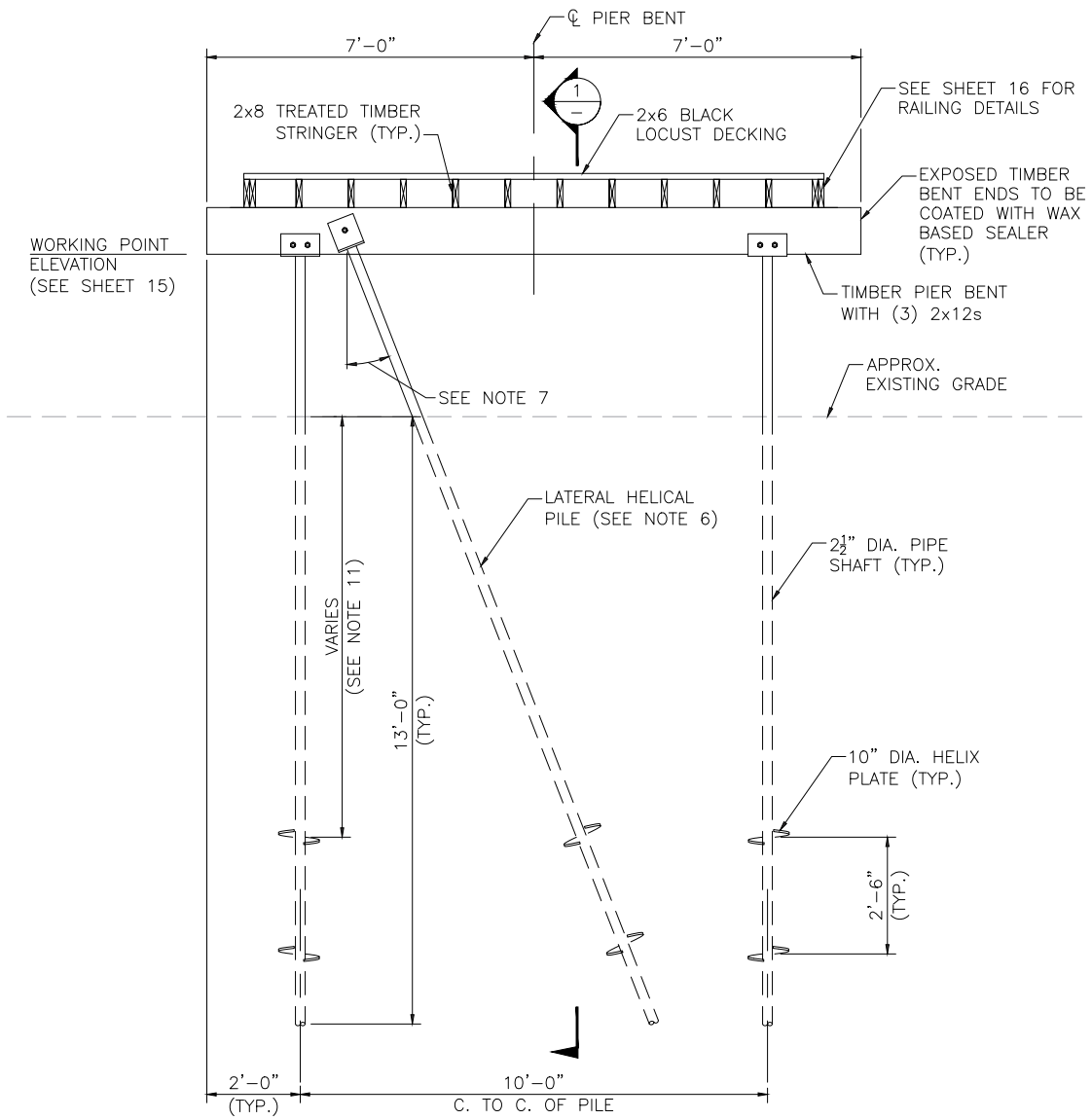
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091

A00831 - 63

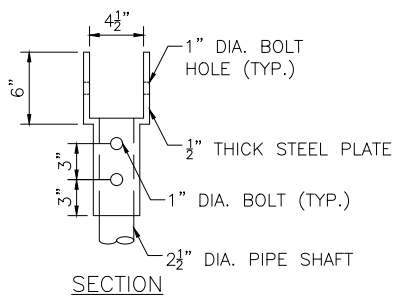
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	70	142
PROJECT FILE NO.	609211		

HELICAL PILE DETAILS

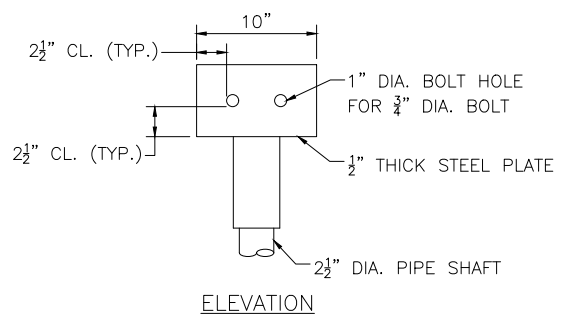


HELICAL PILE TYPICAL SECTION

SCALE: 1/4" = 1'–0"



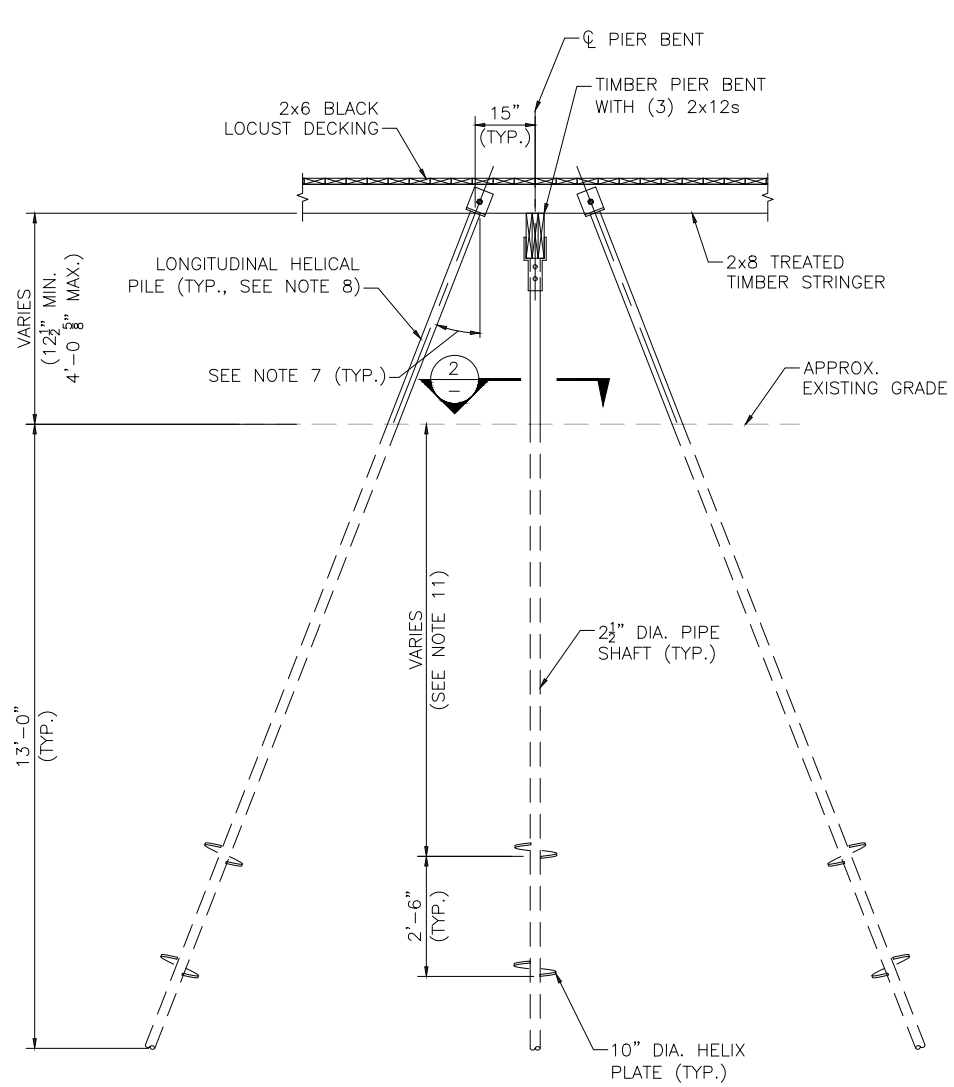
SECTION



ELEVATION

HELICAL PILE ATTACHMENT ASSEMBLY

SCALE: 3/4" = 1'–0"

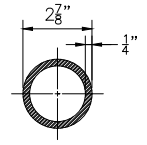


2 0 2 4

SCALE IN FEET

SECTION 1

SCALE: 1/4" = 1'–0"

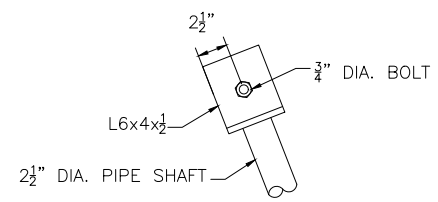


SECTION 2

SCALE: 3/2" = 1'–0"

8" 0 8" 1'-4"

SCALE IN FEET



LATERAL AND LONGITUDINAL HELICAL PILE ATTACHMENT ASSEMBLY

SCALE: 3/4" = 1'–0"

8" 0 8" 1'-4"

SCALE IN FEET

NOTES:

1. THE TABLE BELOW SUMMARIZES THE FACTORED AXIAL DESIGN LOADS PER PILE FOR AASHTO LRFD BRIDGE SPECIFICATIONS STRENGTH I LOAD COMBINATIONS. THE NOMINAL GEOTECHNICAL RESISTANCE, AND THE FACTORED GEOTECHNICAL RESISTANCE PER PILE:

	FACTORED DESIGN LOADS	NOMINAL GEOTECHNICAL RESISTANCE	FACTORED GEOTECHNICAL RESISTANCE**
HELICAL PILE (COMPRESSION)	10.00 KIPS	17.00 KIPS	11.90 KIPS
HELICAL PILE (TENSION)	5.00 KIPS	14.80 KIPS	10.35 KIPS

**FACTORED GEOTECHNICAL RESISTANCE IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE AND A RESISTANCE FACTOR OF 0.70.

2. THE TOP HELIX OF ALL PROPOSED HELICAL PILES SHALL BE TORQUED TO A MINIMUM EMBEDMENT OF 9 FEET BELOW EXISTING GRADE, EXCEPT AS NOTED ON SHEET 8 ADJACENT TO THE SEWER LINE.
3. THREE PRE–PRODUCTION VERIFICATION LOAD TESTS FOR THREE SACRIFICIAL PILES ARE REQUIRED TO CONFIRM THE HELICAL PILE NOMINAL RESISTANCE. LOAD TESTING SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIAL PROVISION REQUIREMENTS, THE GEOTECHNICAL REPORT RECOMMENDATIONS, AND THE SACRIFICIAL PILE LOCATIONS SHALL BE AGREED UPON BY THE CONTRACTOR AND ENGINEER. A RESISTANCE FACTOR OF 0.70 MAY BE UTILIZED UPON SUCCESSFUL COMPLETION OF STATIC LOAD TESTING.
4. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS FOR THE PROPOSED HELICAL PILES SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER LICENSED IN THE COMMONWEALTH OF MASSACHUSETTS.
5. ALTERNATIVE ATTACHMENT AND ASSEMBLIES CAN BE SUBMITTED THROUGH THE SHOP DRAWING PROCESS FOR REVIEW AND APPROVAL.
6. LATERAL PILES ALTERNATE DIRECTION EVERY BENT.
7. LATERAL AND LONGITUDINAL PILE ANGLE CAN RANGE BETWEEN 25° AND 35°.
8. LONGITUDINAL BATTERED PILES SHALL BE AT EVERY THIRD PIER BENT TO RESIST LONGITUDINAL LOADING.
9. HELICAL PILES AND CONNECTIONS SHALL BE HOT–DIPPED GALVANIZED.
10. REMOVAL OF SURFICIAL COBBLES/BOULDERS WILL BE REQUIRED PRIOR TO HELICAL PILE INSTALLATION. PRE–DRILLING MAY BE REQUIRED TO PENETRATE THE COBBLES AND BOULDERS.
11. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'–6" TO THE TOP HELICE FOR ALL P#–3 LOCATIONS WITH AN OFFSET LESS THAN 3'–6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE. MINIMUM EMBEDMENT FOR ALL REMAINING PILES SHALL BE 9'–0".
12. FOR ADDITIONAL HELICAL PILE REQUIREMENTS, SEE SPECIAL PROVISION ITEM NO. 943.20.

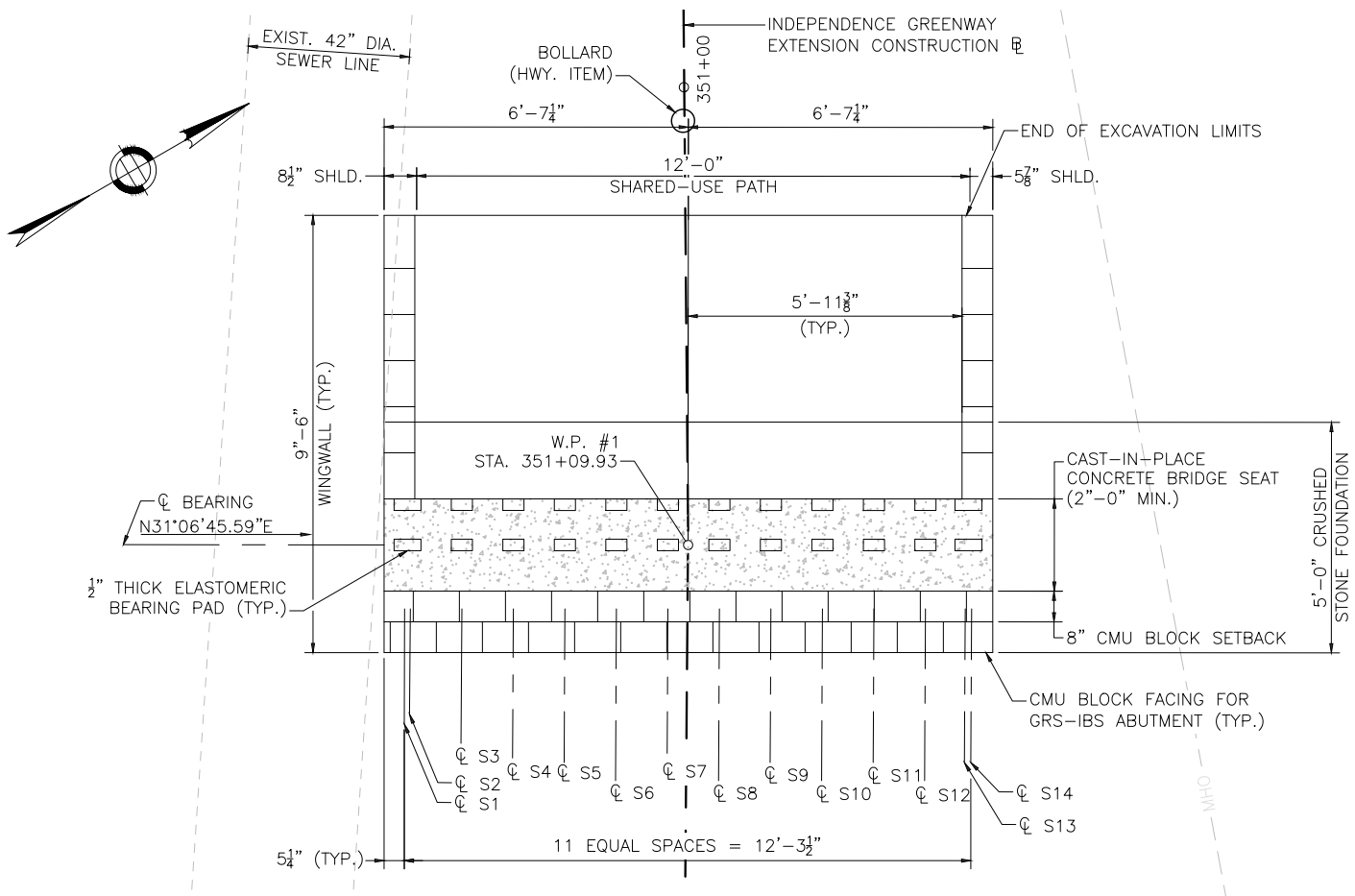
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091

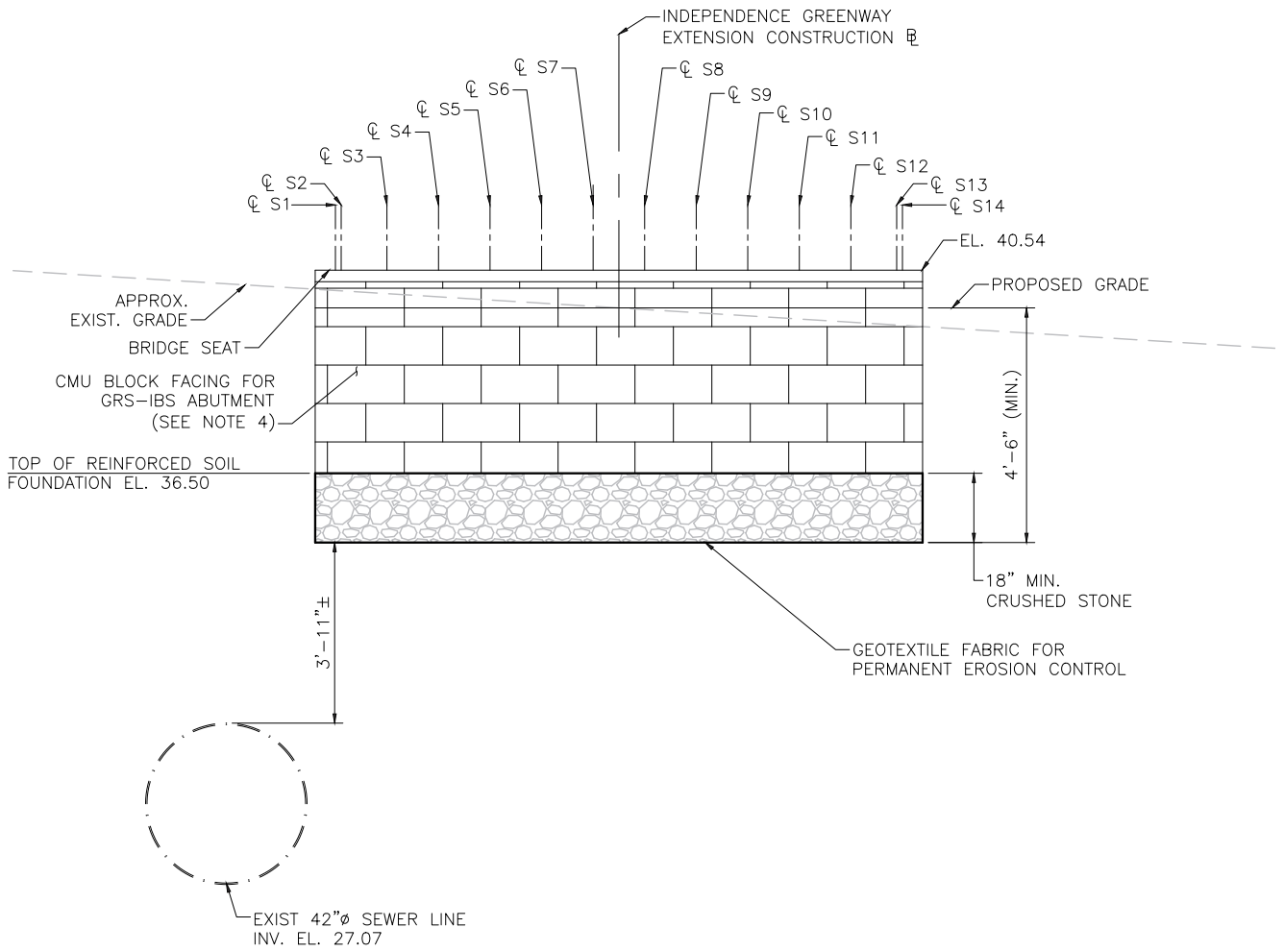
A00831 - 64

Proposal No. 609211-132091



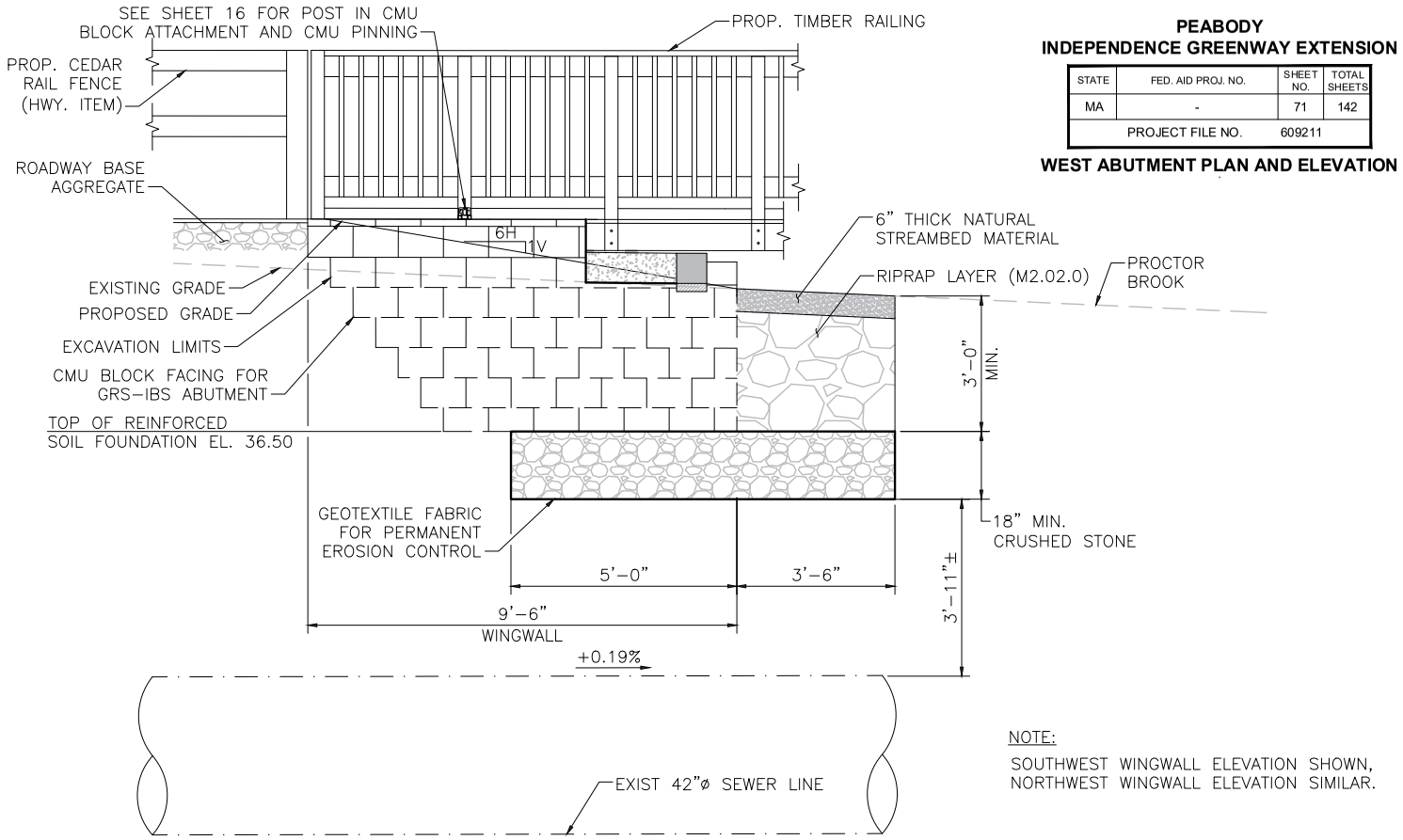
WEST ABUTMENT PLAN

SCALE: ¼" = 1'-0"



WEST ABUTMENT ELEVATION

SCALE: ¼" = 1'-0"

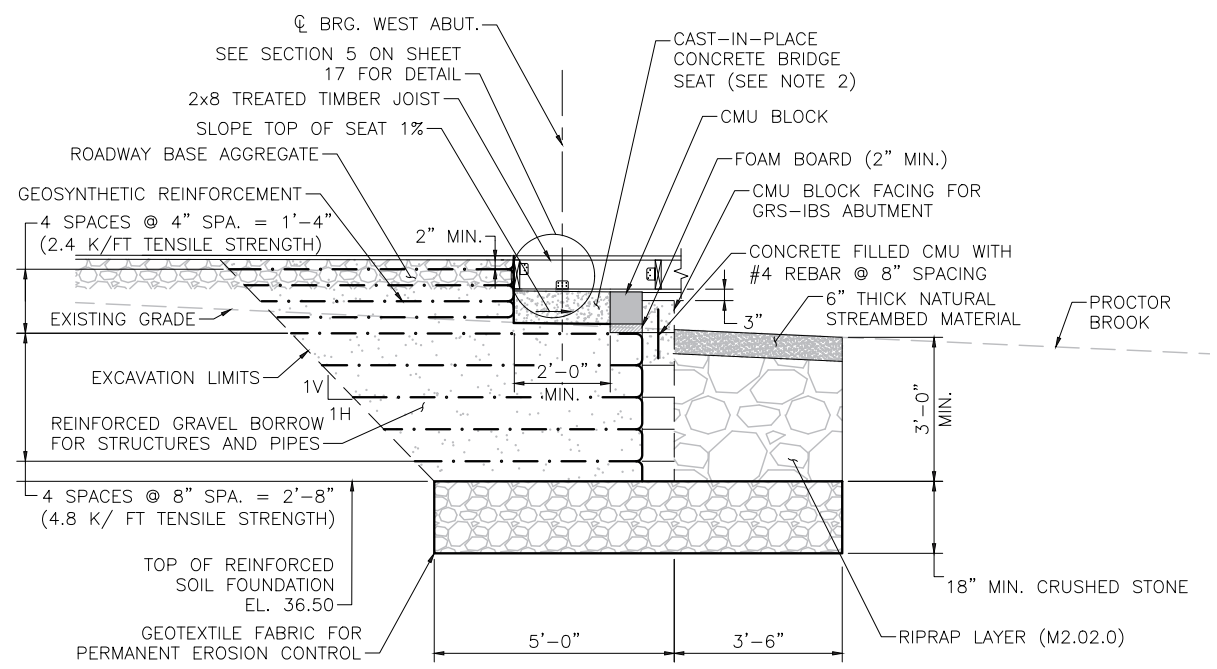


SOUTHWEST ABUTMENT WINGWALL ELEVATION

SCALE: ¼" = 1'-0"

NOTE:

SOUTHWEST WINGWALL ELEVATION SHOWN, NORTHWEST WINGWALL ELEVATION SIMILAR.



WEST ABUTMENT TYPICAL SECTION

SCALE: ¼" = 1'-0"

GRS-IBS ABUTMENT NOTES:

1. THE FACTORED BEARING PRESSURE = 0.897 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.

   FACTORED BEARING RESISTANCE = 5.8 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.65.

2. CAST-IN-PLACE CONCRETE BEARING SEAT SHALL BE 5000 PSI HP CEMENT CONCRETE WITH ONE LAYER OF #4 WELDED WIRE FABRIC PLACED AT MID-HEIGHT.

3. THE GEOTEXTILE REINFORCEMENT SHALL EXTEND BETWEEN THE LAYERS OF CMU BLOCK.

4. ALL CMU BLOCKS ABOVE PROPOSED GRADE AND THE FIRST BLOCK BELOW GRADE SHALL BE HOLLOW AND FILLED WITH BLOCK WALL CONCRETE FILL. ALL CMU BLOCKS BELOW THAT POINT SHALL BE SOLID. SEE SECTION VIEW FOR LIMITS OF CONCRETE FILL CMU BLOCKS ABOVE GRADE.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	71	142
PROJECT FILE NO.	609211		

WEST ABUTMENT PLAN AND ELEVATION

2 0 2 4

SCALE IN FEET

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

A00831 - 65

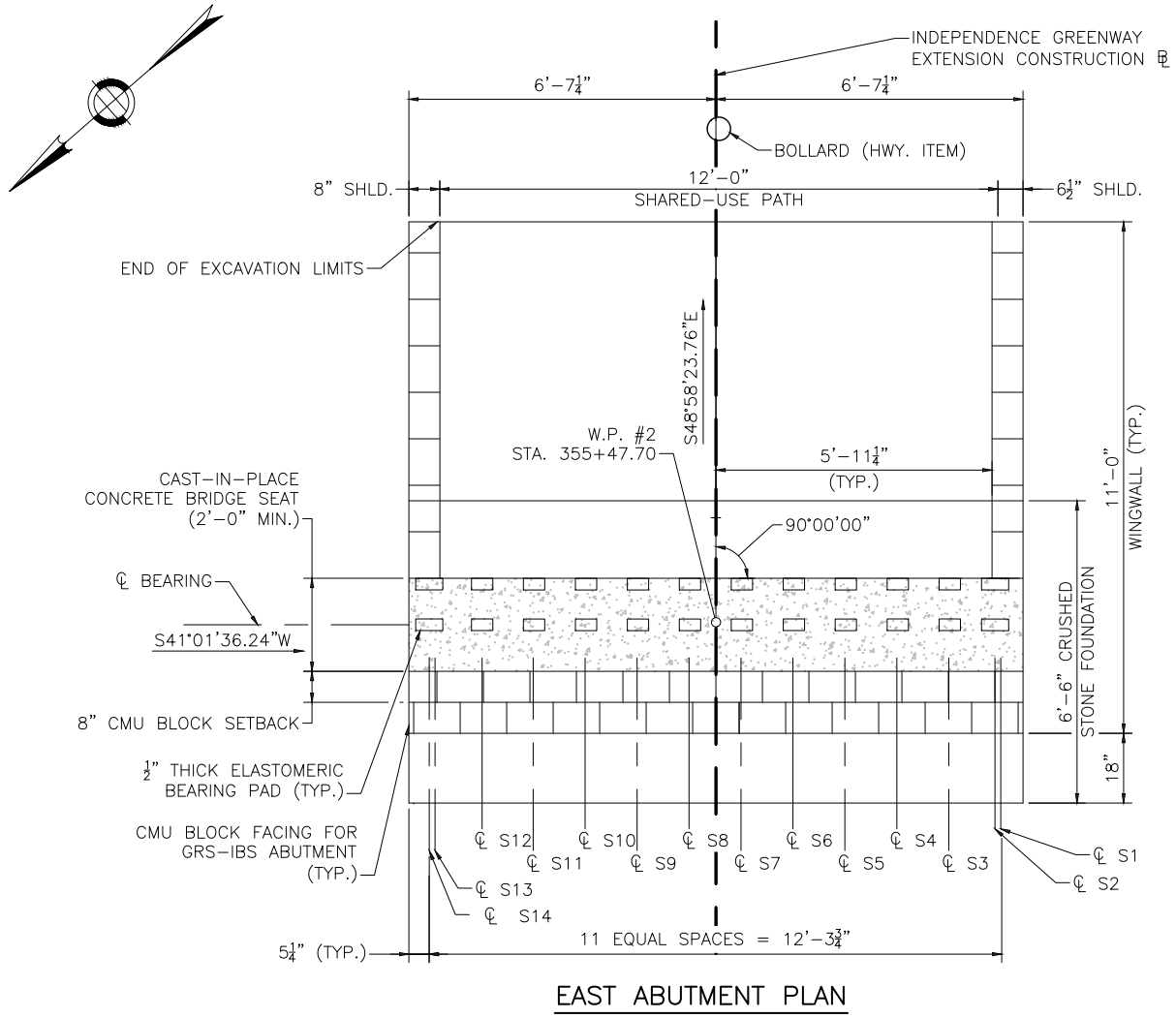
Proposal No. 609211-132091

A00831 - 66

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	72	142
PROJECT FILE NO.	609211		

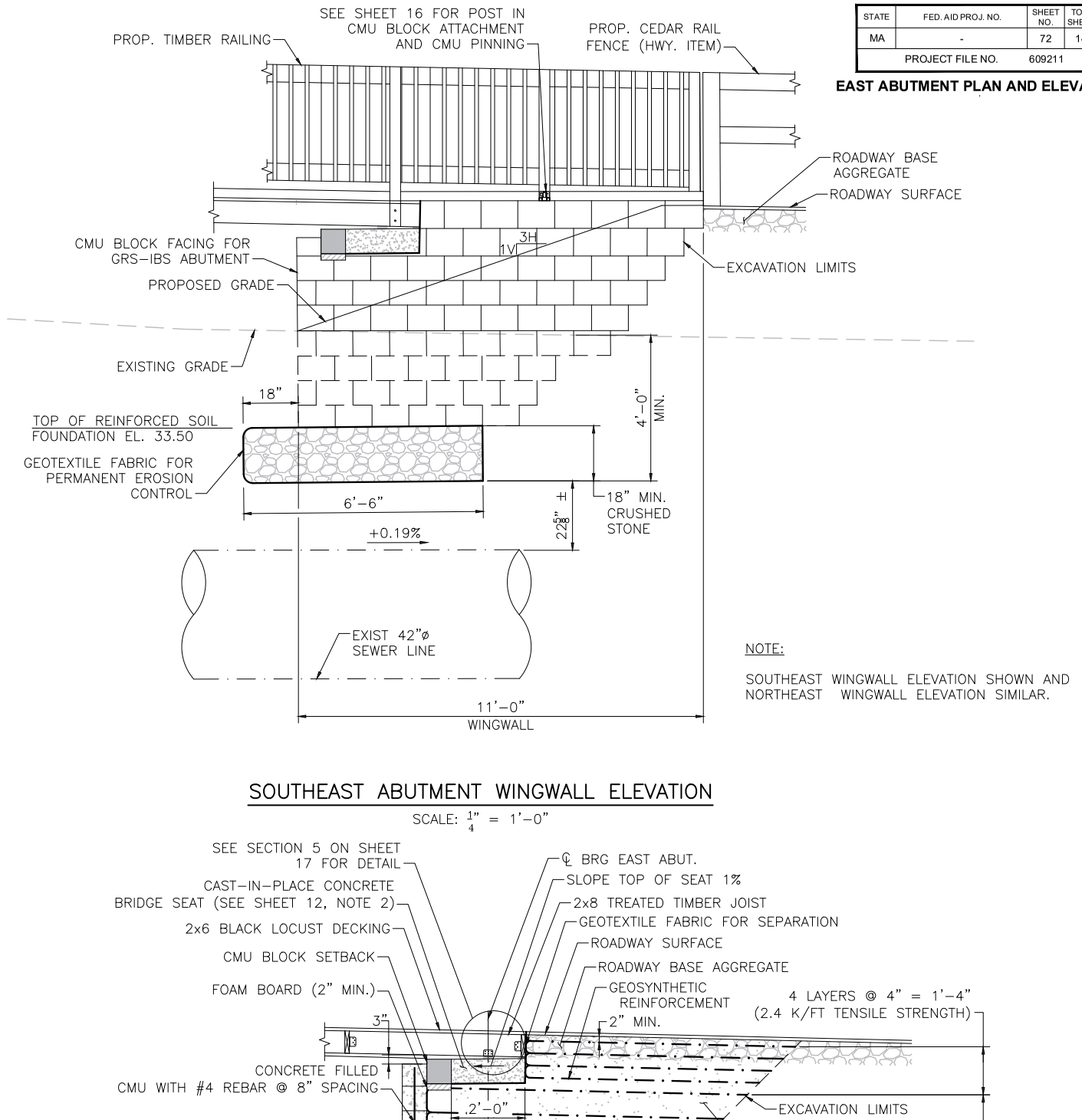
EAST ABUTMENT PLAN AND ELEVATION



EAST ABUTMENT PLAN

SCALE: ¼" = 1'–0"

EXIST. 42" DIA.
SEWER LINE

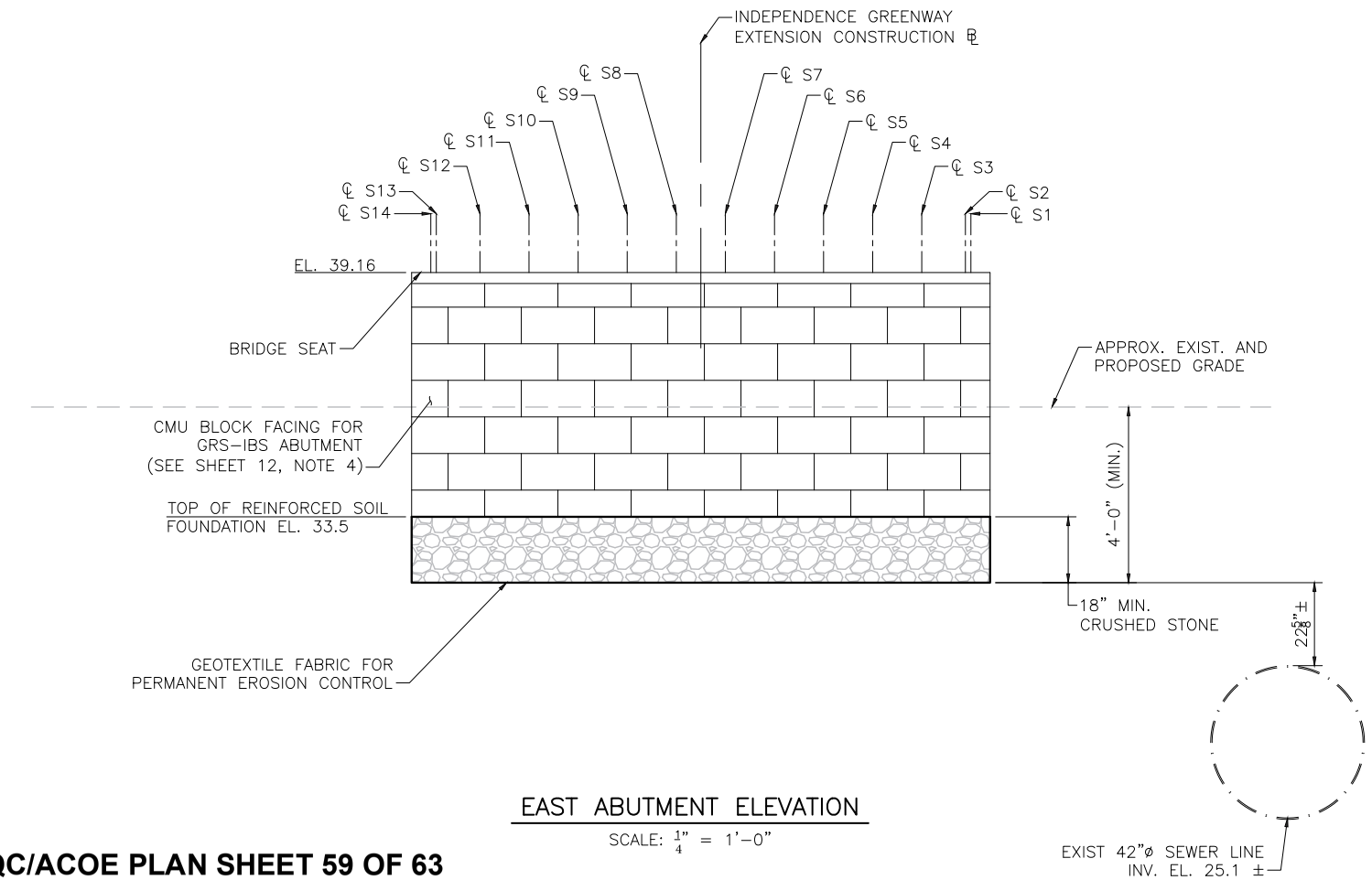


NOTE:

SOUTHEAST WINGWALL ELEVATION SHOWN AND NORTHEAST WINGWALL ELEVATION SIMILAR.

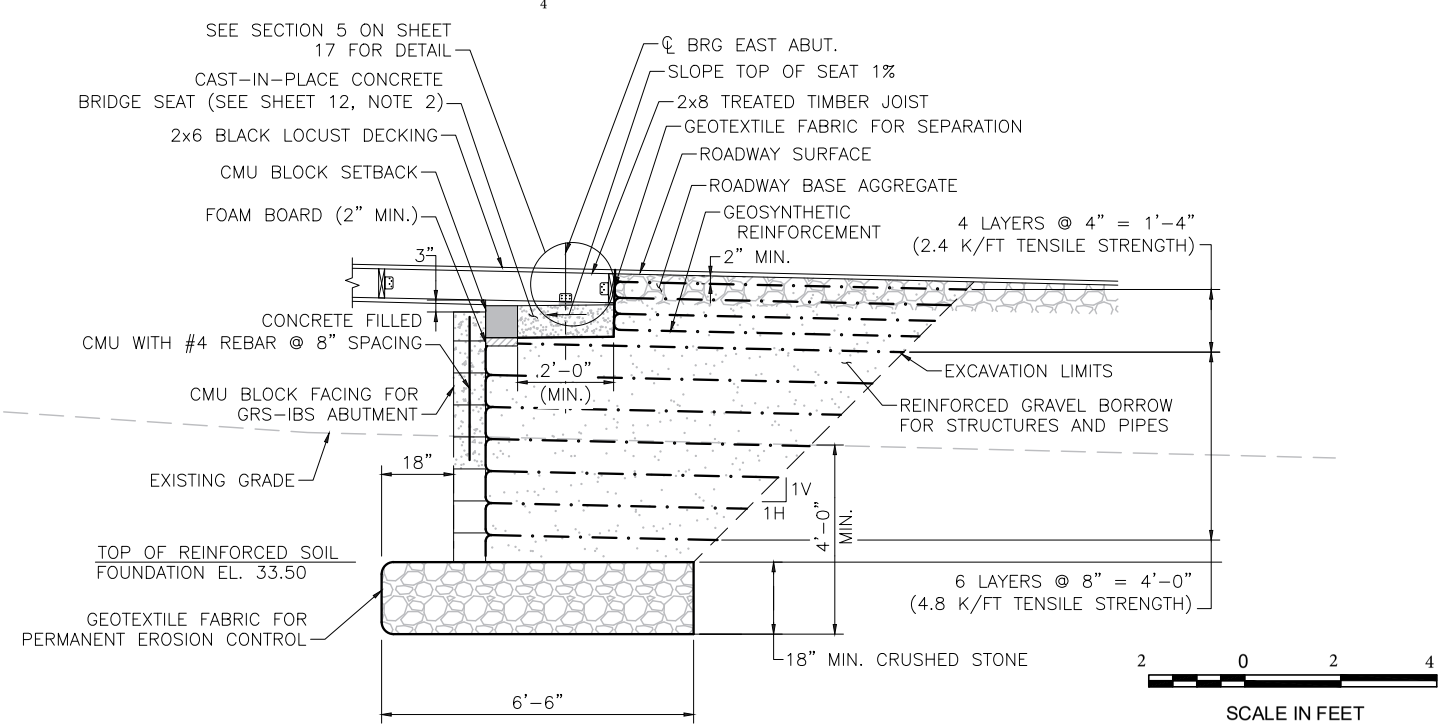
SOUTHEAST ABUTMENT WINGWALL ELEVATION

SCALE: ¼" = 1'–0"



EAST ABUTMENT ELEVATION

SCALE: ¼" = 1'–0"



2 0 2 4

SCALE IN FEET

EAST ABUTMENT SECTION

SCALE: ¼" = 1'–0"

NOTE:

SEE SHEET 12 FOR GRS–IBS ABUTMENT NOTES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

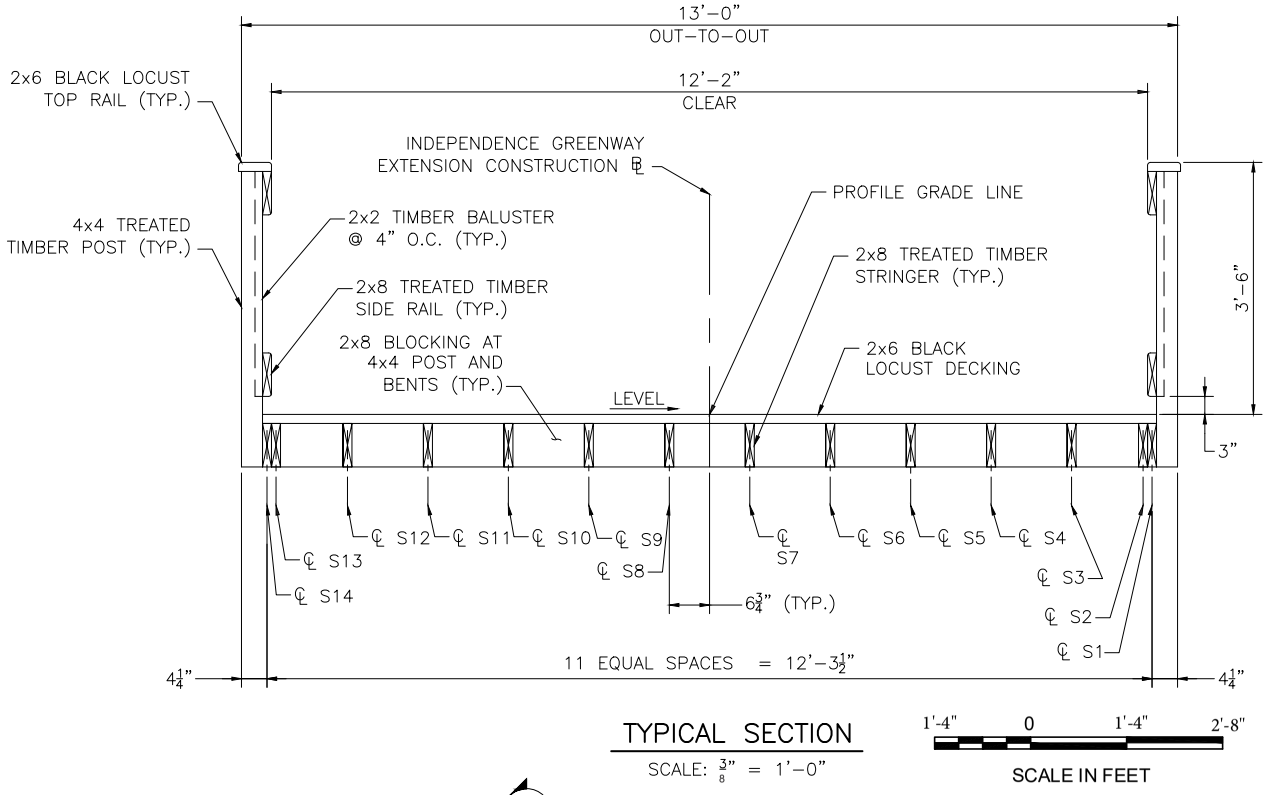
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

WQC/ACOE PLAN SHEET 59 OF 63

PEABODY
INDEPENDENCE GREENWAY EXTENSION

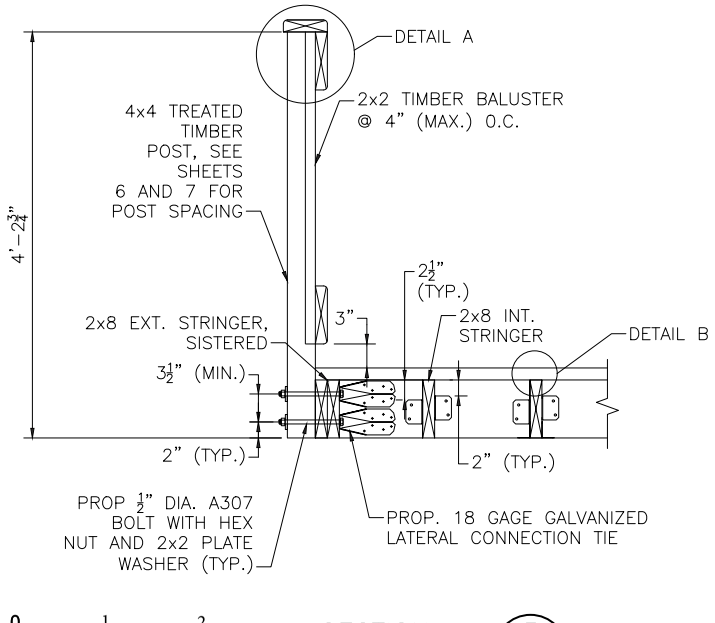
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	75	142
PROJECT FILE NO.	609211		

TYPICAL SECTION AND TIMBER CONNECTION DETAILS



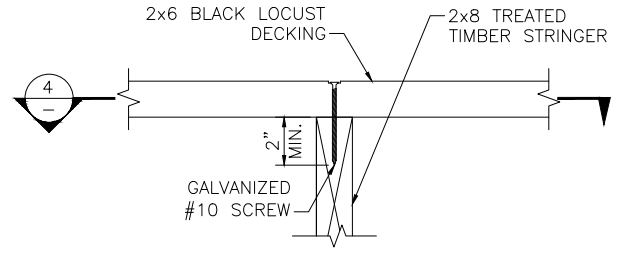
TYPICAL SECTION
SCALE: ⅜" = 1'-0"

1'-4" 0 1'-4" 2'-8"
SCALE IN FEET

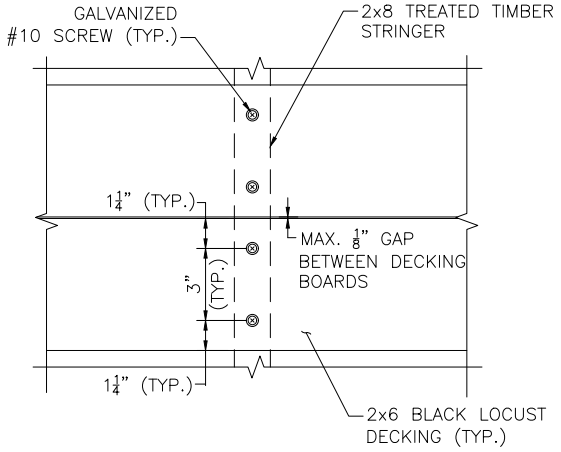


1 0 1 2
SCALE IN FEET

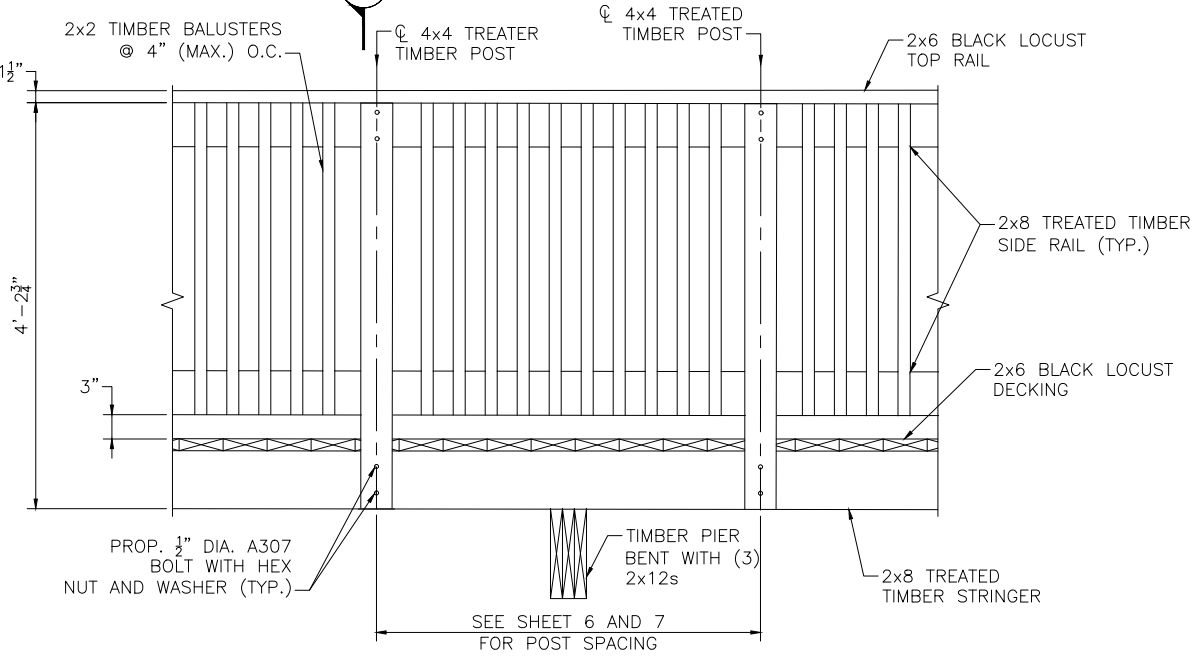
SECTION 3
SCALE: 1" = 2'-0"



DETAIL B
SCALE: ½" = 1'-0"

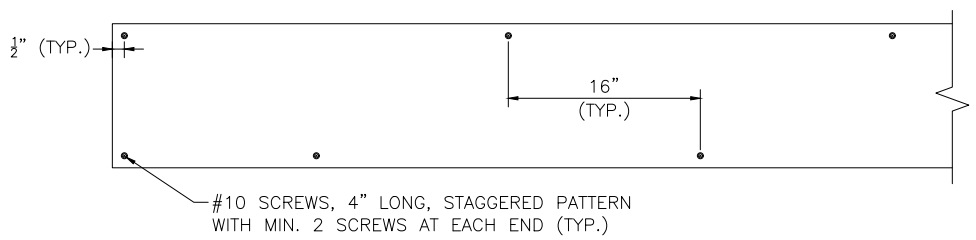


SECTION 4
SCALE: ½" = 1'-0"



RAILING ELEVATION
SCALE: 1" = 2'-0"

1 0 1 2
SCALE IN FEET

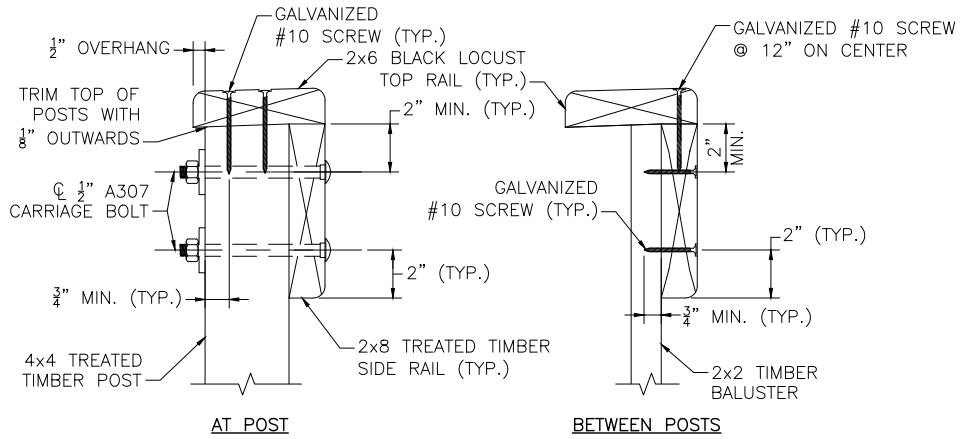


NOTES:

1. DETAIL SHOWN FOR PIER CAP ASSEMBLY, SISTERED EXTERIOR STRINGERS SIMILAR.
2. FOR CONNECTION OF 3 MEMBERS, SCREWS TO BE INSTALLED ON BOTH SIDES. FOR CONNECTIONS OF 2 MEMBERS SCREWS TO BE INSTALLED ON ONE SIDE

PIER CAP ASSEMBLY DETAIL
SCALE: ¾" = 1'-0"

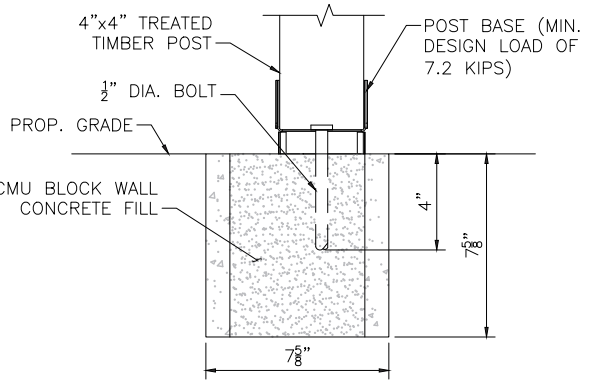
8" 0 8" 1'-4"
SCALE IN FEET



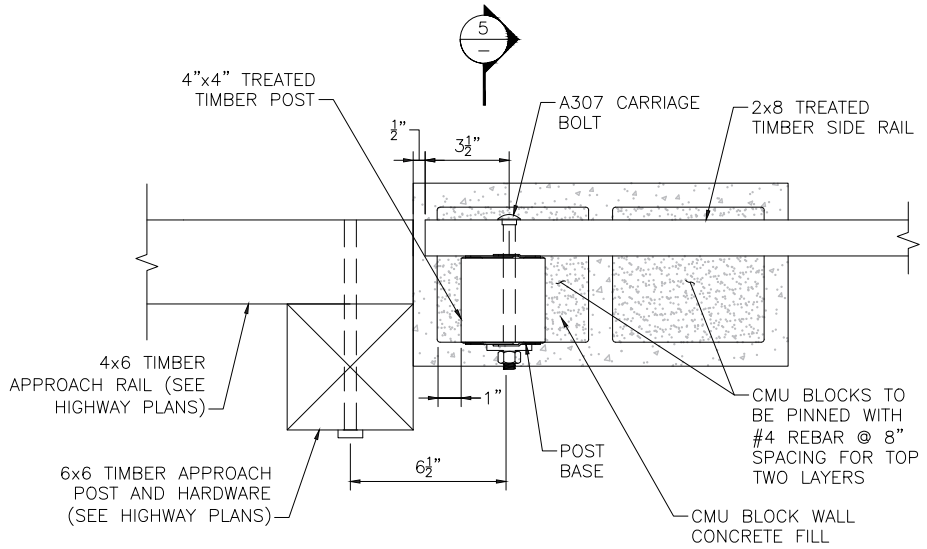
NOTE:
RUB RAIL CONNECTION NOT SHOWN BUT SIMILAR.

8" 0 8" 1'-4"
SCALE IN FEET

DETAIL A
SCALE: ½" = 1'-0"



SECTION 5
SCALE: ½" = 1'-0"



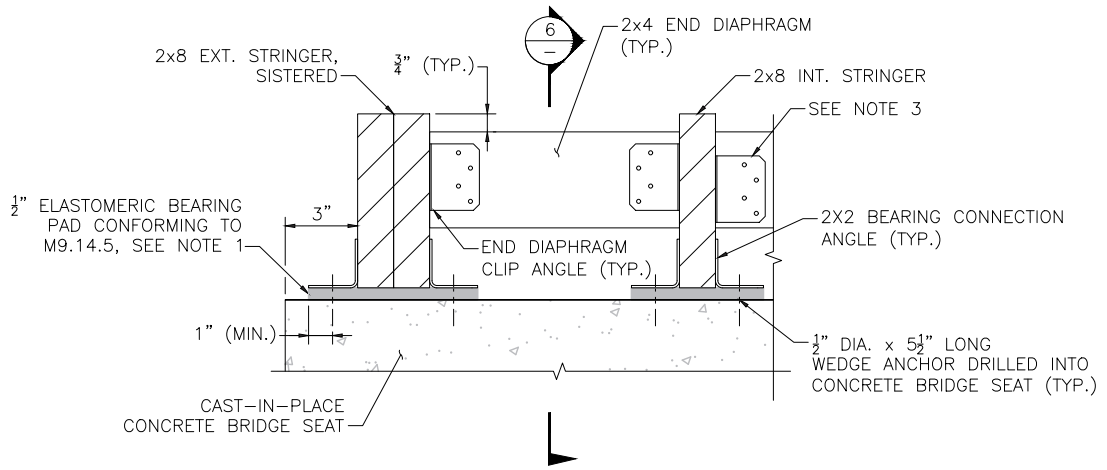
RAILING POST IN CMU BLOCK PLAN
SCALE: ½" = 1'-0"

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	76	142
PROJECT FILE NO.	609211		

TYPICAL SECTION AND TIMBER CONNECTION DETAILS



NOTES:

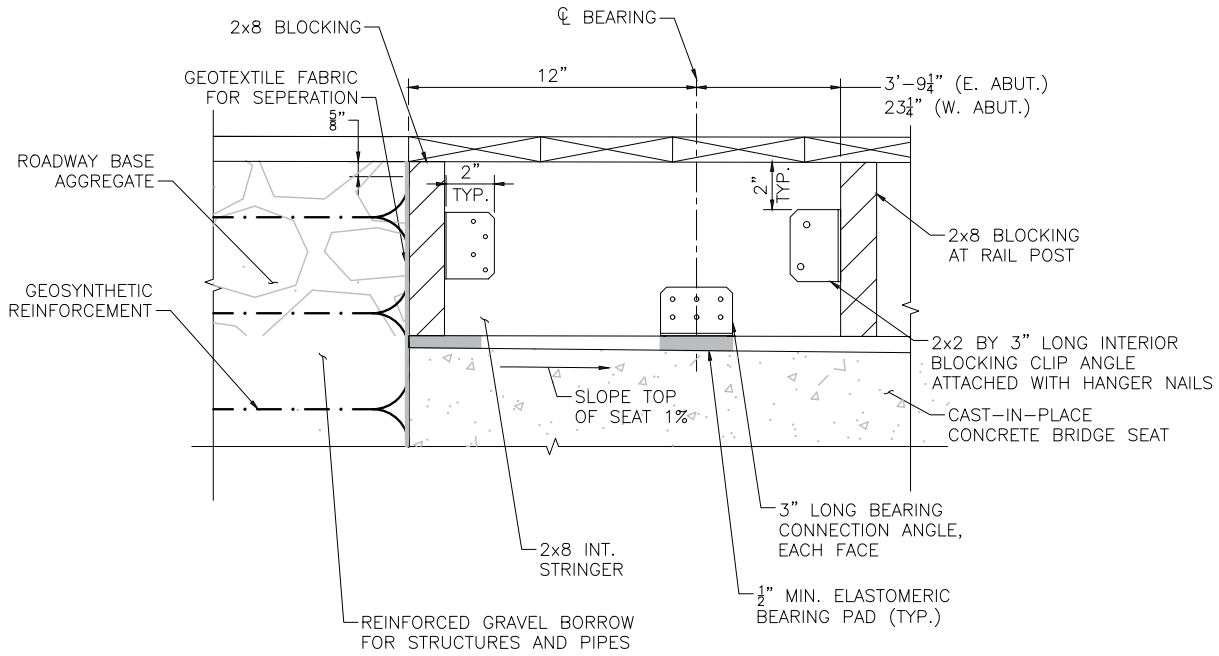
1. ELASTOMERIC BEARING PAD SHALL BE CUT TO SIZE TO MATCH THE PLAN VIEW LIMITS OF THE CONNECTION ANGLES AND STRINGER(S) IN BETWEEN.
2. TIMBER DECKING NOT SHOWN FOR CLARITY.
3. INTERIOR BLOCKING CLIP ANGLES STAGGERED UP TO ½" VERTICALLY AT EACH FACE OF STRINGER TO AVOID CONFLICT WITH SCREW INSTALLATION.

END DIAPHRAGM & BEARING ELEVATION

SCALE: 3/2" = 1'-0"

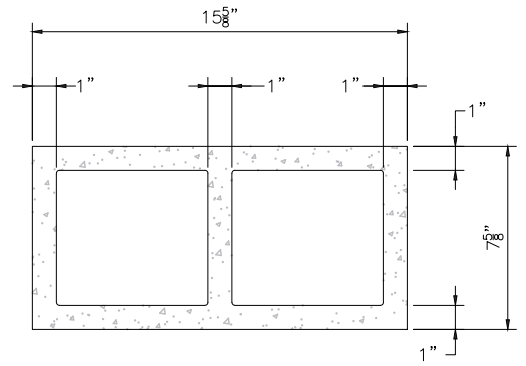
4" 0 4" 8"

SCALE IN FEET



SECTION 6

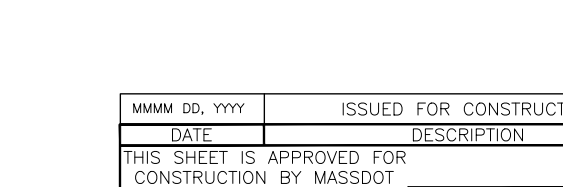
SCALE: 3/2" = 1'-0"



NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.

8" CMU PLAN VIEW

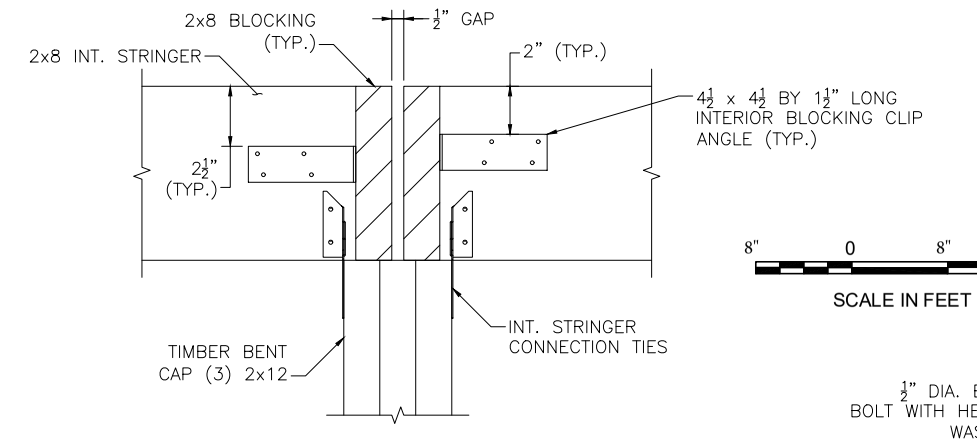
SCALE: 3/2" = 1'-0"



NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.

TYPICAL CMU BLOCK ELEVATION

SCALE: ¾" = 1'-0"

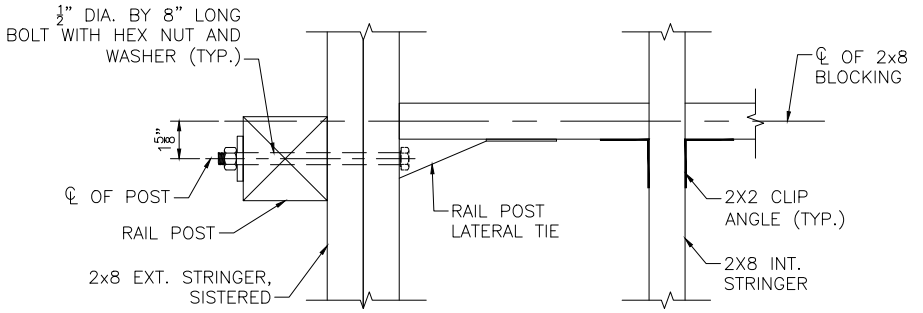


SECTION 7

SCALE: 3/2" = 1'-0"

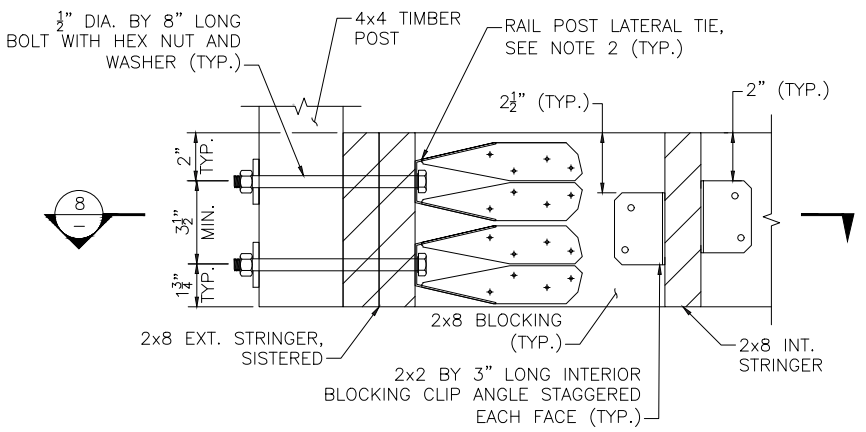
8" 0 8" 1-4"

SCALE IN FEET



SECTION 8

SCALE: 3/2" = 1'-0"

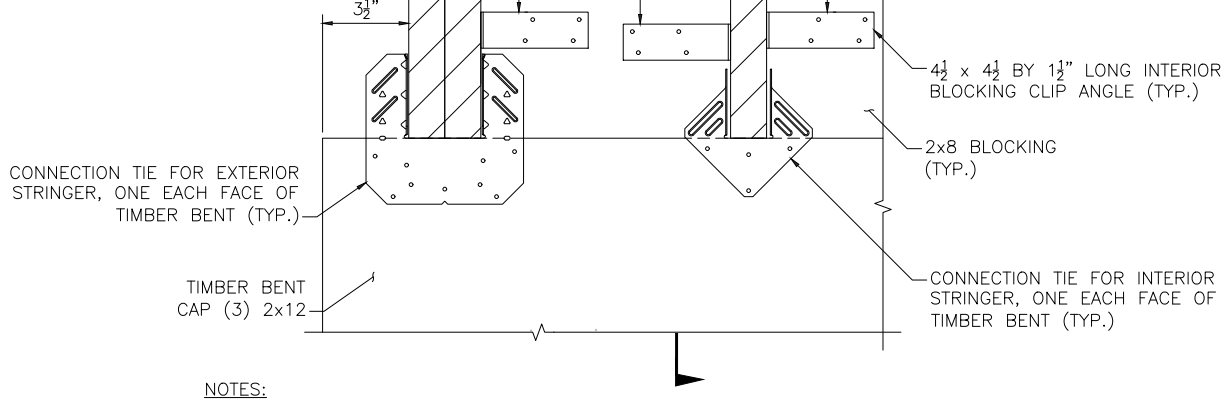


NOTES:

1. TIMBER DECKING NOT SHOWN FOR CLARITY.
2. LATERAL TIES SHALL BE STAINLESS STEEL, GALVANIZED, OR ZINC COATED. EACH TIE SHALL PROVIDE A MINIMUM LATERAL TENSILE CAPACITY OF 1,500 LBS.

RAIL POST CONNECTION TO STRINGER ELEVATION

SCALE: ¾" = 1'-0"



NOTES:

1. TIMBER DECKING NOT SHOWN FOR CLARITY.

STRINGER AT PIER BENT SUPPORT ELEVATION

SCALE: 3/2" = 1'-0"

4" 0 4" 8"

SCALE IN FEET

CONNECTION HARDWARE GENERAL NOTES:

1. ALL CONNECTION COMPONENTS, OTHER THAN BOLTS, SHALL BE 33 KSI STAINLESS STEEL, GALVANIZED STEEL, OR ZINC COATED STEEL, UNLESS OTHERWISE SPECIFIED.
2. ALL CONNECTION COMPONENTS SHALL BE A MINIMUM OF 18 GAUGE STEEL.
3. ALL PROPOSED BOLTS SHALL BE EITHER ASTM A307 GALVANIZED BOLTS, OR ASTM SS316 STAINLESS STEEL BOLTS.
4. ALL WOOD OR LAG SCREWS SHALL BE GALVANIZED OR STAINLESS STEEL #10 BY 1½" LONG, UNLESS OTHERWISE NOTED.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091

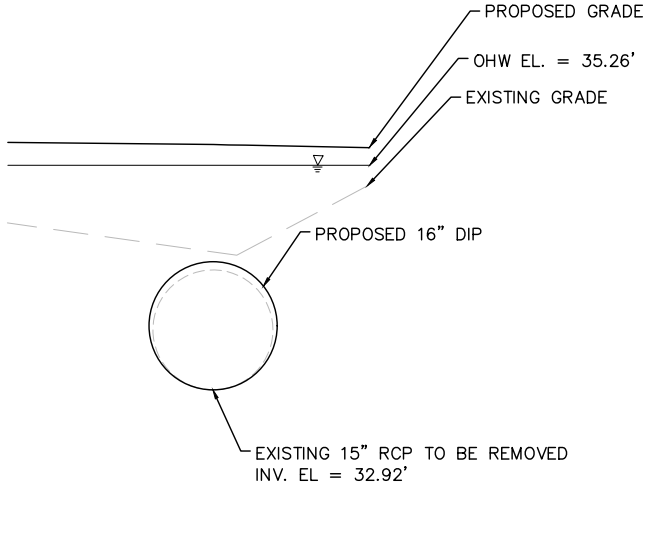
A00831 - 68

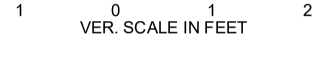
CULVERT AT STATION 358+50

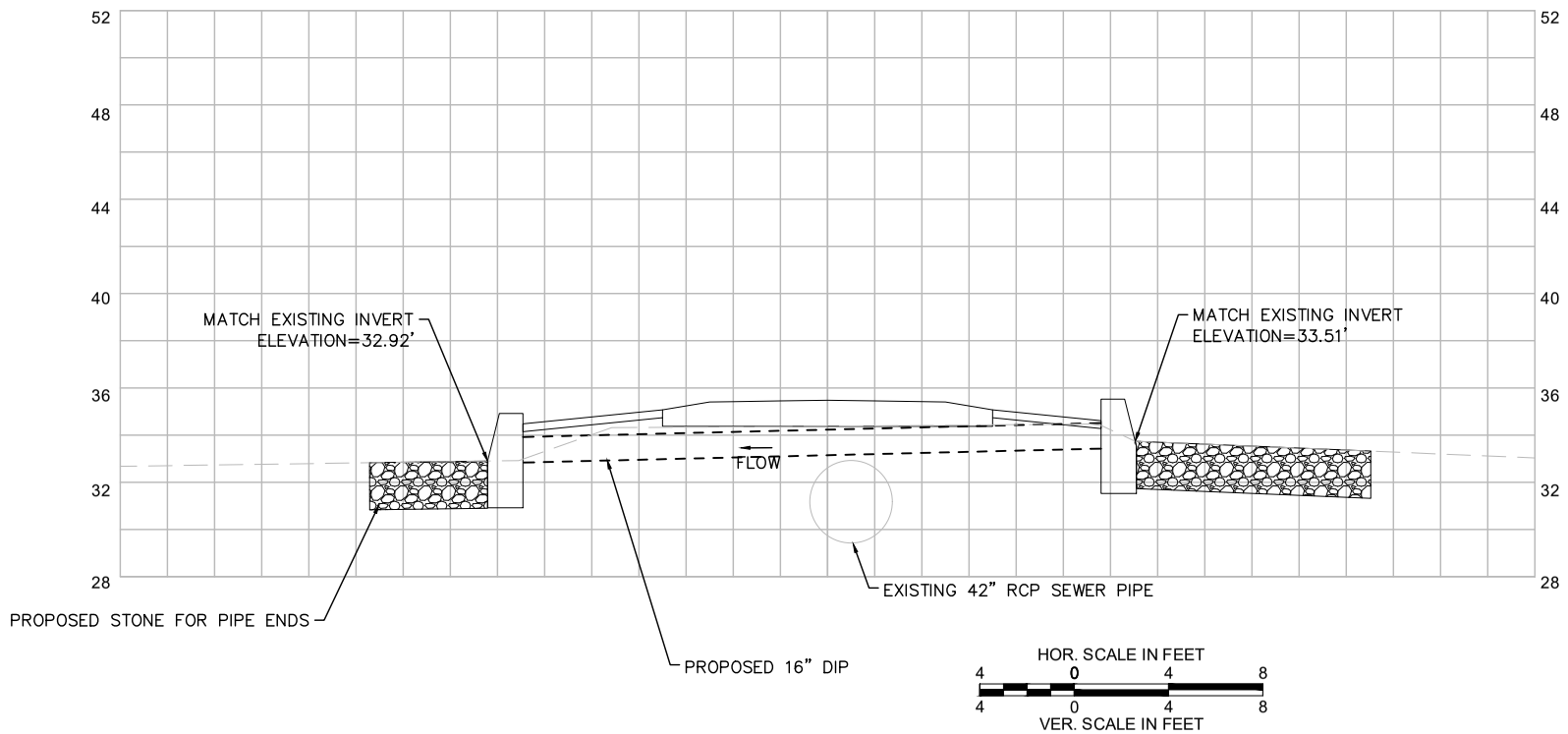
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609211		

CULVERT CROSS SECTION







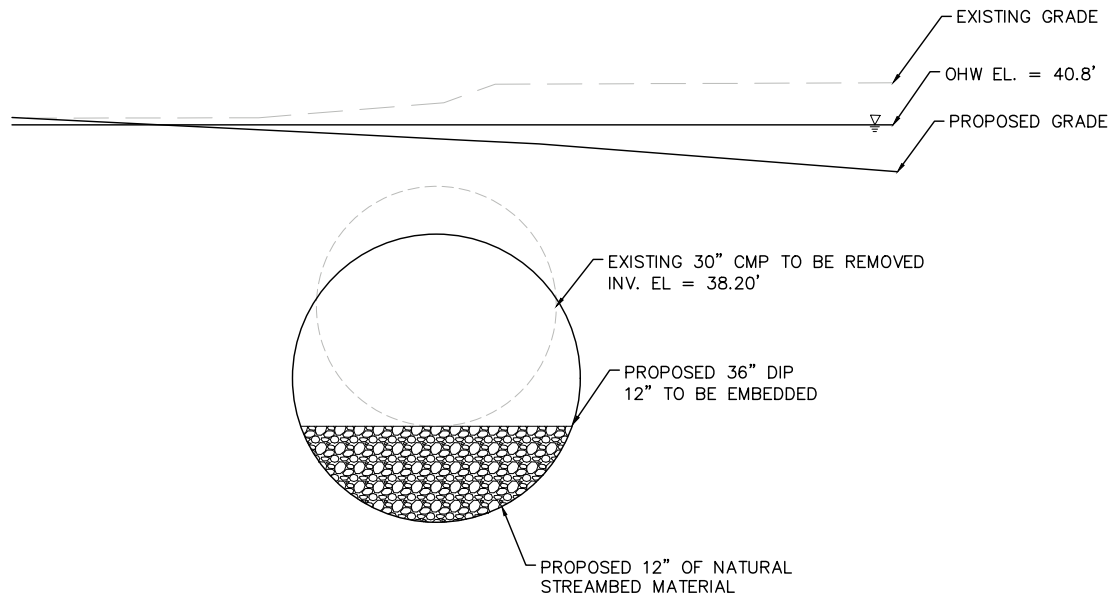
SUPPLEMENTAL WQC/ACOE PLAN SHEET 62

Proposal No. 609211-132091
16 IN STA 358+50.DWG Plotted on 15-Jul-2024 8:28 AM
A0083831 - 69

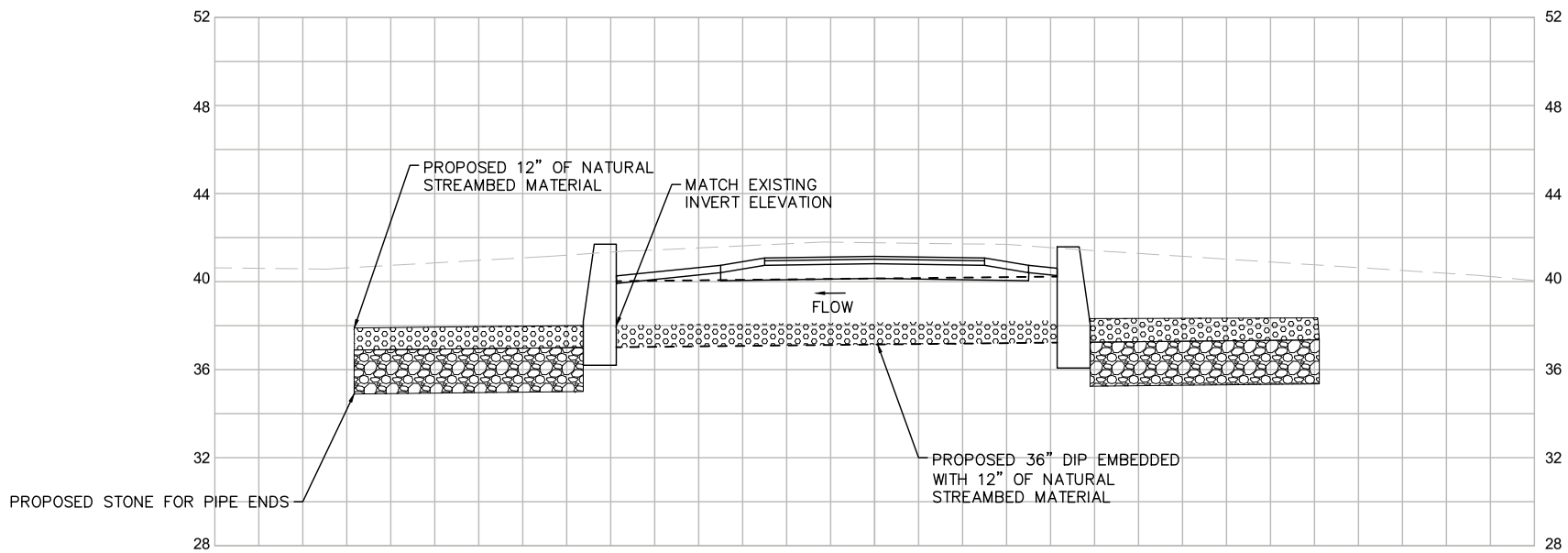
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609211		

CULVERT CROSS SECTION

CULVERT AT STATION 340+10



HOR. SCALE IN FEET
1 0 1 2
1 0 1 2
VER. SCALE IN FEET



HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

SUPPLEMENTAL WQC/ACOE PLAN SHEET 63

Proposal No. 609211-132091
36 IN STA 340+10 CULVERT_RECOVER.DWG Plotted on 5-Jul-2024 12:38 PM
A00831 - 70

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 5, 2024

City of Peabody
24 Lowell Street
Peabody, MA 01960
ATTN: Brendan Callahan, Assistant Director of Planning

RE: 401 WATER QUALITY CERTIFICATION
BRP WW 10, Major Fill Project
BRP WW 08, Minor Dredge Project
Independence Greenway Extension
Peabody, MA

401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge)
USACE Application No. NAE-2024-01390
MassDOT File Number: 609211

Dear Mr. Callahan:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed your application for a Water Quality Certification (WQC), as referenced above; this application was deemed complete on June 11, 2024. In accordance with the provisions of MGL Ch. 21, §§26-53 and Section 401 of the Federal Clean Water Act as amended (33 U.S.C. §1251 et seq.), it has been determined there is reasonable assurance the proposed project will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law.

The City of Peabody, in coordination with the Massachusetts Department of Transportation (MassDOT), proposes to extend the existing Independence Greenway rail trail from Essex Center Drive to Endicott Street along an existing former railroad right-of-way owned and maintained by the City of Peabody (the Project). The Project includes construction of a paved shared-use pathway (SUP) along the existing abandoned railroad right-of-way; construction of a light duty timber boardwalk structure supported on helical piles over Proctor Brook and associated wetlands; replacement of culverts that convey Proctor Brook and its tributaries beneath the railroad bed; stormwater infrastructure improvements; construction of a compensatory flood storage area; and modifications required for connections to the existing paths at either end including sidewalk reconstruction and drainage improvements. The Project purpose is to provide a continuation and connection of the existing rail trail facilities to be utilized by pedestrians and bicyclists.

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

Existing Conditions

The proposed SUP alignment generally extends in an east/west orientation along an existing abandoned and elevated railroad bed in a forested area. At the west end, a portion of the SUP will also extend along Essex Center Drive and Northshore Road to connect the alignment from the existing terminus of the Independence Greenway to the railroad bed. Essex Center Drive is classified as a local roadway with two 15-foot-wide lanes, a typical pavement width of 30 feet and five-foot-wide paved and concrete sidewalks on each side. Where Essex Center Drive extends under Route 128, it is 23 feet wide with 11-foot-wide and 12-foot-wide lanes, a 9.5-foot-wide raised median, and 3.5-foot-wide paved sidewalks on each side. Northshore Road is classified as a local roadway with two 11-foot-wide lanes, a pavement width of 23 feet, and a 4.5-foot-wide paved sidewalk on the west side.

Proctor Brook, a perennial stream, meanders west to east generally parallel to the railroad bed, crossing it in three locations. The bankfull width of Proctor Brook varies between 19 and 35 feet within the Project area. Two crossings at Stations 329+85 and 346+20 consist of culverts that are obstructed and/or washed out and are no longer functioning. Twin 42-inch culverts are present at Station 329+85 and the crossing at Station 346+20 was formerly a four-foot-high by approximately six-foot-wide concrete culvert that washed out. The third Proctor Brook crossing at Station 351+50 consists of a former railroad bridge that also washed out and is largely no longer present.

Two existing intermittent streams also flow north under the railroad bed at Stations 340+10 and 358+51 via a 30-inch corrugated metal pipe (CMP) and 15-inch ductile iron pipe (DIP), respectively. A 24-inch CMP at Station 342+20 provides a hydrologic connection between Bordering Vegetated Wetlands (BVWs) on either side of the railroad bed. Extensive BVWs are present along Proctor Brook and the railroad bed throughout the corridor.

On Essex Center Drive, Northshore Road, and Endicott Street, stormwater flows to a combination of country drainage and closed drainage systems. The Project will occur within a Federal Emergency Management Agency 1% annual chance of flooding zone (Zone AE) and Regulatory Floodway with a Base Flood Elevation ranging from 47.1 feet at the west end to 39.6 feet at the east end.

Project Description

The Project is approximately 1.3 miles in length. The SUP path will be 10 feet wide carrying two five-foot-wide travel lanes, one in each direction. Two-foot-wide stone dust shoulders will be present on either side along the railroad bed. Portions of Essex Center Drive will be fully reconstructed and/or repaved but will not be widened. Intersection improvements will also occur along Essex Center Drive, Northshore Road, and Endicott Street, and two compensatory flood storage areas will also be constructed along the SUP.

A 56-span light-duty timber boardwalk structure supported on helical piles will replace the previous railroad bridge that washed away. The boardwalk will be approximately 438 feet long and a total of 13 feet wide. It will carry two five-foot-wide travel lanes, one in each direction, with one-foot-wide shoulders on each side. Riprap scour protection will be placed along the abutment at the west end.

A four-foot-high by eight-foot-wide precast concrete box culvert will be installed at each of the Proctor Brook crossings at Stations 329+85 and 346+20. The streams within each box culvert will be restored

with 12 inches of natural streambed substrate and will match the existing invert elevations. Riprap scour protection will be installed within the channels as depicted on the plans approved herein.

The CMP at Station 340+10 will be replaced with a 36-inch DIP and the CMP at Station 342+20 will be replaced with a 24-inch DIP. Both culverts will be embedded 12 inches with a layer of natural streambed substrate and will match the existing invert elevations. The RCP at Station 358+51 will be replaced with a 16-inch DIP but due to its small diameter will not have natural stream substrate.

BVW and LUW Impacts

In total, 17,998 sf of fill impacts to BVWs and LUW are required to construct the Project; 2,344 sf of permanent and 4,681 sf of temporary BVW impacts, and 8,661 sf of permanent and 2,312 sf of temporary LUW impacts. The Project requires 1,491 cubic yards of dredging. Impacts are required to construct the boardwalk, replace the culverts, and install associated scour protection.

Alternatives Analysis

Several alternative alignments and cross sections were evaluated for the SUP. Constructing the SUP along Warren Street Extension rather than constructing the boardwalk over Proctor Brook and associated BVWs was considered but rejected due to safety concerns. The SUP and shoulders are the minimum width required and the side slopes have been narrowed to the extent practicable to avoid and minimize impacts to adjacent BVWs and LUW. Riprap scour protection in BVW and LUW at the culvert replacements is the minimum amount required based on Federal Highway Administration standards. A concrete deck was considered for the boardwalk but would require a more substantial substructure in BVWs and LUW, including the potential need for a pier and foundation. It would also require the use of larger equipment and potentially more temporary impacts. A timber boardwalk allows for the use of helical piles to support the structure, which results in less impacts to BVWs and LUW.

BVW and LUW Replication and Restoration

Permanent BVW impacts will be mitigated through construction of a 2,500 sf BVW replication area under the supervision of a qualified Wetland Scientist. The replication area will be located at the end of Gilmore Terrace along BVWs associated with Proctor Brook. Wetland soil will be installed to a depth of 18 inches to match the existing adjacent BVW elevation, the area will be planted with native trees and shrubs, and a native wetland seed mix will be applied.

Temporary BVW impacts will be restored in place under the supervision of a qualified Wetland Scientist. Where riprap scour protection will be placed in BVWs at the culvert replacements, a layer of compost will be placed over the riprap, native live stakes will be installed, and a native wetland seed mix will be applied. Twelve inches of natural streambed substrate will be placed over the riprap scour protection in LUW at the culvert replacements.

Stormwater Management Standards

The Project will increase impervious surface by 1.1 acres (46,907 sf). The roadway reconstruction portion of the Project qualifies as a redevelopment as defined at 314 CMR 9.02. Per Volume 1, Chapter

1 of the Massachusetts Stormwater Management Standards, the Standards only apply to the SUP portion of the Project to the maximum extent practicable.

Through the installation of deep sump catch basins, an infiltration trench, and a rock-lined drainage swale, the Project will meet Stormwater Management Standards 2, 3, and the structural stormwater best management practice requirements of Standard 4 to the maximum extent practicable. Two-foot-wide stone dust shoulders over eight inches of subbase gravel borrow will also be installed along each side of the SUP to capture and treat stormwater, which will improve existing conditions. A complete evaluation concluded additional Stormwater Control Measures are not practicable within the Project area.

Stream Crossing Standards

The Project will meet the Massachusetts Stream Crossing Standards to the maximum extent practicable in accordance with 314 CMR 9.06(2)(b)4. The boardwalk will meet all Stream Crossing Standards and all stream crossing culvert sizes will be increased from existing conditions. Except for the boardwalk, spans are not practicable for the other stream crossings and would require footings resulting in more impacts to adjacent BVWs and LUW. Both Proctor Brook culverts will exceed the openness ratio Standard. Twelve inches of natural streambed material will be placed within three of the replacement culverts which is the maximum practicable given the constraints. Improved water depths and velocities more consistent with natural conditions are anticipated due to the crossing improvements.

Sediment Chemistry

Sediment sample analytical results were compared to the Reportable Concentration (RC) S-1 criteria of the Massachusetts Contingency Plan (MCP). Results of the sediment samples analyzed indicated the presence of lead in Sample SS-3 in concentrations above the RC S-1 criteria. As conditioned herein, the City of Peabody is required to determine if dredged sediments are suitable for reuse or required to be handled and disposed of at an offsite facility in accordance with all applicable regulations. If required, all materials will be limited to specific pre-approved disposal facilities. MassDEP is to be notified, in writing, of the name and location of the licensed facility accepting the dredged material for disposal or reuse as daily cover material.

Invasive Species

Invasive species will be managed in accordance with an Invasive Plant Management Strategy (IPMS) to be approved by MassDEP.

Based on a review of information provided by the applicant, MassDEP finds that this project complies with the standards described under 314 CMR 9.06 and 9.07. Public notice was provided in the Peabody Weekly News on May 23, 2024, and in the MEPA Environmental Monitor on June 7, 2024. No comment letters were received during the public comment period.

Therefore, based on information currently in the record, MassDEP grants a WQC for this project subject to the following conditions to maintain water quality, to minimize impact on waters and wetlands, and to ensure compliance with appropriate state law. The Department further certifies in accordance with 314 CMR 9.00 that there is reasonable assurance the project or activity will be conducted in a manner

which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law. Finally, the Department has determined that upon satisfying the conditions and mitigation requirements of this approval, the project provides a level of water quality necessary to protect existing uses and accordingly finds that the project to be implemented satisfies the Surface Water Quality Standards at 314 CMR 4.00.

Pursuant to 314 CMR 9.09(1)(d); 314 CMR 9.06(6)(a); 310 CMR 9.06(2); 314 CMR 9.07; 314 CMR 9.07(1); 314 CMR 9.09(7)(5)(c); 314 CMR 9.11; and 314 CMR 9.09(1)(e), the following Special Conditions are necessary to ensure that construction practices and stormwater controls are implemented in such a manner as to prevent degradation to wetlands and waters; ensure that practicable steps have been taken which will avoid and minimize impacts to wetlands and waters; minimize turbidity and sediment caused by construction activities; ensure that water quality is not degraded, and that biology of the waters are not negatively impacted by potential discharges; and/or maintain a record of the dredged material for reference and to ensure accountability in its transportation.

Those Special Conditions that require direct submittals to MassDEP for either review, or review and approval, are denoted by the following notation (Submittal) at the end of the condition and are summarized in Attachment A. In addition, those conditions with the (Submittal) designation shall be included in the Special Provisions and, as applicable, reviewed at the Pre-Construction Meeting.

1. All work shall be performed in accordance with the following documents and plans:

    - Application for Water Quality Certification. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody, with cover letter and attachments. Dated May 15, 2024. 401 WQC Filing Number: 24-WW26-0034-APP.
    - Plans entitled: “Massachusetts Department of Transportation Highway Division Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the City of Peabody, Essex County. PS&E Submittal.” Last revised April 19, 2024.
    - MassDEP Administrative Completeness and Technical Deficiency Review. 401 WQC Transmittal No: 24-WW26-0034-APP (Fill and Dredge). Dated June 5, 2024.
    - Response to MassDEP Administrative Completeness and Technical Deficiency Review letter for 401 WQC Transmittal No: 24-WW26-0034-APP, including attachments. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody. Dated June 11, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Expanded Environmental Notification Form and Proposed Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated January 29, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated May 24, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Final Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated August 5, 2024.

- Order of Conditions issued by the Peabody Conservation Commission. MassDEP File #: 055-0939. Issued July 3, 2024.
- MassDEP Notice of Appeal. MassDEP File #055-0939. Issued July 15, 2024.

Pre-Construction

2. A qualified **Wetland Scientist** (WS) with a minimum of five years of relevant professional experience with wetland and stream replacement and restoration projects shall be employed to oversee all BVW and LUW replacement and restoration activities, including but not limited to grading, placement of substrate, seeding, vegetation plantings, and placement of wildlife habitat features. The name, contact information, and qualifications of the WS shall be provided to MassDEP for approval prior to the Pre-Construction Meeting required in Condition 4. The name and contact information of the approved WS shall be provided to the Peabody Conservation Commission prior to the start of work. **(Submittal)**

3. Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the Resident Engineer (RE) responsible for ensuring that all work complies with the conditions of this WQC. **(Submittal)**

4. A minimum of 21 days prior to the start of work, MassDOT shall contact MassDEP to schedule an onsite Pre-Construction Meeting to review the approved plans and terms and conditions of this WQC. The RE, the Construction Contractor (Contractor), the WS, and a representative from the MassDOT Environmental Section and/or the District Environmental Engineer shall attend the Pre-Construction Meeting.

5. MassDEP shall be copied on applicable submittals to the U.S. Army Corps of Engineers (USACE). These include but are not limited to: Self-Verification Notification Form (SVNF); Pre-Construction Notification (PCN); Work-Start Notification Form; Mitigation Work-Start Notification Form; and Compliance Certification Form. The Work-Start Notification Form shall be submitted at least 14 days before the anticipated start of work and the Compliance Certification Form shall be submitted within 30 days following the completion of the authorized work. **(Submittal)**

6. A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CP/PP) shall be developed and implemented as required by 314 CMR 9.06(6)(a)8. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit the CP/PP for review and approval. If the U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) applies, the Stormwater Pollution Prevention Plan (SWPPP) may serve as the CP/PP, providing it includes the measures required to be in the CP/PP per these Special Conditions, in addition to the measures specifically required by the CGP. Any subsequent changes to the Final CP/PP (defined herein as including the construction period SWPPP if applicable) must be approved by MassDEP. **(Submittal)**

7. Training regarding erosion and sedimentation controls is required. The RE, CP/PP Inspector, and any other relevant personnel responsible for erosion and sedimentation controls shall complete the EPA CGP Inspector Training, or other training that meets the CGP requirements, as well as

complete a comprehensive review of the Final CP/PP. Verification of proof of completion of the training shall be submitted to MassDEP prior to the start of work. **(Submittal)**

8. The CP/PP shall identify, but shall not be limited to, staging and laydown areas in relation to BVWs and LUW, proposed dewatering locations, proposed stockpile locations and their proximity to catch basins or other drainage conveyances that discharge to wetland resource areas, and the location of construction-period erosion and sedimentation controls.

9. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit a Water Management Plan for review and approval. The Plan shall include proposed methods to manage construction-period water including but not limited to dewatering methods and locations, specifications for any water bypass systems, and dredge and debris material dewatering prior to shipment off site, as applicable. The plan shall meet requirements of the CP/PP and be specific to the Project. Dewatering and water bypasses shall be conducted under the supervision of the RE and comply with the applicable conditions identified herein. **(Submittal)**

10. Prior to the start of work, approved erosion and sedimentation control measures shall be installed per the approved CP/PP and as applicable, the manufacturer specifications. Erosion and sedimentation control measures may consist of, but are not limited to, silt fence, staked straw bales, silt/turbidity curtains, compost filter tubes, etc.

11. Prior to the Pre-Construction Meeting, the boundaries of BVWs and LUW shall be re-flagged where they are within 50 feet of the limits of work. In the event BVWs and LUW boundaries overlap, the outermost boundary (i.e., closest to the proposed work) shall be flagged. All boundary markers, once in place, shall remain in place throughout construction until all disturbed surfaces have been permanently stabilized. Boundary markers shall be fully evaluated annually and refreshed where needed. Implementation of and compliance with this requirement shall be documented by the WS. All construction personnel shall be made aware of these markers.

12. A Flood Contingency Plan shall be submitted to MassDEP for review and approval that addresses areas that fall within the 1% annual chance of flooding zone within project limits. The Plan shall address the potential need for temporary relocation of construction and auxiliary equipment during flood events to designated upland locations above the Base Flood Elevation. The Plan shall be approved by MassDEP prior to any work within the 1% annual chance of flooding zone, including mobilization or storage of equipment and materials. **(Submittal)**

13. The applicant shall develop an Invasive Plant Management Strategy (IPMS) to be submitted to MassDEP for review and approval prior to the Pre-Construction Meeting. The IPMS shall be implemented as approved. **(Submittal)**

14. If needed, use of herbicides to control invasive species shall be implemented in accordance with the approved IPMS and with the following requirements:

    a. Herbicides can only be applied by a Licensed Applicator;

b. Applicant must provide MassDEP Material Safety Data Sheets (MSDS) of the product being used and must also keep MSDS sheets on site;

c. Product registration in MA with Massachusetts Pesticide Product Registration Number must be confirmed with Massachusetts Department of Agricultural Resources Pesticide Division;

d. EPA Registration Number for the product must be identified;

e. Product label restricted use provisions must be followed; and

f. Applicant must contact MassDEP Division of Watershed Planning to determine if a BRP WM 04 herbicide permit is required.

15. Final Construction Plans (the plans provided to the Contractor) shall be submitted for review at least 30 days prior to the Pre-Construction Meeting. Sufficient supporting information, explanation, and documentation shall be provided to MassDEP and the Peabody Conservation Commission for any changes, and MassDEP may at its discretion require additional supporting documentation as a condition of review. Once MassDEP provides written approval, the updated set of plans shall become the "Final Plan of Record." The Plan shall be prepared and signed by a Professional Engineer in the Commonwealth of Massachusetts and shall incorporate all revisions and additions to the original plans that have been approved as discussed herein. **(Submittal)**

Construction Period

16. No more than **2,344 sf** of permanent and **4,681 sf** of temporary impacts to BVWs shall occur. No more than **8,661 sf** of permanent and **2,312 sf** of temporary impacts to LUW shall occur. No more than **1,491 cy** of dredging in LUW shall occur. All work shall avoid unapproved impacts to BVW and LUW.

17. CP/PP inspections shall occur at least once every seven calendar days and within 24 hours of a storm event that produces 0.5 inches or more of rain within a 24-hour period, or at a more stringent frequency if the CP/PP requires.

18. Copies of CP/PP Inspection and Maintenance Log Forms shall be submitted to MassDEP within 14 days upon request.

19. Inspection and maintenance of erosion and sediment controls in active work areas shall be the responsibility of both the Contractor and RE. The project team shall include an individual with at least three years of experience with construction period erosion and sedimentation controls. The RE shall be ultimately responsible for inspection and maintenance of site controls. The RE and/or Contractor shall immediately notify MassDEP and the Peabody Conservation Commission if any unauthorized discharges to BVWs or LUW occur.

20. Disturbed areas shall be stabilized immediately after activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. The installation of stabilization measures

shall be implemented as soon as practicable, but no later than 14 calendar days after stabilization has been initiated.

21. Work within LUW shall be conducted in low or no-flow conditions to the extent practicable. Notice shall be provided to MassDEP and the Peabody Conservation Commission within 24 hours prior to the commencement of dewatering. Dewatering methods and location(s) shall be approved by the RE prior to use, and shall be documented in the CP/PP. There shall be no discharge of untreated dewatered stormwater or groundwater to BVWs or LUW. Any discharges shall be visibly free of sediment.

22. Additional erosion and sedimentation control materials shall be stored on-site at all times for emergency and routine replacement. Materials shall be kept covered, dry, and accessible at all times. The RE shall be responsible for anticipating the need for and installation of additional erosion and sedimentation controls and shall have the authority to require additional erosion control measures to protect wetland resource areas beyond what is shown on the plans if field conditions or professional judgment dictate that additional protection is necessary.

23. The RE shall monitor the National Weather Service forecast for updates, and upon issuance of a flood watch for the 1% annual chance of flooding zone, shall implement the flood contingency plan referenced in Condition 12.

24. Any storm drains with potential to receive discharge from stockpiled materials or construction operations shall be managed to inhibit the inflow of sediment while not increasing the likelihood of roadway flooding during periods of precipitation. Stockpiles shall be located no less than 50 feet from BVWs, LUW, catch basins, or other drainage conveyances that discharge to BVWs or LUW. The CP/PP shall specify measures to implement this. Filter fabric stretched under storm drain inlet grates are not acceptable for this purpose.

25. The contractor shall have designated washout areas for concrete equipment that will be comprised of impermeable material and sized to contain project concrete wastes and wash water. Concrete wash out areas shall be located no less than 50 feet from BVWs, LUW, and catch basins or other drainage conveyances that discharge directly or indirectly to BVWs, or LUW.

26. Refueling, washing, and cleaning of vehicles and other construction equipment shall not take place within 50 feet of BVWs or LUW and any wash water shall be contained such that it does not drain toward BVWs or LUW. MassDEP shall explicitly approve in writing any deviation to this condition for oversized stationary vehicles.

27. The contractor shall have spill containment kits on site. In the event of a release of fuels and/or oils, the local fire department and MassDEP shall be notified.

28. Construction vehicles or other vehicles or heavy equipment are prohibited from traversing over the proposed infiltration Stormwater Control Measures (SCMs) to avoid compaction of soils during construction. These areas shall be demarcated by silt fence with signage, or high visibility fencing. If access through the location of an infiltration SCM is unavoidable, the City of Peabody

or its Contractor shall request written approval from MassDEP to use low ground pressure equipment to complete the work. Following completion of the work, subsoils shall be tilled to a minimum depth of 18 inches prior to placement of final surface dressing materials required by the approved plans. Tilling shall only be conducted when the subsoils are in a friable condition and dry enough so that a clump cannot be formed into a ball shape by hand. No vehicles or heavy equipment shall be permitted within the infiltration SCM following placement of the final materials without written approval from MassDEP. Proposed infiltration SCMs shall remain offline until final stabilization is achieved, unless written approval is obtained from MassDEP.

29. If sheet piles are required, they shall be fully removed from wetland resource areas upon stabilization of the area as required. No portion of sheet piles shall remain unless approved by MassDEP in writing prior to installation. A request to leave sheet piles shall include, but not be limited to, demonstration that full removal of the sheet piles is not feasible or practicable, and an alternatives analysis demonstrating alternative methods to isolate the work area(s) are not feasible or practicable.

Dredging

30. No later than 21 days prior to commencement of dredging activity, a Dredged Material Dewatering Plan shall be submitted to MassDEP for review and approval. At a minimum, the Plan shall include but not be limited to the type of containment, method of dewatering (i.e. mechanical or by gravity), method of collecting the dewatered effluent and method of disposal. **(Submittal)**

31. All sediment management activities authorized by this WQC shall be conducted under the supervision of a Licensed Site Professional (LSP). Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the LSP. **(Submittal)**

32. A Health & Safety Plan shall be required for handling of sediment which has been characterized as exceeding MCP RCS-1 criteria. A copy shall be provided to MassDEP within six weeks of the effective of this WQC or two weeks prior to the commencement of the dredging operation, whichever comes first.

33. Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. MassDEP will review the data to determine if the sediment will require offsite disposal. Under no circumstances shall the material be transported until MassDEP has reviewed the data and approved disposal methods. **(Submittal)**

34. Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined and securely covered with wind tear resistance

tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down. Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted daily and more frequently immediately before, during and after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner.

35. In the event of a precipitation or storm event, the site shall be secured beforehand in such a way as to protect resource areas and waters on site and downstream of the site, including covering of stockpiles of dredged material. Sediment stockpile areas shall be inspected immediately prior to, during and immediately after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner to prevent discharge from the stockpiled material. If stormwater runoff and erosion is observed from stockpiled dredged material, additional erosion and/or damage prevention controls measures shall be implemented.

36. Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation.

37. Measures shall be in place to prevent turbid waters, due to dredging, demolition, or debris removal activities, from extending past the limits of work into Proctor Brook and its tributaries. These measures can be items such as turbidity curtains and/or sheet piles.

38. MassDEP shall be notified one week prior to the start of dredging so that staff may inspect the work for compliance throughout the project.

39. If visual turbidity escapes the controls in place, work shall stop immediately and MassDEP shall be notified within 24 hours. Work shall not resume until the issue is corrected and MassDEP to the satisfaction of MassDEP.

40. All turbidity controls shall be inspected daily by the RE. If any damage is observed the controls in place will be replaced or repaired immediately.

41. MassDEP shall be notified in writing of the name and location of the upland licensed facilities accepting the dredged material for disposal or reuse for review and approval. If the licensed facility is located out of state, documentation shall be provided to MassDEP that the dredged material disposal/reuse has been approved and will be accepted by the receiving state. The dredged material shall not be transported to the facility without concurrence of MassDEP.

42. Transportation and disposal of the dredged material shall be overseen by the LSP of record. A Bill-of-Lading (BOL) or a Material Shipping Record (MSR) shall be used to track the dredged material to the proposed intermediate (stockpiling /dewatering) facility. A fully executed copy of the BOL or MSR shall be provided to MassDEP within 30 days of final shipment to the reused location or facility.

43. BMPs shall be implemented during transportation of the dredged material to the licensed receiving facility. At a minimum, when transported upon public roadways, all dredged material shall have no free liquid as determined by the Paint Filter Test or other suitably analogous methodology acceptable to MassDEP, and a tarpaulin or other means shall be used to cover the dredged material during transport.

Wetland Mitigation

44. A minimum of 2,500 sf of wetland replication shall be completed in coordination with an approved WS. The WS shall oversee all BVW replication and restoration, including final grading, seeding, and planting. The WS shall confirm that constructed BVW replication and restoration areas have adequate soils and hydrology to promote wetland plant species prior to seeding and installation of plantings and shall recommend measures to amend soils and promote wetland hydrology as needed.

45. Planting and seeding shall not take place between November 15th and April 15th, except as allowed by MassDEP in writing. The WS shall inspect trees and shrubs to ensure they are healthy prior to planting. Trees and shrubs deemed unhealthy in the professional judgment of the WS shall be replaced. Plantings and seed mixes shall consist of native and non-invasive species. Species may be substituted at the recommendation of the WS, and review and approval by MassDEP.

46. At least 75% of the surface area of the BVW replication and restoration areas shall be vegetated with indigenous wetland plant species within two growing seasons, or the period required by the Section 404 permit, whichever is longer. Additionally, evidence of hydrology, including hydric soil formation shall be submitted at the same time. Annual monitoring reports shall be submitted by the WS no later than January 15th each year. Monitoring reports shall include an assessment based on the approved success criteria, representative photos, and recommended corrective actions as needed. **(Submittal)**

47. MassDEP reserves the right to determine the success or failure of the BVW replication and restoration areas, and reserves the right to require additional plantings, regrading, or other measures deemed necessary to promote success.

Stream Mitigation

48. The WS shall oversee all LUW replication and restoration. Placement of streambed materials shall take place in no- or low-flow conditions. The Water Management Plan required in Condition 9 shall include measures to create no-flow conditions for this work such as a pump bypass system or other dewatering method, if needed. Placement of streambed materials during greater than low-flow conditions shall require a placement plan, with a narrative describing turbidity control measures, submitted to MassDEP for review and approval.

49. Water shall be slowly introduced back into the restored and dewatered LUW work areas as to not cause erosion and sedimentation. This work shall be overseen by the WS.

50. MassDEP reserves the right to determine the success or failure of the LUW replication and restoration areas and reserves the right to require additional measures deemed necessary to promote success.

Post-Construction

51. All temporary erosion controls shall be removed at the conclusion of work once the surrounding area has achieved final stabilization.

General Conditions

52. Any proposed alterations, minor plan changes, or amendment requests, as well as any required submittals shall be sent by email for review and approval to heidi.davis@mass.gov and ryan.hale@mass.gov. **(Submittal)**

53. This WQC remains in effect for the same duration as the Section 404 permit that requires it.

54. No Special Condition set forth herein shall be construed or operate to prohibit MassDEP from taking enforcement against the City of Peabody or its contractors for any failure to comply with the terms and requirements of this WQC.

55. No activity authorized by this WQC may begin prior to expiration of the 21-day appeal period, or until a final decision is issued by MassDEP in the event of an appeal.

Failure to comply with this Certification is grounds for enforcement, including civil and criminal penalties, under MGL Ch. 21 §42, MGL Ch. 21A §16, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This Certification does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations.

NOTICE OF APPEAL RIGHTS

a.) Appeal Rights and Time Limits

Certain persons shall have a right to request an adjudicatory hearing concerning certifications by MassDEP when an application is required: (a) the applicant or property owner; (b) any person aggrieved by the decision who has submitted written comments during the public comment period; (c) any ten (10) persons of the Commonwealth pursuant to M.G.L. c.30A where a group member has submitted written comments during the public comment period; or (d) any governmental body or private organization with a mandate to protect the environment which has submitted written comments during the public comment period. Any person aggrieved, any ten (10) persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c.30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or

hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within twenty-one (21) days from the date of issuance of this Certificate, and addressed to:

Case Administrator
Department of Environmental Protection
100 Cambridge Street, 9th Floor
Boston, MA 02114

A copy of the request shall at the same time be sent by certified mail or hand delivery to the Department of Environmental Protection at:

Department of Environmental Protection
Commissioner's Office
100 Cambridge Street, Suite 900
Boston, MA 02114

b.) Contents of Hearing Request

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

3. the 401 Certification Transmittal Number;
4. the complete name of the applicant and address of the project;
5. the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
6. if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
7. a clear and concise statement that an adjudicatory hearing is being requested;
8. a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this Certificate, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief sought through the adjudicatory hearing, including specifically the changes desired in the final written Certification; and
9. a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Conservation and Recreation (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

c.) Filing Fee and Address

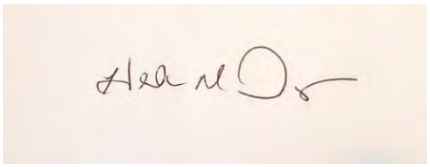
The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

Should you have any questions relative to this permit, please contact myself or Ryan Hale at heidi.davis@mass.gov and ryan.hale@mass.gov.

Very truly yours,



Heidi M. Davis
Highway Unit Supervisor

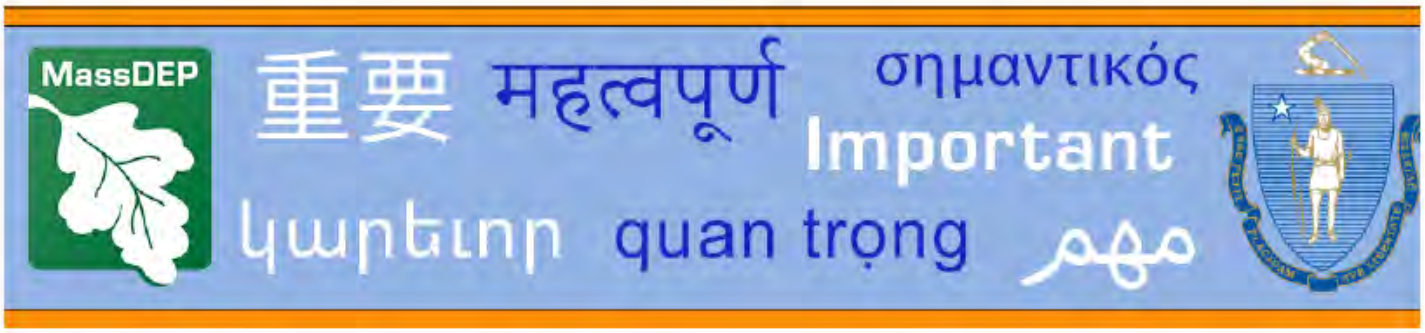
Ecc: DEP NERO – Jill Provencal
USACE – Dan Vasconcelos
MassDOT – Melissa Lenker
MassDOT – Erica Larner
MassDOT – Corinna Beckwith
Green International Affiliates, Inc. – Oxana Fartushnaya
Green International Affiliates, Inc – Danielle Spicer
Peabody Conservation Commission – Lucia DelNegro, Conservation Agent

ATTACHMENT A
PRE-CONSTRUCTION SUBMITTAL CHECKLIST

Independence Greenway Extension
Peabody, MA

THIS CHECKLIST MUST BE COMPLETED PRIOR TO THE START OF WORK. NOTE THAT SOME CONDITIONS REQUIRE THAT INFORMATION BE SUBMITTED A SPECIFIC NUMBER OF DAYS PRIOR TO THE START OF WORK OR THE PRE-CONSTRUCTION MEETING.

Condition	Required Submittal	Due Date	Date Submitted	Date Approved
PRE-CONSTRUCTION SUBMITTAL REQUIREMENTS				
2	Name, contact information, and qualifications of the WS, including specific experience and years to meet requirement	Prior to Pre-Construction Meeting		
3	Name and contact information of the RE	Prior to Pre-Construction Meeting		
5	USACE Work-Start Notification Form	14 days prior to work start		
6	CP/PP	14 days prior to work start		
7	EM Verification of SWPPP Training	Prior to work start		
9	Water Management Plan	14 days prior to work start		
12	Flood Contingency Plan	Prior to any work within 1% annual chance of flooding zone		
13	Invasive Plant Management Strategy	Prior to Pre-Construction Meeting		
15	Final Construction Plans	30 days prior to Pre-Construction Meeting		



Communication for Non-English-Speaking Parties

This document is important and should be translated immediately.

If you need this document translated, please contact MassDEP's Director of Environmental Justice at the telephone number listed below.

Español Spanish

Este documento es importante y debe ser traducido inmediatamente. Si necesita traducir este documento, póngase en contacto con el Director de Justicia Ambiental de MassDEP (*MassDEP's Director of Environmental Justice*) en el número de teléfono que figura más abajo.

Português Portuguese

Este documento é importante e deve ser traduzido imediatamente. Se você precisar traduzir este documento, entre em contato com o Diretor de Justiça Ambiental do MassDEP no número de telefone listado abaixo.

繁體中文 Chinese Traditional

本文檔很重要，需要即刻進行翻譯。
如需對本文檔進行翻譯，請透過如下列示電話號碼與 MassDEP 的環境司法總監聯絡。

简体中文 Chinese Simplified

这份文件非常重要，需要立即翻译。
如果您需要翻译这份文件，请通过下方电话与 MassDEP 环境司法主任联系。

Ayisyen Kreyòl Haitian Creole

Dokiman sa a enpòtan epi yo ta dwe tradui l imedyatman. Si w bezwen tradui dokiman sa a, tanpri kontakte Direktè. Jistis Anviwònmantal MassDEP a nan nimewo telefòn ki endike anba a.

Việt Vietnamese

Tài liệu này và quan trọng và phải được dịch ngay. Nếu quý vị cần bản dịch của tài liệu này, vui lòng liên hệ với Giám Đốc Phòng Công Lý Môi Trường của MassDEP theo số điện thoại được liệt kê bên dưới.

ប្រទេសកម្ពុជា Khmer/Cambodian

ឯកសារនេះមានសារៈសំខាន់
ហើយគប្បីត្រូវត្រូវបានបកប្រែភ្លាមៗ.
ប្រសិនបើអ្នកត្រូវការអោយឯកសារនេះបកប្រែ
សូមទាក់ទងនាយកផ្នែកយុត្តិធម៌បរិស្ថានរបស់
MassDEPតាមរយៈលេខទូរស័ព្ទដែលបានរាយដូចខាងក្រោម។

Kriolu Kabuverdianu Cape Verdean

Es dokumentu sta important i tenki ser tradusidu immediatamenti. Se nho ta presisa ke es dokumentu sta tradisidu, por favor kontata O Diretor di Justisia di Environman di DEP ku es numero di telifoni menxionadu di baixo.

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Русский Russian

Это чрезвычайно важный документ, и он должен быть немедленно переведен. Если вам нужен перевод этого документа, обратитесь к директору Департамента экологического правосудия MassDEP (MassDEP's Director of Environmental Justice) по телефону, указанному ниже.

العربية Arabic

هذه الوثيقة مهمة وتجب ترجمتها على الفور.

إذا كنت بحاجة إلى ترجمة هذه الوثيقة، فيرجى الاتصال بمدير العدالة البيئية في MassDEP على رقم الهاتف المذكور أدناه.

한국어 Korean

이 문서는 중대하므로 즉시 번역되어야 합니다.
본 문서 번역이 필요하신 경우, 매사추세츠 환경보호부의 "환경정의" 담당자 분께 문의하십시오. 전화번호는 아래와 같습니다.

հայերեն Armenian

Այս փաստաթուղթը կարևոր է, և պետք է անհապաղ թարգմանել այն:
Եթե Ձեզ անհրաժեշտ է թարգմանել այս փաստաթուղթը, դիմեք Մասաչուսեթսի շրջակա միջավայրի պահպանության նախարարության (MassDEP) Բնապահպանական հարցերով արդարադատության ղեկավարին (Director of Environmental Justice)՝ ստորև նշված հեռախոսահամարով

فارسی Farsi Persian

این نوشتار بسیار مهمی است و باید فوراً ترجمه شود.
اگر نیاز به ترجمه این نوشتار دارید لطفاً با مدیر عدالت محیط زیستی MassDEP در شماره تلفن ذکر شده زیر تماس بگیرید.

Français French

Ce document est important et doit être traduit immédiatement. Si vous avez besoin d'une traduction de ce document, veuillez contacter le directeur de la justice environnementale du MassDEP au numéro de téléphone indiqué ci-dessous.

Deutsch German

Dieses Dokument ist wichtig und muss sofort übersetzt werden. Wenn Sie eine Übersetzung dieses Dokuments benötigen, wenden Sie sich bitte an MassDEP's Director of Environmental Justice *(Direktor für Umweltgerechtigkeit in Massachusetts)* unter der unten angegebenen Telefonnummer.

Ελληνική Greek

Το έγγραφο αυτό είναι πολύ σημαντικό και πρέπει να μεταφραστεί αμέσως. Αν χρειάζεστε μετάφραση του εγγράφου αυτού, παρακαλώ επικοινωνήστε με τον Διευθυντή του Τμήματος Περιβαλλοντικής Δικαιοσύνης της Μασαχουσέτης στον αριθμό τηλεφώνου που αναγράφεται παρακάτω

Italiano Italian

Questo documento è importante e deve essere tradotto immediatamente. Se hai bisogno di tradurre questo documento, contatta il Direttore della Giustizia Ambientale di MassDEP al numero di telefono sotto indicato.

Język Polski Polish

Ten dokument jest ważny i powinien zostać niezwłocznie przetłumaczony. Jeśli potrzebne jest tłumaczenie tego dokumentu, należy skontaktować się z dyrektorem ds. sprawiedliwości środowiskowej MassDEP pod numerem telefonu podanym poniżej.

हिन्दी Hindi

यह दस्तावेज महत्वपूर्ण है और इसका अनुवाद तुरंत किया जाना चाहिए। यदि आपको इस दस्तावेज का अनुवाद कराने की जरूरत है, तो कृपया नीचे दिए गए टेलीफोन नंबर पर MassDEP के पर्यावरणीय न्याय निदेशक से संपर्क करें।

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

General Permit No.: NAE-2022-02649 Final Effective Date: June 2, 2023
Applicant: General Public, Commonwealth of Massachusetts Expiration Date: June 1, 2028

Department of the Army
General Permits for the Commonwealth of Massachusetts

The New England District of the U.S. Army Corps of Engineers (USACE) hereby issues twenty-five (25) regional general permits (GPs) for activities subject to USACE jurisdiction in waters of the U.S., including wetlands, navigable waters within the Commonwealth of Massachusetts and adjacent ocean waters to the seaward limit of the outer continental shelf. The Massachusetts GPs (hereafter referred to as the MA GP or GP) are issued in accordance with USACE regulations at 33 CFR 320 – 332 [see 33 CFR 325.5(c)(1)]. These GPs establish criteria and contain permit conditions to ensure that the authorized activities have no more than minimal individual and cumulative adverse impacts to the environment.

This document contains the following sections:		Pages
SECTION I	Statutory Authorities & Regulated Activities	2
SECTION II	Review Categories & Application Procedures	3-7
SECTION III	Massachusetts General Permits	8-34
SECTION IV	General Conditions	35-51
SECTION V	Mitigation Standards	52-54
SECTION VI	Federal & State Agency Contact Information & Websites	55-56
SECTION VII	Definitions & Acronyms	57-66
APPENDIX A	Guidance for Section 106 NHPA Compliance in Massachusetts	67-71
APPENDIX B	Pre-Construction Notification	72-77
APPENDIX C	Self-Verification Notification	78-81
APPENDIX D	Pre-Construction Notification Application Checklist	82-88

In issuing these GPs, the Federal Government does not assume any liability for the following: (a) damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes; (b) damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the U.S. in the public interest; (c) damages to persons, property or to other permitted or unpermitted activities or structures caused by the activity authorized by any of the GPs; (d) design or construction deficiencies associated with the permitted work; or (e) damage claims associated with any future modification, suspension or revocation of these permits.

Tammy R. Turley 02 June 2023

Tammy R. Turley Date
Chief, Regulatory Division

SECTION I. STATUTORY AUTHORITES & REGULATED ACTIVITIES

1. Work Requiring USACE Authorization

a. Section 10: Work and structures that are located in, over, under or that affect navigable waters of the United States (U.S.) (see 33 CFR 329). The USACE regulates these activities under section 10 of the Rivers and Harbors Act of 1899 (see 33 CFR 322).

b. Section 404: The discharge of dredged or fill material into waters of the U.S (see 33 CFR 328). The USACE regulates these activities under Section 404 of the Clean Water Act (CWA). The term "discharge of dredged or fill material" also includes certain discharges resulting from excavation. Applicants should contact USACE to determine if a particular excavation discharge occurring within waters of the U.S., is a regulated activity. See 33 CFR 323.4 of the CWA for exempted activities.

For additional information on the limits of USACE jurisdiction, please see: https://www.nae.usace.army.mil/Portals/74/docs/regulatory/JurisdictionalLimits/Jurisdictional_Limits_Brochure.pdf

2. Authority to Issue General Permits

a. In accordance with 33 CFR 322.2(f), 325.2(e)(2), and 325.5(c), USACE may issue regional general permits authorizing activities under Section 10 of the RHA.

b. In accordance with Section 404(e) of the CWA, 33 USC 1344(e), and 33 CFR 323.2(h), 325.2(e)(2), and 325.5(c), after notice and opportunity for public hearing, USACE may issue regional general permits for any category of activities involving discharges of dredged or fill material if the activities in such category are similar in nature, will cause only minimal adverse environmental effects when performed separately, and will only have minimal cumulative adverse effect on the environment.

3. Related Laws

33 CFR 320.3 includes a list of related laws including, but not limited to, Section 408 of the Rivers and Harbors Act of 1899, Section 401 of the Clean Water Act, Section 402 of the Clean Water Act, Section 307(c) of the Coastal Zone Management Act of 1972, Section 106 of the National Historic Preservation Act of 1966, Section 7 of the Endangered Species Act, the Fish and Wildlife Coordination Act of 1956, the Magnuson-Stevens Fishery Conservation and Management Act, the Fish and Wildlife Coordination Act, Section 302 of the Marine Protection, Research and Sanctuaries Act of 1972, Section 7(a) of the Wild and Scenic Rivers Act, the Golden Eagle Protection Act, and the Migratory Bird Treaty Act.

SECTION II. REVIEW CATEGORIES & APPLICATION PROCEDURES

To qualify under these GPs, the design, construction, and maintenance associated with each proposed activity must meet the terms and eligibility criteria listed in Section III, all applicable general conditions (GCs) in Section IV, and any specific mitigation requirements in Section V. Applicants should first review the GPs to see if a project is eligible for authorization under one or more of the GPs within this document. Any activity not specifically listed may still be eligible for authorization under these GPs; applicants are advised to contact USACE for specific eligibility determination.

Please note that these GPs allow for Self-Verification (SV) contingent upon meeting all criteria and with full adherence to all GCs. Projects that do not qualify for SV, may meet criteria for Pre-Constriction Notification (PCN). Tables are provided under each activity, which outline criteria for SV and PCN. Activities that do not meet criteria for SV or PCN may require review as an Individual Permit (IP). Activities may require a PCN or IP as noted in Sections III and/or IV of this GP. Notwithstanding compliance with the terms of these GPs, USACE retains discretionary authority to require either PCN review or IP review on a case-by-case basis for any project based on concerns for the environment or for any of the other public interest factors found in 33 CFR 320.4(a). These GPs also do not replace or change those activities identified as exempt from USACE regulation (33 CFR 323.4).

1. Pre-Application Assistance

Prospective applicants may request a pre-application meeting to address any questions they may have. USACE may also request a pre-application meeting or additional information to facilitate review of the request. Pre-application meetings and/or site visits help streamline the authorization process by alerting the prospective applicant to potentially time-consuming factors that may arise during the evaluation of their project (e.g., avoidance, minimization and compensatory mitigation requirements, historic properties, endangered species, essential fish habitat, impacts to federal projects, and/or dredging of contaminated sediments).

To schedule a pre-application meeting, present questions, or if you need further assistance, please contact USACE at:

Email: cenae-r-ma@usace.army.mil (strongly preferred) Phone: (978) 318-8338

Mail: U.S. Army Corps of Engineers
New England District
Regulatory Division, Massachusetts Section
696 Virginia Road
Concord, MA 01742

2. Submitting a Request

Please follow the procedures outlined in Sections II.2-5 when requesting an SV or applying for PCN authorization for activities covered by these GPs. The GPs are provided in Section III below. For SV-eligible projects, the Self-Verification Notification (SVN) must be submitted within 30 days of commencing work. Otherwise, a Pre-Construction Notification (PCN) must be submitted for work that is not SV-eligible. Please include appropriate drawings and attachments and submit your request using the mailbox identified in Section II.4 or II.5 below. USACE will promptly confirm receipt of your request and notify you in the event additional information is required. Guidance on

how to submit electronic correspondence is located on the NAE Regulatory website here: https://www.nae.usace.army.mil/Missions/Regulatory/Submitting-Electronic-Correspondence.

3. Local, State & Federal Approvals

Applicants are responsible for applying for and obtaining any required local, state, and federal permits or approvals. These must be obtained prior to the commencement of work in waters. Such authorizations may include a Water Quality Certification, a Coastal Zone Management Act consistency determination, and other approvals as noted below. Authorization under these GPs does not obviate the need for the permittee to obtain other Federal, State, or local permits, approvals, or authorizations required by law.

I. Water Quality Certification under Section 401 of the Federal Clean Water Act (33 USC 1341).
Applicants are responsible for determining the appropriate 401 Water quality Certification (WQC) requirements and submitting this information to the USACE at the time of their PCN application or when completing their SVN. Applicants that are unsure of whether their activity has been certified should contact MassDEP, or EPA Region 1 when the activity is located on tribal lands, for a determination. The 401 WQC requirement must be satisfied by acquiring one of the following WQCs from MassDEP (see GC 8):

General 401 WQC: The MassDEP issued a WQC on April 21, 2023 conditionally certifies all activities in GPs 1 – 24 eligible for SV and PCN so long as the activity is described in 314 CMR 9.03, and is not an activity described in 314 CMR 9.04, and so long as the activity meets all other requirements, terms and conditions of this WQC. The MassDEP WQC also conditionally certifies activities described in GP 25 so long as the activity meets all other conditions of the WQC. Emergency projects described in GP 25 must obtain an emergency certification or otherwise be authorized pursuant to 310 CMR 10.06, qualify under a Severe Weather Emergency Declaration pursuant to 310 CMR 10.06(8) issued by the MassDEP, or meet the requirements of 9.12(2) or (3) in order to be certified under the WQC

Applicants should refer to the following link to determine if their activity is eligible: *https://www.nae.usace.army.mil/Missions/Regulatory/ State-General-Permits/ Massachusetts-General-Permit/*. If eligible, you must comply with all applicable WQC conditions. Activities listed in 314 CMR 9.03 that are not exempt from the Wetland Protection Act must have a valid Final Order of Conditions (OOC) or Final Restoration Order of Conditions pursuant to 310 CMR 10.00 to be eligible under the General 401 WQC.

Individual 401 WQC: In the event the proposed activity is not covered by the general WQC, applicants shall contact MassDEP and apply for an individual 401 WQC if their activity does not qualify for a General 401 WQC as outlined above. MassDEP may issue, waive, or deny the individual 401 WQC on a case-by-case basis. All activities listed in 314 CMR 9.04 must obtain an individual 401 WQC from MassDEP to be eligible under these GPs. When an Individual 401 WQC is required for *PCN activities*, the applicant shall submit their Individual 401 WQC application concurrently to MassDEP and the USACE to comply with 40 CFR 121.

Activities Proposed on Tribal Lands: When an activity is proposed on Tribal lands, the applicant shall refer to the general 401 WQCs granted by the Environmental Protection Agency (EPA), Region 1 on May 15, 2023. These 401 WQCs are located on the USACE Regulatory website: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.

II. Coastal Zone Management Act Federal Consistency Concurrence pursuant to Section 307 of the CZMA of 1972, as amended. Federal consistency concurrence is required for all activities located within the coastal zone, unless determined otherwise by the Massachusetts Office of Coastal Zone Management (MA CZM) (see GC 9). As applicable, this requirement must be satisfied by acquiring one of the following from the MA CZM:

General CZM Federal Consistency Concurrence (General Concurrence): MA CZM has granted General Concurrence for all SV and PCN activities for GPs 1-25 and this can be found at: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/. The applicant must obtain all applicable permits and approvals prior to the commencement of work in USACE jurisdiction (i.e., construction begins on site). For SVs, General Concurrence is automatically granted and no further action is required from the applicant. For PCNs, the USACE will coordinate with MA CZM to acquire General Concurrence as part of the PCN application review. During review of the PCN application, USACE may request additional information from the applicant to support CZM's evaluation of the activity.

Individual CZM Federal Consistency Concurrence (Individual Concurrence): In certain cases, MA CZM may elevate any GP activity 1-25 to require Individual Concurrence. The applicant must contact MA CZM and follow the procedures to obtain Individual Concurrence as determined appropriate by MA CZM.

The MA CZM program includes five regional offices that serve 78 coastal municipalities. The following map provides more information about these offices: https://www.mass.gov/service-details/czm-regions-coastal-communities-and-coastal-zone-boundary

III. Other Approvals: Approvals typically required in Massachusetts include, but are not limited to, a Chapter 91 Permit/License, Massachusetts Environmental Protection Act (MEPA) review, Wetlands Protection Act Order of Conditions, and/or Aquaculture Certification. *Applicants should also be aware that USACE may not be able to render a permit decision in the event the proposed activity is denied by another local, state and/or federal agency.*

4. Procedures for Self-Verification (SV) Eligible Projects

If the activity is eligible for an SV, the Self-Verification Notification (SVN) must be completed prior to the start of project construction and submitted to USACE within 30 days of commencing work. The purpose of the SVN is to provide applicants with a tool to assist them when determining if the activity as proposed is SV-eligible. The following GPs do not require submission of the SVN: GP 1 (SV #1), GP 3 (SV #2-3), GP 4 (SV #2), GP 11, GP 12 (note #2), GP 14 (see note), GP 15 (see note), and GP 24 (SV #3). **For the activities not listed above, the SVN must be completed prior to the start of work and be kept on site at all times during project construction.** The applicant shall not begin work for SV-eligible activities until they have completely verified the bulleted items below.

Digital submittals by email are **strongly encouraged** to facilitate the most efficient processing of the SVN submittal. Please communicate with USACE staff if you are unable to provide a digital copy. Addresses are cenae-r-ma-sv@usace.army.mil (email) or Regulatory Division, U.S. Army Corps of Engineers, New England District, 696 Virginia Road, Concord, MA 01742-2751 (mail).

Eligible SV Activities:

- Are subject to USACE jurisdiction (see GC 2); and
- Qualify for one or more of the GPs within this document (Section III); and
- Meet the GCs within this document (Section IV); and

- When required, are supported by a complete SVN (Appendix C); and
- Receive all other required local, State, and/or Federal approvals.

5. Procedures for Pre-Construction Notification (PCN) Eligible Projects

For activities that require a PCN, an application to and written authorization from USACE is required. *No work requiring a PCN may proceed until the applicant receives written authorization from USACE verifying that the activity is authorized.* The verification letter may include special conditions that the applicant must comply with. When possible, it is *highly* recommended that PCN application materials are submitted at least 90 days before the target start date to allow for USACE evaluation and any necessary agency consultations. PCN applications shall demonstrate in writing how the proposed activity complies with all GCs, as applicable to their activity.

Digital submittals by email are **strongly encouraged** to facilitate the most efficient processing of the PCN application. Please communicate with USACE staff if you are unable to provide a digital copy. Addresses are cenae-r-ma@usace.army.mil or Regulatory Division, U.S. Army Corps of Engineers, New England District, 696 Virginia Road, Concord, MA 01742-2751 (mail).

Eligible PCN Activities:

- Are subject to USACE jurisdiction (see GC 2); and
- Qualify for one or more of the GPs within this document (Section III); and
- Meet the GCs within this document (Section IV); and
- Comply with the Mitigation Standards within this document (Section V); and
- Are supported by a complete PCN document (Appendix B); and
- When required, are supported by the submittal of project information to the appropriate parties identified in Appendix A; and
- Receive all other required local, State, and/or Federal approvals.

6. Interagency Review Procedures

The USACE reserves the opportunity to coordinate PCN activities with Federal and State agencies to ensure that the proposed activity results in no more than a minimal impact to the aquatic environment. In some cases, USACE may require project modifications involving avoidance, minimization, and/or compensatory mitigation for unavoidable impacts to ensure the net effects of a project are minimal. The USACE determines, after review and coordination with the agencies and/or the applicant, if PCN applications:

a. Meet the terms and conditions of the GP as proposed;
b. Require additional information;
c. Require avoidance, minimization, compensatory mitigation, construction sequencing, project modification, or other special conditions to avoid or minimize adverse impacts to the aquatic environment;
d. Require individual permit review regardless of whether the terms and GCs of these GPs are met, based on concerns for the aquatic environment or any other factor of the public interest (see Section 9 below).

For activities requiring a PCN, the applicant must wait for written authorization from USACE before commencing activities in waters of the U.S. Beginning work for PCN required activities without a USACE written authorization is a violation of these GPs, and the terms and conditions of this document. The applicant may be subjected to an enforcement action by USACE and/or the Environmental Protection Agency (EPA).

7. Construction of Solid Fill Structures and Fills Along the Coastline or Baseline from Which the Territorial Sea is Measured.

Projects involving the construction of solid fill structures or discharge of fill that may extend beyond the coastline or the baseline from which the territorial sea is measured (i.e., mean low water) will require a PCN. The USACE will submit a description of the proposed work and a copy of the plans to the Solicitor, Department of the Interior, Washington, DC 20240, and request comments concerning the effects of the proposed work on the outer continental rights of the United States. These comments will be included in the administrative record of the application. After completion of permit review, the record will be forwarded to the Chief of Engineers. The decision on the application will be made by the Secretary of the Army after coordination with the Attorney General.

8. Emergency Activities

Per 33 CFR 325.2(e)(4), an emergency is limited to a situation that would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process an application under standard procedures. Emergency work shall be limited to that which is necessary to stabilize and secure the situation. Additional work needed for final repairs shall not be completed until approval is obtained through the appropriate, non-emergency process. Emergency work is subject to the same terms and conditions of these GPs as non-emergency work, and similarly, must qualify for authorization under these GPs; otherwise, an IP is required. *See GP 25 Emergency Situations for additional information.*

9. Individual Permit

Projects that do not meet the terms and conditions of this GP may require review as an IP (33 CFR 325.5 (b)). Proposed work in this category will require a separate Federal application for an individual permit from USACE (33 CFR 325.1). In addition, USACE retains discretionary authority on a case-by-case basis to elevate GP-eligible activities to an IP based on concerns for the environment or any other factor of the public interest (33 CFR 320.4 (a)). Applicants are required to submit the appropriate application materials directly to USACE as early as possible to expedite the permit review process. General information and application forms can be obtained at our website or by contacting our office at cenae-r-ma@usace.army.mil or (978) 318-8338. Individual 401 WQC and/or CZMA Federal consistency concurrence from the appropriate MA agencies are required before USACE can issue an individual permit. Applying for an IP does not relieve the applicant from their obligation to obtain all required Federal, State and/or local approvals.

10. Compliance

Applicants shall ensure compliance with all applicable GPs in Section III, GCs in Section IV, and any special conditions included in USACE verification letters. Noncompliance with these GPs, GCs, and special conditions may subject the applicant to criminal, civil, or administrative penalties, and/or an ordered restoration, and/or the permit may be modified, suspended or revoked by USACE. The USACE will consider any activity requiring USACE authorization to be noncompliant if that activity does not comply with all GP terms and conditions at all times, including while the project is under construction and when work is completed.

SECTION III. MASSACHUSETTS GENERAL PERMITS

Applicants are encouraged to review Sections I & II prior to submitting an application to confirm that the activity as proposed complies with all terms and conditions of the 2023 MA GPs. Applicants are also encouraged to review the definitions in Section VII, Definitions & Acronyms, of this document. Several terms are frequently used throughout the GPs, and it is important for the reader to understand these terms. If seeking verification for an activity previously verified under the 2018 MA GPs, please contact the USACE to discuss permitting needs in advance of submitting an application.

General Permits

1. Aids to Navigation and Temporary Recreational Structures
2. Maintenance
3. Moorings
4. Structures in Navigable Waters of the U.S.
5. Boat Ramps and Marine Railways
6. Utility Lines, Oil or Natural Gas Pipelines, Outfall Or Intake Structures, and Appurtenant Features
7. Dredging, Disposal of Dredged Material, Beach Nourishment, Rock Removal and Rock Relocation
8. U.S. Coast Guard Approved Bridges
9. Bank and Shoreline Stabilization
10. Aquatic Habitat Restoration, Enhancement, and Establishment Activities
11. Fish and Wildlife Harvesting and Attraction Devices and Activities
12. Response Operations, Oil and Hazardous Substances
13. Cleanup of Hazardous and Toxic Waste
14. Scientific Measurement Devices
15. Survey Activities
16. Land and Water-Based Renewable Energy Generation Facilities and Hydropower Projects
17. Residential, Commercial and Institutional Developments, and Recreational Facilities
18. Aquaculture
19. Mining Activities
20. Living Shorelines
21. Agricultural Activities
22. Reshaping Existing Drainage Ditches, Construction of New Ditches, and Mosquito Management
23. Linear Transportation Projects and Wetland/Stream Crossings
24. Temporary Construction, Access, and Dewatering
25. Emergency Situations

GP 1. AIDS TO NAVIGATION AND TEMPORARY RECREATIONAL STRUCTURES (Authority: §10)

(a) The placement of aids to navigation and regulatory markers that are approved by and installed in accordance with the requirements of the U.S. Coast Guard (USCG). See 33 CFR, Part 66; and (b) Temporary buoys, markers, and similar structures placed for recreational use during specific events such as water skiing competitions and boat races or seasonal use. See GC 16.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. Aids to navigation and regulatory markers approved by and installed in accordance with the requirements of the USCG. 2. Temporary buoys, markers and similar structures that are: (a) placed for recreational use during specific events and removed within 30 days after event; or (b) placed during winter events on ice and removed before spring thaw. These structures must be authorized by the local harbormaster, not located within an FNP or its buffer zone, and not located in saltmarsh or tidal vegetated shallows.	1. Impacts in saltmarsh or tidal vegetated shallows. 2. Activities that are not SV eligible.
Note: An SVN submittal to USACE is not required for work authorized under SV #1 above.	

GP 2. MAINTENANCE (Authorities: §10 and §404)

Repair, rehabilitation, or replacement of any previously authorized[1], currently serviceable structure, or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3 (activities occurring before certain dates), provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area, including those due to changes in materials, construction technique requirements of other regulatory agencies, or current construction codes or safety standards that are necessary to make the repair, rehabilitation, or replacement are authorized. This GP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the activities above. Maintenance dredging and beach nourishment are not eligible under GP 2 (see GP 7). Stream crossing modifications (including sliplining), replacements or extensions are not eligible under GP 2 (see GPs 6, 17, 23). *See GP 25 Emergency Situations for expedited review of emergency activities.*

Not authorized under GP 2 (IP required): (a) Permanent impacts in >1 acre in non-tidal waters and/or wetlands; or (b) Permanent impacts >1/2 acre in tidal waters; >1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in tidal vegetated shallows; or (c) Temporary impacts >1 acre in tidal waters; >5000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >1000 SF in vegetated shallows; (d) New stream channelization or stream relocation projects (e.g., those in response to storm or flood events).

Self-Verification Eligible

Maintenance activities that meet all of the following terms:

1. In non-tidal waters, the combined permanent and temporary impacts extending beyond the original footprint are ≤5,000 SF[2] and not located in vegetated shallows or riffle and pool complexes.

2. In tidal waters, the combined permanent and temporary impacts extending beyond the original footprint are ≤5,000 SF, ≤1,000 SF in mudflats and/or natural rocky habitat, and not located in saltmarsh and tidal vegetated shallows.

3. Minor deviations in the repair, rehabilitation, or replacement of previously authorized, currently serviceable structures or fills.

4. Bulkhead replacement in tidal and non-tidal waters via installation of new bulkhead within 18 inches of the existing bulkhead and associated backfill.

5. Drawdown of an impoundment for dam/levee repair provided it does not exceed 18 months and one growing season (April through September).

Pre-Construction Notification Required

1. Discharges associated with removal of accumulated sediments and debris in the vicinity of existing structures, including intake and outfall structures and associated canals.

2. The removal of sediment outside the immediate vicinity of existing structures (e.g., bridges, culverted road crossings, water intake structures, etc.) that is ≥200 linear feet. This activity is limited to the minimum necessary to restore the waterway in the vicinity of the structure to the approximate dimensions existing when the structure was built.

3. Dam and flood control or levee repair, rehabilitation, or replacement involves:
   a. A change in the flood elevation or permanent water surface elevation of the impoundment; or
   b. Drawdown of impoundment for construction exceeding one growing season (see SV eligible #5);
   c. Any modification that changes the character, scope, or size of the original fill design; or
   d. Does not meet SV eligible 1-7.

4. Installation of steel piles, including steel sheet piles, that cannot be done in the dry and where NOAA-ESA listed species are mapped as present.

[1] Some maintenance activities may not be subject to regulation under Section 404 of the CWA in accordance with 33 CFR 323.4(a)(2). Per 33 CFR 330.3, Vested dates are: a) Work performed and structures installed before December 18, 1968 (Section 10); and b) Fill placed before July 25, 1975 (Section 404).
[2] This excludes dam projects that may require a temporary drawdown with impacts >5,000 SF in non-tidal waters. Instead, the drawdown shall comply with SV #5 to be eligible under Self-Verification.

6. Any stream channel modification is limited to the minimum necessary for the repair, rehabilitation, or replacement of the structure or fill; such modifications, including the removal of material from the stream channel, must be immediately adjacent to the project or within the boundaries of the structure or fill. 7. Work to previously approved tide gates not affecting upstream tidal resource areas.	5. Activities located in the Connecticut River or Merrimack River, unless they are completed in the dry or when the tide is waterward of the work area. 6. Activities on USACE properties & USACE-controlled easements. 7. Activities that do not require an IP. Activities that do not require a PCN or an IP may be SV eligible.
Notes: 1. This authorizes the repair, rehabilitation, or replacement of any previously authorized structure or fill that does not qualify for the CWA §404(f) exemption for maintenance. See 33 CFR 323.4(a)(2). Prior USACE permits may have included authorization to maintain the activity, in which case authorization under this GP is not necessary. 2. See GC 22 for information on temporary construction mats.	

GP 3. MOORINGS (Authority: §10)

New moorings and mooring fields; the relocation of previously authorized moorings; expansions, boundary reconfigurations or modifications of previously authorized mooring fields; and maintenance and replacement of moorings.

Not authorized under GP 3 (IP required): (a) Moorings or mooring fields converted to or associated with a new boating facility[1]; or (b) Moorings in a USACE Federal Navigation Anchorage or USACE Federal Navigation Channel, except municipal-operated mooring fields.

Self-Verification Eligible	Pre-Construction Notification Required
1. New or relocated moorings that meet all the following terms: a. Authorized by a local harbormaster/ municipality under MGL Chapter 91 §10A; and b. No interference with navigation; and c. Single boat, single-point and non-commercial; and d. Not associated with a boating facility, and e. Neither placed within nor impact tidal vegetated shallows (e.g., eelgrass); and f. Not located within a USACE Federal navigation project (FNP) or the FNP buffer zone. 2. Existing, authorized moorings are converted from traditional moorings to low impact mooring technology (see note below) and/or helical anchors. 3. Maintenance and replacement of moorings authorized by the USACE.	1. New mooring fields; or expansions, boundary reconfigurations or modifications of existing, authorized mooring fields. 2. Moorings located such that they, and/or vessels docked or moored at them, are within the buffer zone of the horizontal limits of a Federal Anchorage. The buffer zone is equal to 3 times the authorized depth of that channel (see GC 15). 3. New individual moorings located in saltmarsh, mudflats, natural rocky habitat, and tidal vegetated shallows. Locating moorings these areas should be avoided to the maximum extent practicable. If these areas cannot be avoided, plans should show conservation mooring or low-impact mooring systems that prevent mooring chains from resting or dragging on the bottom substrate at all tides, where practicable. USACE may require a survey in areas previously mapped as containing eelgrass or within 100 ft. of existing eelgrass beds to document presence or absence of eelgrass and to determine the appropriate type and amount of compensatory mitigation for impacts to eelgrass. 4. Replacement moorings located in tidal vegetated shallows. 5. Moorings that are not SV eligible and do not require an IP.

Notes:

1. Low impact mooring systems, including conservation moorings, are encouraged to minimize impacts of chain scouring from conventional moorings during the tidal cycle.
2. An SVN submittal to USACE is not required for work authorized under SV #2-3 above.

[1] Boating facilities are marinas, yacht clubs, boat clubs, boat yards, dockominiums, town facilities, land/homeowner's associations, etc. that provide for a fee, rent or sell mooring or docking space. Not classified as boating facilities are municipal moorings or municipal mooring fields that charge an equitable user fee based only on the actual costs incurred.

GP 4. STRUCTURES IN NAVIGABLE WATERS OF THE U.S. (Authority: §10 & §404)

New, expansions, reconfigurations or modifications of structures for navigational access in waters of the U.S. including but not limited to temporary/seasonal or permanent pile and pole-supported piers, floats, stairs, shore outhauls, and boat and float lifts.

Not authorized under GP 4 (IP required): (a) Structures associated with a new boating facility; (b) Structures in a USACE Federal anchorage or channel; or (c) Artificial reefs.

Self-Verification Eligible

1. Private, non-commercial piers, floats and lifts that meet all the following terms:

a. Piers and floats in: (i) Tidal waters total ≤600 SF combined; and (ii) Non-tidal navigable waters of the U.S. total ≤600 SF combined; and

b. Piers are ≤4 feet wide and ≥6 feet above the marsh substrate (the height is measured from the marsh substrate to the bottom of the lowest longitudinal support); and

c. Floats and lifts in tidal waters and non-tidal navigable waters of the U.S. are ≥24 inches above the substrate during all tidal cycles. Float stops are preferred when site conditions warrant them (i.e., low tide exposes substrate), and skids can only be used in areas where piles are not feasible and on sandy or hard bottom substrates; and

d. Piers, floats and lifts: (i) Are ≥25 feet from previously mapped or existing vegetated shallows, or riparian property line extensions; (ii) Extend ≤25% of the waterway width in non-tidal navigable waters of the U.S. or MHW in tidal navigable waters of the U.S.

e. Installation of ≤12-inch diameter timber piles. Installation of ≥12-inch diameter piles of any material type when installed in the dry.

2. Fenders and similar structures.

Pre-Construction Notification Required

1. Shore outhauls.
2. Expansions, modifications, or new reconfiguration zones at any authorized boating facility.
3. New, expansions, reconfigurations, reconfiguration zones, or modifications of structures that provide public, community or government recreational uses such as boating, fishing, swimming, access, etc.
4. Installation of steel piles, including steel sheet piles, that cannot be done in the dry and where NOAA-ESA listed species are mapped as present.
5. Located within the buffer zone of the horizontal limits of an FNP (GC 15).
6. Miscellaneous structures.
7. Impacts in tidal vegetated shallows.
8. Structures that are not SV eligible and do not require an IP.

Notes:

1. See GC 19 regarding pile driving and pile removal in navigable waters and
2. See GC 20 regarding time of year restrictions in tidal waters.
3. Boating facilities are facilities that provide for a fee, rent, or sell mooring space, such as marinas, yacht clubs, boat clubs, boat yards, town facilities, dockominiums, etc. Pile supported structures with no discharges of dredged or fill material are not regulated by USACE in non-navigable waters.
4. A SVN submittal to USACE is not required for SV #2 above.

GP 5. BOAT RAMPS AND MARINE RAILWAYS (Authorities: §10 and §404)

Activities required for the construction of boat ramps and marine railways, including excavation and fill.

Not authorized under GP 5 (IP required): (a) Permanent impacts that are >1 acre in non-tidal waters of the U.S., >½ acre in tidal waters; >1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in tidal vegetated shallows; (b) Temporary impacts in tidal waters that are >1 acre; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows[1]; or (c) dredging in navigable waters of the U.S. (see GP 7).

Self-Verification Eligible	Pre-Construction Notification Required
1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, and (b) not located in riffle and pool complexes and non-tidal vegetated shallows.	1. Boat ramps are located within 25 feet of property line extensions unless the properties are owned by the same owner. The USACE may require a letter of no objection from the abutter(s).
2. In tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) ≤1,000 SF in mudflats and/or natural rocky habitat, and (c), not located in saltmarsh and tidal vegetated shallows.	2. Activities that are not eligible for SV and do not require an IP.

GP 6. UTILITY LINES, OIL OR NATURAL GAS PIPELINES, OUTFALL OR INTAKE STRUCTURES, AND APPURTENANT FEATURES (Authorities: §10 & §404)

Activities required for: (a) The construction, maintenance, repair or removal of utility lines, oil or natural gas pipelines[1], outfall or intake structures[2], and appurtenant features including the associated excavation, backfill, or bedding for these structures. (b) The construction, maintenance, or expansion of substations and other appurtenant facilities associated with a utility line, oil or natural gas pipeline, and outfall or intake structure in non-tidal waters of the U.S.; and (c) The construction and maintenance of foundations for overhead utility line towers, poles, and anchors in tidal and non-tidal waters of the U.S., provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) are used where feasible. This GP authorizes the construction of access roads to facilitate construction of the above activities provided the activity, in combination with all other activities included in one single and complete project, does not exceed the thresholds identified below (IP required). Access roads used solely for construction of the utility line must be removed upon completion of the work. This GP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the activities above.[3]

Not authorized under GP 6 (IP required): (a) Permanent impacts for any single and complete project that are >1 acre in non-tidal waters of the U.S.; >½ acre in tidal waters; >1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in tidal vegetated shallows; (b) Temporary impacts in tidal waters that are >1 acre; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows; (c) Stormwater treatment or detention systems, or subsurface sewage disposal systems in waters of the U.S.; or (d) New tide gates that do not meet SV criteria below.

Self-Verification Eligible	Pre-Construction Notification Required
1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, and (b) not located in riffle and pool complexes and non-tidal vegetated shallows. 2. In tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) ≤1,000 SF in mudflats and/or natural rocky habitat, and (c), not located in saltmarsh and tidal vegetated shallows. 3. Intake structures that are dry hydrants used exclusively for firefighting activities with no stream impoundments. 4. New tide gates on outfall structures for pipes conveying stormwater and/or industrial NPDES-permitted discharges from waters that are not waters of the U.S.	1. New outfall and/or intake structures. 2. Unconfined work or silt producing activities in streams with diadromous fish. 3. Submarine cables, conduits, or pipelines that occur in, over or under navigable waters of the U.S. 4. Stream channelization, relocation, impoundment, or loss of streambed occurs. 5. The activity is placed within and runs parallel to or along a streambed within waters of the U.S. 6. There is a permanent change in preconstruction contours in waters of the U.S. 7. Installation of utility lines or gas/oil pipelines using trench excavation where material is temporarily sidecast into waters of the U.S. for >3 months. Applicants must demonstrate how the material would not be dispersed by currents or other forces. 8. Activities that are not SV eligible and do not require an IP.

[1] See the definitions of a “utility line” and “oil or natural gas pipeline” in Section VII.
[2] Outfall structures must be in compliance with regulations issued under the National Pollutant Discharge Elimination System Program (Section 402 of the Clean Water Act).
[3] Temporary impacts shall comply with all GCs, including GC 32 Utility Line Installation and Removal.

GP 7. DREDGING (Authority: §10), DISPOSAL OF DREDGED MATERIAL (Authorities: §10, §404), BEACH NOURISHMENT (Authorities: §10 & §404), ROCK REMOVAL (Authority: §10) AND ROCK RELOCATION (Authorities: §10 & §404)

New, improvement and maintenance dredging (see notes below) including: (a) Disposal of dredged material at a confined aquatic disposal cell, beach nourishment location, near shore site, or ocean disposal site selected under Section 404 of the Clean Water Act pursuant to the 404(b)(1) Guidelines, provided the dredged material meets the requirements for such disposal; (b) Beach nourishment not associated with dredging; and (c) Rock removal and relocation for navigation.

Not authorized under GP 7 (IP required): (a) Dredging where ocean disposal is required for the disposal of dredged material (Section 103); New dredging >½ acre; ≥10,000 CY; >1000 SF permanent impacts to intertidal areas, saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF permanent impacts to tidal vegetated shallows; (b) Maintenance or improvement dredging and/or disposal with >1 acre of impacts to intertidal areas, saltmarsh, mudflats, riffle and pool complexes, or non-tidal vegetated shallows; (c) New dredging where the primary purpose is sand mining for beach nourishment; (d) Beach scraping; (e) Boulder removal and relocation for navigation >½ acre; or (f) Blasting.

Self-Verification Eligible

1. Maintenance dredging of previously dredged areas, with upland disposal, that meet all of the following terms:
   a. Dredged area ≤1/2 acre; and
   b. Activities comply with GC 20, TOY Restrictions. The time-of-year restriction(s) stated in Appendix B of the MA Division of Marine Fisheries (DMF) Technical Report TR-47[1] can apply instead if the general TOY restriction if a TOY is provided for a specific waterbody and is less restrictive. This is to protect endangered species, EFH, and other species; and
   c. The dredge footprint is located >25' from salt marsh or >100' from vegetated shallows; and
   d. Combined permanent and temporary impacts that are (i) ≤1,000 SF in mudflats or natural rocky habitat, or (ii) ≤5,000 SF within intertidal habitat and areas containing shellfish (an area contains shellfish unless: it is verified that minimal shellfish are present per the local shellfish constable or a shellfish survey; or it is not mapped as a MassGIS shellfish suitability area).
   e. No return water from upland disposal areas.

2. Boulder relocation with ≤1,000 SF of impacts, relocated to a similar depth and substrate.

Pre-Construction Notification Required

1. Maintenance dredging where the primary purpose is sand mining for beach nourishment.

2. New dredging and associated disposal ≤1/2 acre or <10,000 cubic yards.

3. Improvement dredging.

4. Beach nourishment in waters of the U.S. not associated with dredging.

5. Activities that are located in saltmarsh and tidal vegetated shallows.

6. Dredging in a Federal Navigation Project or within the buffer zone (see GC 15).

7. Activities that are not eligible for SV and do not require an IP.

Notes:

1. See Section VII for definitions of improvement and maintenance dredging.
2. For PCN activities, the USACE may waive or adjust the time of year requirement on a case-by-case basis after consultation with resource agencies.
3. Disposal site of any dredged material must be identified prior to obtaining USACE authorization.
4. Contact the USACE if a ten-year authorization to maintain an area is desired.

[1] The MA DMF Technical Report TR-47: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/

GP 8. U.S. COAST GUARD APPROVED BRIDGES (Authorities: §404)

Discharges of dredged or fill material incidental to the construction and modification of bridges across navigable waters of the U.S., including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided that the USCG authorizes the construction of the bridge structure under Section 9 of the Rivers and Harbors Act of 1899 or other applicable laws. A USCG Authorization Act Exemption or a Surface Transportation and Uniform Relocation Assistance Act (STURRA) (144h) exemption do not constitute USCG authorization.

Not authorized under GP 8 (IP Required): Causeways and approach fills (see GP 23).

Self-Verification Eligible	**Pre-Construction Notification Required**
1. Discharges of dredged or fill material that are incidental to the construction of bridges across navigable waters and meet all of the following: a. Combined permanent and temporary impacts that are ≤5,000 SF. b. Combined permanent and temporary impacts that are ≤1,000 SF in mudflats and natural rocky habitat. c. Not located in saltmarsh and tidal vegetated shallows.	1. Activities on USACE properties & USACE controlled easements.2. Installation of steel piles, including steel sheet piles, that cannot be done in the dry and where NOAA-ESA listed species are mapped as present. 3. Activities that are not eligible for SV and do not require an IP.

Notes:

1. GP 8 is not applicable to bridges over inland waters or wetlands that are not tidally influenced or regulated as navigable under Section 10.
2. See eligibility criteria for GPs 2 & 23 for projects that are not subject to USCG regulations.

GP 9. BANK AND SHORELINE STABILIZATION (Authorities: §10 & §404)

Bank stabilization activities necessary for erosion protection along the banks of lakes, ponds, streams, estuarine and ocean waters, and any other open waters. Includes bulkheads, seawalls, riprap, revetments, living seawalls, or slope protection & similar structures, specifically for the purpose of shoreline protection. This GP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the activities above.

Activities must meet the following criteria: (a) No material is placed in excess of the minimum needed for erosion protection; (b) No material is of a type, or is placed in any location, or in any manner, that will impair surface water flow into or out of any waters of the U.S.; (c) No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored native trees and treetops may be used in low energy areas); (d) Native plants appropriate for current site conditions, including salinity, must be used for bioengineering or vegetative bank stabilization; (e) The activity is not a stream channelization activity; and (f) The activity must be properly maintained, which may require repairing it after severe storms or erosion events. This GP authorizes those maintenance and repair activities if they require authorization. This GP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to construct the bank stabilization activity. See GP 20 for living shoreline stabilization structures or fills.

Not authorized under GP 9 (IP required): (a) New bank stabilization >500 feet in total length (>1,000 linear feet in total length when necessary to protect transportation infrastructure) or permanent loss of saltmarsh >1,000 SF, unless the District Engineer waives this criterion by making a written determination concluding that the discharge of dredged or fill material will result in no more than minimal adverse environmental effects (an exception is for bulkheads – the district engineer cannot issue a waiver for a new bulkhead that is >1,000 feet in length along the bank); (b) Stream channelization or relocation activities; or (c) Breakwaters, groins or jetties.

Self-Verification Eligible

1. Activities in tidal and non-tidal waters that are:
   a. <200 feet in length.
   b. <400 feet in length when necessary to protect transportation infrastructure.
   c. ≤1 cubic yard of fill per linear foot average along the bank waterward of the plane of OHW or HTL.
   d. Not located in non-tidal wetlands, saltmarsh, vegetated shallows.

Pre-Construction Notification Required

1. Activities in tidal and non-tidal waters that are:
   a. ≥200 feet to ≤500 feet in total length. Activities >500 feet in total length must have a written waiver from USACE.
   b. ≥400 feet to ≤1,000 feet in total length when necessary to protect transportation infrastructure. Activities >1,000 feet in total length must have a written waiver from USACE.
   c. >1 cubic yard of fill per linear foot average along the bank waterward of the plane of OHW or HTL.
   d. Located in non-tidal wetlands, saltmarsh, vegetated shallows.
2. Activities with permanent loss of tidal or non-tidal waters that is (a) ≥5,000 SF or (b) ≥1,000 SF in mudflats and natural rocky habitat.
3. Activities that are (a) located in the Connecticut River or Merrimack River and/or (b) require installation of steel piles/steel sheet piles that cannot be done in the dry where NOAA ESA-listed species are mapped as present.
4. Activities on USACE properties & USACE-controlled easements.
5. Activities that require grouted riprap and/or poured/unformed concrete.
6. Activities that are not eligible for SV and do not require an IP.

Note: The applicant shall comply with GC 24. This includes utilization of bioengineering techniques in lieu of hard armoring to the maximum extent practicable as site conditions allow.

GP 10. AQUATIC HABITAT RESTORATION, ENHANCEMENT, AND ESTABLISHMENT ACTIVITIES (Authorities: §10 and §404)

Activities for the restoration, enhancement and establishment of non-tidal and tidal wetlands and riparian areas, including invasive, non-native or nuisance species control; the restoration and enhancement of non-tidal streams and other non-tidal open waters; the relocation of non-tidal waters, including non-tidal streams & associated wetlands for reestablishment of a natural stream morphology and reconnection of the floodplain; the restoration and enhancement of shellfish, finfish and wildlife; and the rehabilitation or enhancement of tidal streams, tidal wetlands and tidal open waters; provided those activities result in net increases in aquatic resource functions and services. See GP 9 for bank and shoreline stabilization. See GP 20 for living shorelines.

Not authorized under GP 10 (IP required): Stream channelization activities and artificial reefs.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. In tidal and non-tidal waters excluding tidal vegetated shallows, the combined permanent and temporary impacts are ≤5,000 SF. 2. Eelgrass (vegetated shallows) planting and transplanting ≤100 SF in tidal waters.	1. In tidal and non-tidal waters excluding tidal vegetated shallows, the combined permanent and temporary impacts are >5,000 SF. 2. Eelgrass (vegetated shallows) planting and transplanting >100 SF in tidal waters. 3. Permanent water impoundments, dam removal, fish ladders, or tide gates. 4. Stream relocation, impoundment, or loss of streambed occurs. 5. Runneling projects with the purpose of restoring saltmarsh by removing excess water that ponds on the saltmarsh surface. 6. The conversion of: (a) a stream or natural wetlands to another aquatic habitat type (e.g., stream to wetland or vice versa, wetland to pond, etc.) or uplands, (b) one wetland type to another (e.g., forested wetland to an emergent wetland). 7. Activities in the Connecticut River from the Turners Falls Dam to the MA/CT border, or Merrimack River from the Essex Dam to the mouth, involving permanent or temporary impacts unless they are performed <5 feet waterward from OHW or HTL and in the dry. This is to protect endangered species. 8. Activities on USACE properties & USACE-controlled easements. 9. Activities that are not eligible for SV and do not require an IP.

Notes:

1. Changes in wetland plant communities that occur when wetland hydrology is more fully restored during wetland rehabilitation activities are not considered a conversion to another aquatic habitat type.
2. See RGL 18-01 for guidance on removal of obsolete dams and other structures from rivers and streams. https://www.usace.army.mil/missions/civil-works/regulatory-program-and-permits/guidance-letters/
3. An ecological reference site may be used for a design basis of the restoration activity. The reference site should possess characteristics of an intact aquatic habitat or riparian area that exists in the region. The reference site shall represent the target habitat type of the proposed activity. A reference site may be required at the discretion of USACE.

GP 11. FISH AND WILDLIFE HARVESTING AND ATTRACTION DEVICES AND ACTIVITIES (Authorities: §10 and §404)

Fish and wildlife harvesting and attraction devices and activities in waters of the U.S. such as pound nets, crab traps, crab and shellfish dredging, eel pots, lobster traps, duck blinds, clam and oyster digging, fish aggregating devices, and small fish attraction devices such as open-water fish concentrators (sea kites, etc.).

Not authorized under GP 11 (IP required): Artificial reefs; or new, or expansions of, impoundments and semi-impoundments of waters of the U.S. for the culture or holding of motile species such as lobster with an impounded area >½ acre.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤1/2 acre, and (b) not located in riffle and pool complexes and non-tidal vegetated shallows. 2. Fish and wildlife harvesting and attraction devices and activities that do not require a PCN or IP.	1. Pound nets, impoundments or semi-impoundments of waters of the U.S. for the culture or holding of motile species such as lobster with an impounded area ≤½ acre, fish aggregating devices, or small fish attraction devices. 2. Devices and activities that are located in tidal vegetated shallows, mud flats, or saltmarsh. 3. Devices and activities that do not require an IP.

Note: An SVN submittal to USACE is not required for work authorized under GP 11.

GP 12. RESPONSE OPERATIONS, OIL AND HAZARDOUS SUBSTANCES (Authorities: §10 & §404)

(a) Activities conducted in response to a discharge or release of oil and hazardous substances that are subject to the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) including containment, cleanup, and mitigation efforts, provided that the activities are done under either: (i) The Spill Prevention, Control and Countermeasure Plan required by 40 CFR 112.3; (ii) The direction or oversight of the Federal on-scene coordinator designated by 40 CFR 300; or (iii) Any approved existing State, regional or local contingency plan provided that the Regional Response Team concurs with the proposed response efforts or does not object to the response effort; (b) Activities required for the cleanup of oil releases in waters of the U.S. from electrical equipment that are governed by EPA's polychlorinated biphenyl (PCB) spill response regulations at 40 CFR 761; (c) Booms placed in navigable waters of the U.S. for oil and hazardous substance containment, absorption and prevention; and (d) The use of structures and fills for spill response training exercises. Wetlands, vegetated shallows, mudflats, and riffle and pool complexes should be restored in place at the same elevation.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. Activities are conducted in accordance with (a) or (b) above that are not planned or scheduled, but an emergency response (see Note 1). 2. Booms placed in navigable waters of the U.S. for oil and hazardous substance containment, absorption and prevention. 3. Temporary impacts for spill response training exercises ≤5000 SF in non-tidal waters and ≤1000 SF in tidal waters with no impacts to wetlands, saltmarsh, mudflats, or vegetated shallows. 4. Temporary structures in tidal waters with no impacts to wetlands, saltmarsh, mudflats, vegetated shallows, or riffle and pool complexes and in place ≤30 days.	1. Activities (a) or (b) above are planned or scheduled, not an emergency response; or 2. Activities that are not eligible for SV and do not require an IP.

Notes:

1. For emergency response activities in the Connecticut River from the Turners Falls Dam to the MA/CT border, Merrimack River from the Essex Dam to the mouth, and remaining tidal waters that are not rivers, the permittee must contact the USACE at (978) 318-8338 before or as soon as possible after the work authorized under GP 12(a) - (c) commences for the USACE to address effects under the Endangered Species Act.
2. An SVN submittal to USACE is not required for booms used for spill prevention, or properly contained and cleaned de minimus oil or hazardous substance discharges into navigable waters of the U.S.

GP 13. CLEANUP OF HAZARDOUS AND TOXIC WASTE (Authorities: §10 and §404)

Specific activities required to affect the containment, stabilization, or removal of hazardous or toxic waste materials, including court ordered remedial action plans or related settlements, which are performed, ordered or sponsored by a government agency with established legal or regulatory authority.

Not authorized under GP 13: (a) Establishment of new disposal sites; or (b) Expansion of existing sites used for the disposal of hazardous or toxic waste.

Self-Verification Eligible	Pre-Construction Notification Required
1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, and (b) not located in vegetated shallows and riffle and pool complexes.	1. In non-tidal waters, the combined permanent and temporary impacts are (a) >5,000 SF, and (b) located in vegetated shallows and riffle and pool complexes. 2. Permanent and temporary impacts in tidal waters or navigable waters of the U.S. 3. Stream channelization, relocation, impoundment, or loss of streambed occurs. 4. Activities that are not eligible for SV and do not require an IP.

Notes:

1. Wetlands, vegetated shallows, mudflats, and riffle and pool complexes should be restored in place at the same elevation to the maximum extent practicable.
2. Activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA, are not required to obtain permits under Section 404 of the CWA or Section 10 of the Rivers and Harbors Act.

GP 14. SCIENTIFIC MEASUREMENT DEVICES (Authorities: §10 and §404)

Scientific measurement devices for measuring and recording scientific data, such as staff gauges, tide and current gauges, meteorological stations, water recording and biological observation devices, water quality testing and improvement devices, and similar structures. Also eligible are small weirs and flumes constructed primarily to record water elevation, flow and/or velocity. Upon completion of the use of the device to measure and record scientific data, the measuring device and any other structures or fills associated with that device (e.g., foundations, anchors, buoys, lines, etc.) must be removed to the maximum extent practicable and the site restored to preconstruction elevations.

Not authorized under GP 14 (IP required): (a) Permanent impacts that are >5,000 SF in tidal and non-tidal waters of the U.S.; >1000 SF in tidal saltmarsh, mud flats, riffle and pool complexes; or >100 SF in tidal vegetated shallows; or (b) Temporary impacts in tidal waters that are >1 acre, unless the District Engineer waives this criterion by making a written determination concluding that the discharge of dredged or fill material will result in no more than minimal adverse environmental effects; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows.

Self-Verification Eligible

1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) not located in riffle and pool complexes and non-tidal vegetated shallows.

2. In tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) ≤1,000 SF in mudflats and/or natural rocky habitat, (c) not located in saltmarsh and tidal vegetated shallows.

3. Temporary, non-biological sampling devices in waters that do not restrict or concentrate movement of aquatic organisms and will not adversely affect the course, condition, or capacity of a waterway for navigation.

4. Scientific measurement devices, and small weirs and flumes constructed primarily to record water quantity and velocity provided the discharge of fill is limited to 25 cubic yards. These cannot obstruct or restrict the waterway course, condition, capacity, and location.

5. Temporary measuring devices and associated structures (e.g., anchors, buoys, etc.) in tidal and non-tidal waters that do not require a PCN or IP.

Pre-Construction Notification Required

1. Biological sampling devices, weirs or flumes, or the activity restricts or concentrates movement of aquatic organisms.

2. Permanent towers located in navigable waters that record and measure scientific data.

3. Devices that are not eligible for SV and do not require an IP.

Note: An SVN submittal to USACE is not required for temporary measuring devices with a footprint of <10 SF, with a profile of <3 feet high measured from the substrate and located in water deeper than -10 feet MLW.

GP 15. SURVEY ACTIVITIES (Authorities: §10 and §404)

Survey activities such as soil borings, core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, exploratory trenching, soil surveys, sampling, sample plots or transects for wetland delineations, and historic resources surveys.

Not authorized under GP 15 (IP required): (a) Permanent impacts that are >1 acre in tidal and non-tidal waters; >1000 SF in tidal saltmarsh, mud flats, or riffle and pool complexes; or >100 SF in tidal vegetated shallows; or (b) Temporary impacts in tidal waters that are >1 acre, unless the District Engineer waives this criterion by making a written determination concluding that the discharge of dredged or fill material will result in no more than minimal adverse environmental effects; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) not located in riffle and pool complexes and non-tidal vegetated shallows. 2. In tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, (b) ≤1,000 SF in mudflats and/or natural rocky habitat, (c) not located in saltmarsh and tidal vegetated shallows.	1. Exploratory trenching (see Note 2) occurs in waterways (e.g., streams, tidal waters). 2. Activities associated with the recovery of historic resources, and the drilling and discharge of excavated material from test wells for oil and gas exploration. 3. Seismic exploratory operations occur in tidal waters, the Connecticut River from the Turners Falls Dam to the MA/CT border, or the Merrimack River from the Essex Dam to the mouth. This is to protect endangered species. 4. Activities that are not eligible for SV and do not require an IP.

Notes:

1. An SVN submittal is not required for wetland delineations, and core sampling conducted for preliminary evaluation of dredge project analysis.
2. For the purposes of GP 15, the term “exploratory trenching” means mechanical land or underwater clearing of the upper soil profile to expose bedrock or substrate for the purpose of mapping or sampling the exposed material.
3. The discharge of drilling mud and cuttings may require a permit under §402 of the CWA.

GP 16. LAND AND WATER-BASED RENEWABLE ENERGY GENERATION FACILITIES (Authorities: §10 and §404), AND HYDROPOWER PROJECTS (Authority: §10 and §404)

Structures and work in tidal waters and discharges of dredged or fill material into tidal and non-tidal waters for the construction, expansion, modification or removal of: (a) Land-based renewable energy production facilities (e.g., solar, wind, biomass, geothermal) and their attendant features; (b) Water-based wind or hydrokinetic renewable energy generation projects and their attendant features; and (c) Discharges of dredged or fill material associated with hydropower projects. Attendant features may include, but are not limited to, land-based collection and distribution facilities, control facilities, and parking lots. For each single and complete project in (b) above, no more than 10 generation units (e.g., wind turbines or hydrokinetic devices) are authorized in navigable waters of the U.S. Upon completion of the pilot project (see note 2), the generation units, transmission lines, and other structures or fills associated with the pilot project must be removed to the maximum extent practicable.

Not authorized under GP 16 (IP required): (a) Permanent impacts that are >1 acre in non-tidal waters, >½ acre in tidal waters; >1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in vegetated shallows; or (b) Temporary impacts in tidal waters that are >1 acre; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows.

Self-Verification Eligible	**Pre-Construction Notification Required**
In non-tidal waters, the combined permanent and temporary impacts for land-based activities are (a) ≤5,000 SF, (b) not located in riffle and pool complexes and non-tidal vegetated shallows.	1. In non-tidal waters, the combined permanent and temporary impacts for land-based activities are (a) >5000 SF, or (b) located in vegetated shallows or riffle and pool complexes. 2. Permanent and temporary impacts in tidal waters. 3. Water-based wind or hydrokinetic renewable energy generation projects, and hydropower projects. 4. For all activities eligible for authorization under GP 16: a. The activity occurs in tidal waters or in, over or under navigable waters. b. Stream channelization, relocation, impoundment, or loss of streambed occurs. 5. Activities that are not eligible for SV and do not require an IP.

Notes:

1. Utility lines constructed to transfer the energy from the land-based renewable generation or collection facility to a distribution system, regional grid, or other facility may be authorized by GP 6.
2. For the purposes of this GP, the term “pilot project” means an experimental project where the renewable energy generation units will be monitored to collect information on their performance and environmental effects at the project site.

GP 17. RESIDENTIAL, COMMERCIAL AND INSTITUTIONAL DEVELOPMENTS AND RECREATIONAL FACILITIES (AUTHORITIES: §404)

Discharges of dredged or fill material into non-tidal waters for the construction or expansion of: (a) Residences and residential subdivisions; (b) Residential, commercial and institutional building foundations and building pads; and (c) Recreational facilities such as playgrounds, playing fields, bikeways, trails, etc. This GP also authorizes attendant features that include, but are not limited to, roads, parking lots, garages, yards, and utility lines, and stormwater management facilities. This GP authorizes attendant features if they are necessary for the use of the project purpose.

Not authorized under GP 17 (IP required): (a) Permanent impacts that result in loss of non-tidal waters >1/2 acre; >1000 SF in riffle and pool complexes or vegetated shallows; or (b) Subsurface sewerage disposal systems in non-tidal waters.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. In non-tidal waters, the combined permanent and temporary impacts are (a) <5,000 SF, and (b) not located in riffle and pool complexes and non-tidal vegetated shallows. 2. Stream channelization or relocation resulting in loss of streambed that is <200 LF.	1. In non-tidal waters, the combined permanent and temporary impacts are (a) ≥5,000 SF, or (b) located in riffle and pool complexes or non-tidal vegetated shallows. 2. Stream and wetland crossings that require a PCN per GCs 20 TOY Restrictions and GC 31 Stream Work and Crossings & Wetland Crossings. 3. Stream channelization or relocation resulting in loss of streambed that is ≥200 LF. Stream impoundment activities of any kind. 4. Activities on USACE properties & USACE-controlled easements. 5. Activities that are not SV eligible and do not require an IP.

Notes:

1. Stream and wetland crossings (permanent and temporary), including those built with construction mats; and modifications (including sliplining), replacements or extensions to existing crossings.
2. See GC 22 for information on temporary construction mats.
3. Subdivisions: For residential subdivisions, the aggregate total loss of waters of United States authorized by this GP cannot exceed 1/2-acre. This includes any loss of waters of the United States associated with development of individual subdivision lots.

GP 18. AQUACULTURE (Authorities: §10 and §404)

(a) The installation of buoys, floats, racks, trays, nets, lines, tubes, containers, and other structures into navigable waters of the U.S.; (b) Discharges of dredged or fill material into tidal and non-tidal waters necessary for shellfish seeding, rearing, cultivating, transplanting, and harvesting activities; and (c) Shellfish seeding or brushing the flats projects. Any fill material imported to the project from offsite (this is limited to mineral growth medium used in culture trays) shall be clean and of comparable grain size to the native substrate. Activities authorized under this GP must have (a) their MA DMF Aquaculture Certificate letter for licensed shellfish aquaculture sites, (b) documentation that the applicant has coordinated with the U.S. Coast Guard regarding USCG Private Aids to Navigation standards, (c) their MEPA Certificate (if required), and (d) documentation that the applicant has contacted their local authorities (ex. harbormaster, select board, shellfish constable) for authorization of their facility.

Not authorized under GP 18 (IP required): (a) New, or expansions of, impoundments and semi-impoundments of tidal and non-tidal waters for the culture or holding of motile species such as lobster with an impounded area >½ acre; (b) Cultivation of a nonindigenous species (see Note 1) unless that species has been previously cultivated in the waterbody; (c) Cultivation of an aquatic nuisance species (see Note 1); (d) Attendant features such as docks, piers, boat ramps (see GP 4); (e) stockpiles, staging areas, or the deposition of shell material back into tidal and non-tidal waters as waste.

Self-Verification Eligible

1. In tidal waters, a new lease site area is (a) ≤2-acre, (b) not located in salt marsh, natural rocky habitat, or tidal vegetated shallows.

2. In tidal waters, *expansions* of existing lease sites not to exceed 2 acres for the entire site (e.g. 1 acre lease site increasing to a 2 acre lease site may qualify as SV). A PCN is required for expansions in salt marsh, natural rocky habitat, and tidal vegetated shallows.

3. Cages, racks that are elevated ≥2 feet above the ocean floor with legs within a lease site with ≤4 buoys marking the corners.

4. Floating cage strings with a single connecting line, ≤2 anchors and ≤2 end marker buoys per string within a lease site with ≤4 buoys marking the corners.

5. No activities located within 25 feet of tidal vegetated shallows.

6. Culture only indigenous species.

7. Not located in FNP or within a distance of three times the authorized depth of an FNP (see GC 15).

8. Not located in or impinge upon the value of any National Lands or Federal Properties.

9. Floating upweller docks that total ≤600 SF in area.

Pre-Construction Notification Required

1. Discharges of fill material associated with aquaculture >5,000 SF.

2. Research, educational, commercial-viability or experimental aquaculture gear activities >1,000 SF.

3. Kelp or finfish aquaculture.

4. Land-based hatchery intakes >3 inches in diameter.

5. Activities in water depths >10 feet mean low lower water (MLLW).

6. Activities with in-water lines, ropes or chains that are not SV eligible (see #3-4).

7. Activities occur in the Connecticut River from the Turners Falls Dam to the MA/CT border or the Merrimack River from the Essex Dam to the mouth. This is to protect endangered species.

8. New, or expansions of, impoundments and semi-impoundments for the culture or holding of motile species such as lobster with an impounded area ≤1/2 acre.

9. Activities that do not require an IP. Activities that do not require a PCN or an IP may be SV eligible.

Note: The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 defines: (a) nonindigenous species as “any species or other viable biological material that enters an ecosystem beyond its historic range, including any such organism transferred from one country into another”; and (b) aquatic nuisance species as “a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters.”

GP 19. MINING ACTIVITIES (Authorities: §10 and §404)

Discharges of dredged or fill material into non-tidal waters for mining activities, except for coal mining and metallic mineral mining activities.

Not authorized under GP 19 (IP required): (a) Permanent impacts >1 acre in non-tidal waters; or (b) Activities in tidal waters.

Self-Verification Eligible	Pre-Construction Notification Required
In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, and (b) not located in riffle and pool complexes, non-tidal vegetated shallows, and streams.	1. In non-tidal waters, the combined permanent and temporary impacts are (a) >5,000 SF, or (b) located in riffle and pool complexes, non-tidal vegetated shallows, and streams. 2. The activity occurs in non-tidal navigable waters of the U.S. 3. Stream channelization, relocation, impoundment, loss of streambed, or discharge of tailings into streams occurs. 4. Work on USACE properties & USACE-controlled easements. 5. Activities that are not eligible for SV and do not require an IP.

GP 20. LIVING SHORELINES[1] (Authorities: §10 and §404)

Construction and maintenance of living shorelines to stabilize banks and shores in tidal waters. In non-tidal waters that are not subject to the ebb and flow of the tide, nature-based bank stabilization techniques such as bioengineering and vegetative stabilization may be authorized by GP 9. This GP authorizes those maintenance and repair activities in-kind that are necessary to address changing environmental conditions.

The following terms must be met for both SVs and PCNs as applicable: (a) Coir logs, coir mats, stone, native oyster shell, native wood debris, and other structural materials must be adequately anchored, of sufficient weight, or installed in a manner that prevents relocation in most wave action or water flow conditions, except for extremely severe storms; (b) For living shorelines consisting of tidal fringe wetlands, native plants appropriate for current site conditions, including salinity and elevation, must be used if the site is planted by the permittee; (c) Discharges of dredged or fill material into waters of the U.S., and oyster or mussel reef structures in navigable waters, must be the minimum necessary for the establishment and maintenance of the living shoreline; (d) If sills or other structural materials per PCN #4 must be constructed to protect fringe wetlands for the living shoreline, those structures must be the minimum size necessary to protect those fringe wetlands; (e) The activity must be designed, constructed, and maintained so that it has no more than minimal adverse effects on water and sediment movement between the waterbody and the shore and the movement of aquatic organisms between the waterbody and the shore; and (f) The living shoreline must be properly maintained and monitored, which may require periodic repair of sills, bioengineered components, or replacing sand fills after severe storms or erosion events. Vegetation may be replanted to maintain the living shoreline.

Not authorized under GP 20 (IP required): (a) The activity is ≥1000 feet in length along the bank (≥2000 LF both banks) unless waived by the District Engineer; or (b) The activity is >30 feet channel ward of mean low water in tidal waters; or (c) Upland reclamation activities; or (d) Stream channelization or relocation activities; or (e) Breakwaters, groins, jetties, or artificial reefs; or (f) Permanent impacts >1,000 SF in existing saltmarsh; >100 SF in existing tidal vegetated shallows.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. Tidal and non-tidal living shorelines ≤100 LF for each bank (≤200 LF for both banks). 2. Combined permanent and temporary impacts ≤5,000 SF in tidal waters, excluding existing salt marsh, tidal vegetated shallows, natural rocky habitat, and mudflats.	1. Tidal and non-tidal living shorelines >100 LF to <1000 LF (>200 LF to <2000 LF for both banks). 2. Permanent and temporary impacts in existing salt marsh, tidal vegetated shallows, or mudflats. 3. Work on USACE properties & USACE-controlled easements. 4. Use of stone sills, native oyster shell, native wood debris, or other structural materials.

Notes:

1. PCNs require monitoring for a minimum of 5 years in accordance with an approved restoration plan, unless otherwise determined by the USACE. The first year of monitoring will be the first year that the site has been through a full growing period after completion of construction and planting.
2. Applicants are encouraged to obtain a MEPA certificate prior to submitting a USACE permit application.

[1] A living shoreline has a footprint that is made up mostly of native material. It incorporates vegetation or other living, natural “soft” elements alone or in combination with some type of harder shoreline structure (e.g., oyster or mussel reefs or rock sills) for added protection and stability. Living shorelines should maintain the natural continuity of the land-water interface and retain or enhance shoreline ecological processes. Living shorelines must have a substantial biological component, either tidal or lacustrine fringe wetlands or oyster or mussel reef structures.

GP 21. AGRICULTURAL ACTIVITIES (Authority: §404)

Discharges of dredged or fill material in non-tidal waters for agricultural activities, including the construction of building pads for farm buildings. Authorized activities include: (a) installation, placement, or construction of drainage tiles, ditches, or levees; mechanized land clearing; land leveling; the relocation of existing serviceable drainage ditches; and similar activities; (b) construction of farm ponds, excluding perennial streams, provided the farm pond is used solely for agricultural purposes; and (c) discharges of dredged or fill material to relocate existing serviceable drainage ditches constructed in non-tidal streams.

Not authorized under GP 21 (IP required): (a) Permanent impacts that are >1 acre in non-tidal waters; or >1000 SF in riffle and pool complexes, or non-tidal vegetated shallows; (b) Work in tidal waters; or (c) Construction of farm ponds in perennial streams.

Self-Verification Eligible	**Pre-Construction Notification Required**
In non-tidal waters, the combined permanent and temporary impacts are (a) ≤5,000 SF, and (b) not located in riffle and pool complexes and non-tidal vegetated shallows.	1. In non-tidal waters, the combined permanent and temporary impacts are (a) >5,000 SF, or (b) located in riffle and pool complexes and non-tidal vegetated shallows. 2. Activities occur in non-tidal navigable waters of the U.S. 3. Stream channelization, relocation, impoundment, loss of streambed, or farm ponds in non-perennial streams occurs. 4. Activities that are not eligible for SV and do not require an IP.

Note: Some discharges for agricultural activities may qualify for an exemption under Section 404(f) of the CWA (see 33 CFR 323.4). This GP authorizes the construction of farm ponds that do not qualify for the CWA §404(f)(1)(C) exemption because of the recapture provision at §404(f)(2).

GP 22. RESHAPING EXISTING DRAINAGE DITCHES, CONSTRUCTION OF NEW DITCHES, AND MOSQUITO MANAGEMENT (Authorities: §10 and §404)

Discharges to modify the cross-sectional configuration of currently serviceable drainage ditches constructed in tidal and non-tidal waters, for the purpose of improving water quality by regrading the drainage ditch with gentler slopes, which can reduce erosion, increase growth of vegetation, and increase uptake of nutrients and other substances by vegetation. Also authorized are mosquito reduction activities.

Not authorized under GP 22 (IP required): Stream channelization, relocation, impoundments, or loss of streambed.

Self-Verification Eligible	**Pre-Construction Notification Required**
≤500 linear feet of drainage ditch will be reshaped provided excavated material is deposited in an upland area.	1. >500 linear feet of drainage ditch will be reshaped, excavated material is deposited in a water of the U.S., or the reshaping of the ditch increases the drainage capacity beyond the original as-built capacity or expands the area drained by the ditch as originally constructed (i.e., the capacity of the ditch is not the same as originally constructed or drains additional wetlands or other waters of the U.S.). 2. Permanent and temporary impacts in tidal vegetated shallows. 3. New ditches or relocation of drainage ditches constructed in waters of the U.S. (i.e., the location of the centerline of the reshaped drainage ditch is not approximately the same as the location of the centerline of the original drainage ditch). 4. Activities that are not eligible for SV and do not require an IP.

Note: Some ditch activities are exempt under Section 404(f) of the CWA (see 33 CFR 323.4).

GP 23. LINEAR TRANSPORTATION PROJECTS AND WETLAND/STREAM CROSSINGS (Authorities: §10 & §404)

Activities[1] required for the construction, expansion, modification, or improvement of linear transportation projects (e.g., driveways, roads, highways, railways, trails, airport runways, and taxiways) and attendant features. This GP also authorizes temporary structures, fills, and work, including the use of temporary mats (see Note 1), necessary to construct the linear transportation project.

Not authorized under GP 23 (IP required): (a) Permanent impacts for any single and complete project that are >1 acre in non-tidal waters; >½ acre in tidal waters; >1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in tidal vegetated shallows; (b) Temporary impacts in tidal waters that are >1 acre; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows; (c) Non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars (see GP 17); or (d) New tide gates.

Self-Verification Eligible

1. In non-tidal waters, the combined permanent and temporary impacts are a) ≤5,000 SF; b) not located in riffle and pool complexes and non-tidal vegetated shallows; and c) meet the Massachusetts River and Stream Crossing Standards

2. Existing crossings (e.g., culverts, elliptical or arch pipes, etc.) are not modified by (a) decreasing the diameter of the crossing or (b) changing the friction coefficient, such as through slip lining (retrofitting an existing culvert by inserting a smaller diameter pipe), culvert relining or invert lining.

3. Stream channelization or relocation resulting in loss of streambed that is <200 LF.

Pre-Construction Notification Required

1. In non-tidal waters, the combined permanent and temporary impacts are a) >5,000 SF; b) located in vegetated shallows or riffle and pool complexes; or c) do not meet the Massachusetts River and Stream Crossing Standards (see note 4).

2. The activity occurs in tidal waters, salt marsh, or in, over or under navigable waters of the U.S.

3. Stream and wetland crossings that require a PCN per GC 20 TOY Restrictions and GC 31 Stream Work and Crossings & Wetland Crossings.

4. Stream channelization or relocation resulting in loss of streambed that is ≥200 LF. Stream impoundment activities of any kind.

5. Work on USACE properties & USACE-controlled easements.

6. Activities that are not eligible for SV and do not require an IP.

Notes:

1. See GC 22 for information on temporary construction mats.
2. Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the U.S. may be authorized under GP 8.
3. Loss of streambed does not require a PCN when bridge piers or similar supports are used.
4. In their PCN application submission to the USACE, applicants must explain why they are unable to meet the Massachusetts River and Stream Crossing Standards.
5. For tidal crossings, modeling is encouraged as a method to verify the proposed crossing would not be undersized and resilient to the effects of sea level rise.

[1] Stream crossings must conform with the MA Stream Crossing Guidelines when practicable and comply with all applicable GCs of this document (Section IV).

GP 24. TEMPORARY CONSTRUCTION, ACCESS, AND DEWATERING (Authorities: §10 and §404)

Temporary structures, work, and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites that are not authorized under another GP activity.

Not authorized under GP 24 (IP required): (a) Permanent structures or impacts; (b) Temporary impacts in tidal waters that are >1 acre; >5000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1000 SF in vegetated shallows; (c) Use of cofferdams to dewater wetlands or other aquatic areas to change their use; (d) Temporary stream crossings (see GPs 6, 17, 23); (e) Structures or fill left in place after construction is completed.

Self-Verification Eligible	**Pre-Construction Notification Required**
1. In non-tidal waters, temporary impacts are a) ≤5,000 SF; b) not located in riffle and pool complexes and non-tidal vegetated shallows. 2. In tidal waters, temporary impacts are a) ≤5,000 SF, b) ≤1,000 SF in mudflats and/or natural rocky habitat, and c) not located in saltmarsh and tidal vegetated shallows. 3. Structures in navigable waters of the U.S. provided impacts do not require a PCN and they are left in place ≤30 days.	1. In non-tidal waters, temporary impacts are a) >5,000 SF; b) located in riffle and pool complexes or non-tidal vegetated shallows. 2. In tidal waters, temporary impacts are a) >5,000 SF; b) >1,000 SF in mudflats and/or natural rocky habitat, or (c) located in saltmarsh and tidal vegetated shallows. 3. Activities in the Connecticut River from the Turners Falls Dam to the MA/CT border, or Merrimack River from the Essex Dam to the mouth, involving temporary impacts unless they are performed <5 feet waterward from OHW or HTL and in the dry. This is to protect endangered species; or 4. Activities not eligible for SV and do not require an IP.

Notes:

1. Turbidity or sediment resuspension is generally not considered to occur when properly using management techniques to work in dry conditions. See GC 25.
2. Total impact areas under SV Eligible 1-2 exclude use of temporary construction mats. See GC 22 for information on temporary construction mats.
3. An SVN submittal to USACE is not required for SV #3 above.

GP 25. EMERGENCY SITUATIONS (Authorities: §10 and §404)

Structures or work in or affecting navigable waters of the U.S. and the discharge of dredged or fill material into waters of the U.S., including wetlands, necessary for repair or protection measures associated with an emergency situation[1], MassDEP Emergency Declaration/Certification, or FEMA Declared Disaster. The activity shall be the minimum necessary to alleviate the immediate emergency unless that additional work would result in no more than minimal effects to aquatic environment and is necessary to reduce the potential for future failure or loss of the structure or site. Typical activities authorized under this GP include, but are not limited to, restoration of damaged areas; bank stabilization; temporary fills for staging, access, and dewatering; and, repair, replacement, or rehabilitation of existing structures and/or fills (i.e., roads, bridges, utility pipelines and flood control structures, including attendant features, and other existing structures located in waters of the U.S.).

For the restoration of areas damaged by storms floods, or other discrete events: (a) The restored area must not extend waterward of the ordinary high-water mark or high tide line that existed prior to the damage. (b) The slope of the restored area below the ordinary high-water mark or high tide line must not exceed the slope that existed prior to the damage. (c) The bottom elevation of the restored area must not exceed the bottom elevation that existed prior to the damage (i.e., the restored area must not result in a reduction in the depth of the waterbody that existed prior to the damage). (d) Except in cases of FEMA reimbursement, the activity must be initiated, under contract to commence, or funds shall be allocated for the activity within 30 days of authorization under GP 25.

Not authorized under GP 25 (IP required): (a) Permanent impacts for a single and complete project >1/2 acre in tidal waters, unless the district engineer waives this criterion by making a written determination concluding that the activity will result in no more than minimal adverse environmental effects; >1,000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or >100 SF in tidal vegetated shallows; (b) Temporary impacts in tidal waters that are >5,000 SF in saltmarsh, mud flats, or riffle and pool complexes; or >1,000 SF in vegetated shallows; (c) New structures or fills that did not previously exist before the storm event or other discrete event (see other GPs).

Self-Verification Eligible	**Pre-Construction Notification Required**
1. Activities that qualify under a Severe Weather Emergency Declaration pursuant to 310 CMR 10.06(8) and/or receive an Emergency Certification pursuant to 310 CMR 10.06 and/or meet the requirements of 314 CMR 9.12(2) or (3); and 2. Activities eligible under a FEMA Declared Disaster that also comply with #1 above.	1. Activities that are eligible under a FEMA Declared Disaster and do not qualify under SV #1. 2. Minor deviations in the structure or fill area, including those to existing structures or fills are authorized due to changes in materials, construction techniques, requirements of other regulatory agencies, or current construction codes or safety standards that are necessary to alleviate the emergency. 3. Activities that are not eligible for SV and do not require an IP.

Notes:

1. Review the GCs (Section IV) to confirm if a PCN is not required elsewhere in this document.
2. If the activity is not a MassDEP Emergency Declaration/Certification, does not meet the requirements of 314 CMR 9.12(2) or (3), or is not a FEMA Declared Disaster, applicants must explain in writing why their activity qualifies as an emergency (see footnote) to be eligible under GP 25.
3. SV eligible activities qualify under the general 401 WQC MassDEP issued for the 2023 MA GPs (GC 9).

[1] An emergency, as determined by this office and 33 CFR 325.2(e)(4), is one which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a Department of the Army permit is not undertaken within a time period less than the normal time to process the request under standard processing procedures.

SECTION IV. GENERAL CONDITIONS:

To qualify for GP authorization, the applicant must comply with the following general conditions, as applicable, in addition to authorization-specific conditions imposed by the division or district engineer.

1. Other Permits
2. Federal Jurisdictional Boundaries
3. Single and Complete Projects
4. Use of Multiple General Permits
5. Suitable Material
6. Tribal Rights & Burial Sites
7. Avoidance, Minimization, and Compensatory Mitigation
8. Water Quality & Stormwater Management
9. Coastal Zone Management
10. Federal Threatened and Endangered Species
11. Essential Fish Habitat
12. National Lands
13. Wild and Scenic Rivers
14. Historic Properties
15. USACE Property and Federal Projects (§408)
16. Navigation
17. Permit/Authorization Letter On-Site
18. Storage of Seasonal Structures
19. Pile Driving and Pile Removal in Navigable Waters
20. Time of Year Restrictions
21. Heavy Equipment in Wetlands
22. Temporary Fill & Construction Mats
23. Restoration of Wetland Areas
24. Bank Stabilization
25. Soil Erosion and Sediment Controls
26. Aquatic Life Movements and Management of Water Flows
27. Spawning, Breeding, and Migratory Areas
28. Vernal Pools
29. Invasive Species
30. Fills Within 100-Year Floodplains
31. Stream Work and Crossings & Wetland Crossings
32. Utility Line Installation and Removal
33. Water Supply Intakes
34. Coral Reefs
35. Blasting
36. Inspections
37. Maintenance
38. Property Rights
39. Transfer of GP Verifications
40. Modification, Suspension, and Revocation
41. Special Conditions
42. False or Incomplete Information
43. Abandonment
44. Enforcement Cases
45. Previously Authorized Activities
46. Duration of Authorization

1. Other Permits. Authorization under these GPs does not obviate the need for the permittee to obtain other Federal, State, or local permits, approvals, or authorizations required by law. Permittees are responsible for obtaining all required permits, approvals, or authorizations. Activities that are not regulated by the State, but subject to USACE jurisdiction, may still be eligible for these GPs.

2. Federal Jurisdictional Boundaries.
a. Applicability of these GPs shall be evaluated with reference to Federal jurisdictional boundaries. Activities shall be evaluated with reference to "waters of the U.S." under the CWA (33 CFR 328) and "navigable waters of the U.S." under §10 of the Rivers and Harbors Act of 1899 (33 CFR 329). Permittees are responsible for ensuring that the boundaries used satisfy the Federal criteria defined at 33 CFR 328-329. These sections prescribe the policy, practice, and procedures to be used in determining the extent of the USACE jurisdiction. Note: Waters of the U.S. includes all waters pursuant to 33 CFR 328.3(a), and adjacent wetlands as the term is defined in 33 CFR 328.3(c).
b. Wetlands shall be delineated in accordance with the USACE Wetlands Delineation Manual and the most recent Northcentral/Northeast Regional Supplement. Wetland delineation and jurisdiction information is located at: www.nae.usace.army.mil/missions/regulatory/jurisdiction-and-wetlands and maps are located at www.nae.usace.army.mil/missions/regulatory/state-general-permits/massachusetts-general-permit.
c. Vegetated shallows shall be delineated when present on the project site. Vegetated shallow survey guidance and maps are located at: www.nae.usace.army.mil/missions/regulatory/state-general-permits/massachusetts-general-permit.
d. Natural rocky habitats shall be delineated when present on the project site. The definition of natural rocky habitats is in Section VII of the MA GP. Natural rocky habitat survey guidance and maps are located at: www.nae.usace.army.mil/ missions/regulatory/state-general-permits/massachusetts-general-permit.

3. Single and Complete Projects. The MA GP shall not be used for piecemeal work and shall be applied to single and complete projects. The term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers.
a. For non-linear projects, a single and complete project must have independent utility. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed, even if the other phases were not built, can be considered as separate single and complete projects with independent utility.
b. Unless USACE determines the activity has independent utility, all components of a single project and/or all planned phases of a multi-phased project (e.g., subdivisions should include all work such as roads, utilities, and lot development) shall be evaluated as one single and complete project.
c. For linear projects such as power lines or pipelines with multiple crossings, a "single and complete project" is all crossings of a single water of the U.S. (i.e., single waterbody) at a specific location. For linear projects crossing a single waterbody several times at separate and distant locations, each crossing is considered a single and complete project. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately. If any crossing requires a PCN review or an individual permit review, then the entire linear project shall be reviewed as one project under PCN or the individual permit procedures.

4. Use of Multiple General Permits. The use of more than one GP for a single and complete project is prohibited, except when the acreage loss of waters of the U.S. authorized by the GPs does not exceed the acreage limit of the GPs with the highest specified acreage limit. For example, if a road crossing over waters is constructed under GP 23, with an associated utility line

crossing authorized by GP 6, if the maximum acreage loss of waters of the U.S. for the total project is ≥1 acre it shall be evaluated as an IP.

5. Suitable Material & Discharge of Pollutants. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). All activities involving any discharge into waters of the U.S. authorized under these GPs shall be consistent with applicable water quality standards, effluent limitations, standards of performance, prohibitions, and pretreatment standards and management practices established pursuant to the CWA (33 U.S.C. 1251), and applicable state and local laws. If applicable water quality standards, limitations, etc., are revised or modified during the term of this GP, the authorized work shall be modified to conform with these standards within six months from the effective date of such revision or modification, or within a longer period of time deemed reasonable by the District Engineer in consultation with the Regional Administrator of the EPA. Unless monitoring data indicates otherwise, applicants may presume that their activity complies with state water quality standards provided they are in compliance with the Section 401 WQC (Applicable only to the Section 404 activity).

6. Tribal Rights & Burial Sites

a. For all SV and PCN applications, prospective permittees shall follow the guidance set forth in Appendix A, Guidance for NHPA Section 106 Compliance in Massachusetts.

b. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

c. Many tribal resources are not listed on the National Register of Historic Places (NRHP) and may require identification and evaluation in collaboration with the identifying tribe and by qualified professionals. The Tribal Historic Preservation Officer (THPO) and State Historic Preservation Officer (SHPO) may be able to assist with locating information on:

i. Previously identified tribal resources; and
ii. Areas with potential for the presence of tribal resources.

d. Discovery of Previously Unknown Remains and Artifacts: If any previously unidentified human remains, cultural deposits, or artifacts are discovered while accomplishing the activity authorized by this permit, you must immediately notify the USACE of what you have found, and to the maximum extent practicable, cease work and avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The USACE will initiate the appropriate the Federal, Tribal, and state coordination required to determine if the items or remains are eligible for listing in the NRHP and warrant a recovery effort or can be avoided.

e. Burial Sites: Burial sites, marked or unmarked, are subject to state law (Massachusetts Unmarked Burial Law). Native American burial sites on federal or tribal land are subject to the provisions of Native American Graves Protection and Repatriation Act (NAGPRA). Regulated activities may not result in disturbance or removal of human remains until disposition of the remains has been determined by the appropriate authority under these laws, and the work is authorized by the USACE. Regulated activities which result in an inadvertent discovery of human remains must stop immediately, and the USACE, as well as the appropriate state and tribal authority, must be notified. Regulated work at inadvertent discovery sites requires compliance with state law or NAGPRA, as appropriate, prior to re-starting work.

7. Avoidance, Minimization, and Compensatory Mitigation. To qualify under the MA GP, activities must comply with Section V Mitigation Standards and the following as applicable:

a. Avoid and Minimize: Activities must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the U.S. to the maximum extent practicable at the project site. Avoidance and minimization are required to the extent necessary to ensure that the adverse effects to the aquatic environment (both area and function) are no more than minimal.

b. Compensatory mitigation for unavoidable impacts to waters of the U.S., including direct, indirect, secondary, and temporal loss, will generally be required for permanent impacts that exceed the thresholds identified in Section V, and may be required for temporary impacts, to offset unavoidable impacts which remain after all appropriate and practicable avoidance and minimization has been achieved and to ensure that the adverse effects to the aquatic environment are no more than minimal. Proactive restoration projects or temporary impact work with no secondary effects may generally be excluded from this requirement.
c. Mitigation proposals shall follow the guidelines found in the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule April 10, 2008; 33 CFR 332. Prospective permittees may purchase mitigation credits in-lieu of permittee-responsible mitigation as compensation for unavoidable impacts to waters of the U.S. in the Commonwealth of Massachusetts.

8. Water Quality & Stormwater Management. The 401 WQC requirement applies to all activities listed under GPs 1-25, unless determined otherwise by MassDEP. Permittees shall also satisfy stormwater management requirements in Massachusetts.

a. General 401 WQC: MassDEP issued a WQC on April 21, 2023 which conditionally certifies all activities in GPs 1 – 24 eligible for SV and PCN so long as the activity is described in 314 CMR 9.03, and is not an activity described in 314 CMR 9.04, and so long as the activity meets all other requirements, terms and conditions of the WQC. The MassDEP WQC also conditionally certifies activities described in GP 25 so long as the activity meets all other conditions of the WQC. Emergency projects described in GP 25 must obtain an emergency certification or otherwise be authorized pursuant to 310 CMR 10.06, qualify under a Severe Weather Emergency Declaration pursuant to 310 CMR 10.06(8) issued by the MassDEP, or meet the requirements of 9.12(2) or (3) in order to be certified under the WQC. Prospective permittees may refer to the following link to determine if their activity is eligible: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/ Massachusetts-General-Permit/. The General 401 WQC is located here, and it provides detailed information regarding what activities are certified and the conditions for certification. Activities listed in 314 CMR 9.03 that are not exempt from the Wetland Protection Act must have a valid Final Order of Conditions (OOC) or Final Restoration Order of Conditions pursuant to 310 CMR 10.00 to be eligible under the General 401 WQC.
b. Individual 401 WQC: Prospective permittees shall contact MassDEP and apply for an individual 401 WQC if their activity does not qualify for a General 401 WQC as outlined above. MassDEP may issue, waive, or deny the individual 401 WQC on a case-by-case basis. All activities listed in 314 CMR 9.04 must obtain an individual 401 WQC from MassDEP to be eligible under these GPs. When an Individual 401 WQC is required for *PCN activities*, the prospective permittee shall submit their Individual 401 WQC application concurrently to MassDEP and USACE to comply with 40 CFR 121.
c. The prospective permittee is responsible for determining the appropriate 401 WQC requirement and submitting this information to the USACE at the time of their PCN application or when completing their SVN. Prospective permittees that are unsure of whether their activity has been certified should contact MassDEP for a determination.
d. As applicable, all activities shall be compliant with the Massachusetts Stormwater Handbook. The Stormwater Handbook can be accessed on the NAE Regulatory website here: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.
e. No work requiring authorization under Section 404 of the CWA may be performed unless (1) the prospective permittee qualifies for coverage under the April 21, 2023 General 401 WQC, (2) the prospective permittee receives an individual Section 401 WQC from the MassDEP, or (3) the MassDEP waives individual Section 401 WQC.

9. Coastal Zone Management. The permittee must obtain CZM consistency concurrence when an activity is located in the coastal zone in order to be eligible under the MA GP. This requirement

shall be satisfied by acquiring one of the following from the Massachusetts Office of Coastal Zone Management (MA CZM):

a. General CZM Federal Consistency Concurrence (General Concurrence): MA CZM has granted General Concurrence for all SV and PCN activities for GPs 1-25. The prospective permittee must obtain all applicable permits and approvals before construction of the authorized activity begins (e.g., before work begins on site). For SVs, General Concurrence is automatically granted and no further action is required from the prospective permittee. For PCNs, the USACE will coordinate with MA CZM to acquire General Concurrence as part of the PCN application review.
b. Individual CZM Federal Consistency Concurrence (Individual Concurrence): In certain cases, MA CZM may elevate any GP activity 1-25 and require Individual Concurrence. The prospective permittee must contact MA CZM and follow the procedures to obtain Individual Concurrence as determined appropriate by MA CZM.
c. Permittees must obtain CZM consistency concurrence as outlined above before commencing work authorized under these GPs.

10. Federal Threatened and Endangered Species

a. No activity is authorized under any GP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify designated critical habitat or critical habitat proposed for such designation. No activity is authorized under any GP which “may affect” a listed species or critical habitat, unless ESA section 7 consultation addressing the consequences of the proposed activity on listed species or critical habitat has been completed. See 50 CFR 402.02 for the definition of “effects of the action” for the purposes of ESA section 7 consultation, as well as 50 CFR 402.17, which provides further explanation under ESA section 7 regarding “activities that are reasonably certain to occur” and “consequences caused by the proposed action.”
b. Other Federal agencies should follow their own procedures for complying with the requirements of the ESA (see 33 CFR 330.4(f)(1)). If a PCN is required for the proposed activity, the Federal permittee must provide USACE with the appropriate documentation to demonstrate compliance with those requirements. The USACE will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.
c. USFWS ESA-Listed Species: Non-federal applicants shall use the USFWS website, Information for Planning and Consultation (IPAC), to determine if their activity is located within the ESA-listed species range. The IPAC website can be accessed on the NAE Regulatory website: https://www. nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/. Applicants shall ensure they have an updated, valid species list before construction begins. This may require applicants to update their species list in IPAC before the start of construction. Note: Applicants should refer to the NAE Regulatory Website at the link above to determine if they have been designated as a non-federal representative. Applicants shall complete Section 7 consultation according to the guidance document located on the NAE Regulatory Website. After completing the Rangewide Determination Key and reaching the outcome “may affect, not likely to adversely affect”, you may be required to wait up to 15 days before that outcome is final and compliance under Section 7 of the ESA is fulfilled.

i. *Self-Verification Criteria*: The activity is SV-eligible if:
   1) The activity is not located within the ESA-listed species range;
   2) Another (lead) Federal agency has completed Section 7 consultation; or
   3) The activity is located within the ESA-listed species range ***and*** USACE has designated the applicant as a non-federal representative under 50 CFR 402.08 of the ESA for all

species within the project's action area. As the non-federal representative, the applicant shall complete consultation through IPAC and reach the outcome of "no effect" or "not likely to adversely affect".

ii. *Pre-Construction Notification Criteria*: The activity requires a PCN if:

1) The activity is located within the ESA-listed species range ***and*** USACE has NOT designated the applicant as a non-federal representative under 50 CFR 402.08 of the ESA for all species within the project's action area;

2) The activity is located in designated or proposed critical habitat; or

3) The activity is located within the ESA-listed species range and completion of the IPAC determination key has resulted in the outcome of "may affect" or "may affect, likely to adversely affect"; or

4) A PCN is required elsewhere in this document.

d. NOAA-Listed Species: Non-federal applicants shall refer to the Section 7 Mapper for federally listed species to determine if any species are mapped as present. When NOAA-listed species are present, the applicant shall generate a species report through the mapper and submit this document as part of their PCN or SVN submission. The NOAA Fisheries' Section 7 Mapper can be accessed here on the NAE Regulatory website here: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.

e. Authorization of an activity by an GP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

11. Essential Fish Habitat (EFH).

a. SV eligible activities have been determined to result in no more than minimal adverse effects, provided the permittee complies with all terms and conditions of the MA GP as appliable to the activity. NMFS has granted General Concurrence [50 CFR 600.920(g)] for all SV eligible activities. These activities do not require project specific EFH consultation.

b. For PCN required activities, the applicant is required to describe and identify potential adverse effects to EFH and should refer to NOAA Fisheries' EFH Mapper (http://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper) and Omnibus Essential Fish Habitat Amendment 2 Volume 2: EFH and HAPC Designation Alternatives and Environmental Impacts (https://www.habitat.noaa.gov/application/efhmapper/oa2_efh_hapc.pdf). If an activity is located within EFH, the PCN application must contain:

1. A description of the action located in EFH.
2. An analysis of the potential adverse effects of the action on EFH and the managed Species.
3. Conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable (refer to the mitigation thresholds located in Section V).

c. Federal agencies shall follow their own procedures for complying with the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act. For activities requiring a PCN, the applicant is responsible for furnishing documentation that demonstrates consultation for EFH has been completed.

d. For PCN activities, no work may commence until EFH consultation as required by the Magnuson-Stevens Act has been completed.

12. National Lands. Activities that impinge upon the value of any National Wildlife Refuge, National Forest, National Marine Sanctuary, National Historic Landmarks or any other area administered by the National Park Service, U. S. Fish and Wildlife Service (USFWS) or U.S. Forest Service (USFS) require a PCN or Individual Permit. Federal land managers seeking authorization for activities located in the above listed National Lands may proceed under SV, unless a PCN is required elsewhere in this document.

13. Wild and Scenic Rivers. The following activities in designated river or study river segments in the National Wild and Scenic River (WSR) System require a PCN unless the Federal agency with direct management responsibility for such river, in Massachusetts this is generally the National Park Service, has determined in writing to the proponent that the proposed work will not adversely affect the WSR designation or study status:

a. Activities that occur in WSR segments, in and 0.25 miles up or downstream of WSR segments, or in tributaries within 0.25 miles of WSR segments;
b. Activities that occur in wetlands within 0.25 miles of WSR segments;
c. Activities that have the potential to alter free-flowing characteristics in WSR segments.

No GP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

As of May 10, 2023, affected rivers in Massachusetts include: the Taunton River (40 miles), Sudbury River (16.6 miles), Assabet River (4.4 miles), Concord River (8 miles), Nashua River (27 miles), Squannacook River (16.3 miles), Nissitissit River (4.7 miles), and the Westfield River, including West Branch, Middle Branch, Gendale Brook, East Branch, Drowned Land Brook, Center Brook, Windsor Jambs Brook, Shaker Mill Brook, Depot Brook, Savery Brook, Watson Brook, Center Pond Brook (78.1 miles). The most up to date list of designated and study rivers and their descriptions may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

14. Historic Properties

a. For all SV and PCN applications, permittees shall follow the guidance set forth in Appendix A, Guidance for NHPA Section 106 Compliance in Massachusetts.

b. No undertaking authorized by these GPs shall cause effects[1] (defined in 36 CFR Part 800 and 33 CFR Part 325, Appendix C, and its Interim Guidance) on properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places (NRHP)[2], including previously unknown historic properties within the permit area, unless the USACE or another Federal action agency has satisfied the consultation requirements of Section 106 of the National Historic Preservation Act (Section 106). If another Federal agency is determined the lead federal agency for compliance with Section 106, applicant must obtain the appropriate documentation and provide this information to the USACE to demonstrate compliance with Section 106. The applicant shall not begin the activity until the USACE notifies them in writing that the documentation provided satisfies Section 106 requirements.

[1] Effect means the alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register of Historic Properties.
[2] See the NAE Regulatory website, National Register of Historic Places link here: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.

c. Many historic properties are not listed on the NRHP and may require identification and evaluation by qualified historic preservation and/or archaeological consultants. The State Historic Preservation Officer (SHPO), Massachusetts Board of Underwater Archaeological Resources (BUAR), local historical societies, certified local governments, general public, and NRHP may also be able to assist with locating information on:

i. Previously identified historic properties; and
ii. Areas with potential for the presence of historic properties.

d. Discovery of Previously Unknown Remains and Artifacts: If any previously unidentified human remains, cultural deposits, or artifacts are discovered while accomplishing the activity authorized by this permit, you must immediately notify the USACE of what you have found, and to the maximum extent practicable, cease work and avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The USACE will initiate the Federal, State and tribal coordination required to determine if the items or remains warrant a recovery effort and/or if the site is eligible for listing in the National Register of Historic Places.

e. Section 110k: Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. § 306113) prevents the USACE from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106, has intentionally significantly adversely effected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the USACE, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the USACE is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties effected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or effects historic properties on tribal lands or effects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

f. Underwater Archaeological Resources: Under Massachusetts General Law Ch. 6, s.'s 179-180, and Ch. 91, s. 63, the BUAR has statutory jurisdiction within state waters and is the sole trustee of the Commonwealth's underwater heritage, charged with the responsibility of encouraging the discovery and reporting, as well as the preservation and protection, of underwater archaeological resources. Underwater archaeological resources located within the waters of the Commonwealth of Massachusetts are property of the Commonwealth, which holds title to these resources and retains regulatory authority over their use. Under Massachusetts General Law, no person, organization or corporation may "remove, displace, damage, or destroy" any underwater archaeological resources located within the Commonwealth's submerged lands except through consultation with the BUAR and in conformity with the permits it issues. https://www.mass.gov/orgs/board-of-underwater-archaeological-resources.

15. USACE Property and Federal Projects. (33 USC §408)

a. USACE projects and property can be found at: https://www.nae.usace.army.mil/Missions/Civil-Works/.

b. In addition to any authorization under these GPs, prospective permittee shall contact the USACE Real Estate Division (https://www.nae.usace.army.mil/Missions/Real-Estate-Division/) at (978) 318-8585 for work occurring on or potentially affecting USACE properties and/or USACE-controlled easements. Work may not commence on USACE properties and/or USACE-controlled easements until they have received any required USACE real estate documents evidencing site-specific permission to work.

c. Any proposed temporary or permanent occupation or alteration of a Federal project (including, but not limited to, a levee, dike, floodwall, channel, anchorage, breakwater, seawall, bulkhead, jetty, wharf, pier, or other work built or maintained but not necessarily owned by the United States),

is not eligible for SV and requires a PCN. This includes all proposed structures and work in, over, or under a USACE federal navigation project (FNP) or in the FNP's buffer zone. The buffer zone is an area that extends from the horizontal limits of the FNP to a distance of three times the FNP's authorized depth. The activity also requires review and approval by the USACE pursuant to 33 USC 408 (Section 408 Permission). The prospective permittee may reach out to the POCs located here: https://www.nae.usace.army.mil/ Missions/Section-408/.
d. Any structure or work constructed in a FNP or its buffer zone shall be subject to removal at the owner's expense prior to any future USACE dredging or the performance of periodic hydrographic surveys.
e. Where a Section 408 permission is required, written verification for the PCN will not be issued prior to the decision on the Section 408 permission request.

16. Navigation
a. No activity may cause more than a minimal adverse effect on navigation.
b. Any safety lights and signals prescribed by the U.S. Coast Guard, must be installed, and maintained at the permittee's expense on authorized facilities in navigable waters of the U.S.
c. There shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein, and no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized herein.
d. The permittee understands and agrees that if future U.S. operations require the removal, relocation, or other alteration of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from USACE, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the U.S. No claim shall be made against the U.S. on account of any such removal or alteration.

17. Permit/Authorization Letter On-Site. For PCNs, the permittee shall ensure that a copy of these GPs and the accompanying authorization letter are at the work site (and the project office) whenever work is being performed, and that all personnel with operational control of the site ensure that all appropriate personnel performing work are fully aware of its terms and conditions. The entire permit authorization shall be made a part of any and all contracts and sub-contracts for work that affects areas of USACE jurisdiction at the site of the work authorized by these GPs. This shall be achieved by including the entire permit authorization in the specifications for work. The term "entire permit authorization" means these GPs, including GCs and the authorization letter (including its drawings, plans, appendices, special conditions, and other attachments), and any permit modifications. If the authorization letter is issued after the construction specifications, but before receipt of bids or quotes, the entire permit authorization shall be included as an addendum to the specifications. If the authorization letter is issued after receipt of bids or quotes, the entire permit authorization shall be included in the contract or sub-contract as a change order. Although the permittee may assign various aspects of the work to different contractors or sub-contractors, all contractors and sub-contractors shall be obligated by contract to comply with all environmental protection provisions contained within the entire authorization letter, and no contract or sub-contract shall require or allow unauthorized work in areas of USACE jurisdiction. For SVs, the permittee shall ensure that a complete and signed copy of the SVN is present on site during construction and is made available for review at any time by USACE and other Federal, State, & Local regulatory agencies. A complete and signed copy of the SVN must be submitted to USACE Regulatory within 30 days of initiating construction of the authorized activity, unless stated otherwise in the applicable GP.

18. Storage of Seasonal Structures. Coastal structures such as pier sections, floats, etc., that

are removed from the waterway for a portion of the year (often referred to as seasonal structures) shall be stored in an upland location, located above MHW and not in tidal wetlands. These seasonal structures may be stored on the fixed, pile-supported portion of the structure that is seaward of MHW. This is intended to prevent structures from being stored on the marsh substrate and the substrate seaward of MHW.

19. Pile Driving and Pile Removal in Navigable Waters.
a. Derelict, degraded or abandoned piles and sheet piles in navigable waters of the U.S., except for those inside existing work footprints for piers, must be completely removed, cut and/or driven to 3 feet below the substrate to prevent interference with navigation, and existing creosote piles that are affected by project activities shall be completely removed if practicable. In areas of fine-grained substrates, piles must be removed by the direct, vibratory or clamshell pull method[1] to minimize sedimentation and turbidity impacts and prevent interference with navigation from cut piles. Removed piles shall be disposed of in an upland location landward of MHW or OHW and not in wetlands, tidal wetlands or mudflats.
b. A PCN is required for the installation or removal of structures with jetting techniques.
c. A PCN is required for the installation of >12 inch-diameter piles of any material type or steel piles of any size in tidal waters, unless they are installed in the dry. If piles are not installed in the dry:
i. Impact pile driving shall commence with an initial set of three strikes by the hammer at 40% energy, followed by a one-minute wait period, then two subsequent 3-strike sets at 40% energy, with one minute waiting periods, before initiating continuous impact driving.
ii. Vibratory pile driving shall be initiated for 15 seconds at reduced energy followed by a one-minute waiting period. This sequence of 15 seconds of reduced energy driving, one-minute waiting period shall be repeated two more times, followed immediately by pile-driving at full rate and energy.
iii. In addition to using a soft start at the beginning of the workday for pile driving as described in 19c(i-ii), a soft start must also be used at any time following a cessation of pile driving for a period of 30 minutes or longer.
d. Bubble curtains may be used to reduce sound pressure levels during vibratory or impact hammer pile driving.

20. Time-of-Year (TOY) Restrictions. Activities that include in-water work must comply with the TOY Restrictions below to be SV eligible, otherwise a PCN is required. PCN submittals shall contain written justification for deviation from the TOY Restrictions. The term “in-water work” does not include conditions where the work site is “in-the-dry” (e.g., intertidal areas exposed at low tide). The term “in-the-dry” includes work contained within a cofferdam so long as the cofferdam is installed and subsequently removed outside the TOY Restriction. The TOY restrictions stated in Appendix B of the MA DMF Technical Report TR-47[2] can apply instead for activities in tidal waters if (1) TOYs are provided for a specific waterbody where the activity is proposed and (2) the TOYs are less restrictive than below. The activity must also not require a PCN elsewhere in this document to be SV eligible.

[1] Direct Pull: Each piling is wrapped with a choker cable or chain that is attached at the top to a crane. The crane then pulls the piling directly upward, removing the piling from the sediment. Vibratory Pull: The vibratory hammer is a large mechanical device (5-16 tons) that is suspended from a crane by a cable. The vibrating hammer loosens the piling while the crane pulls up. Clamshell Pull: This can remove intact, broken or damaged pilings. The clamshell bucket is a hinged steel apparatus that operates like a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the piling stub as the crane pulls up. The size of the clamshell bucket is minimized to reduce turbidity during piling removal.
[2] The MA DMF Technical Report TR-47: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/

	TOY Restriction (No work)
Non-tidal Waters	Defer to TR-47
Tidal Waters	January 15 – November 15

Alternate work windows proposed under a PCN will generally be coordinated with the USFWS and NMFS. Resulting written verifications may include species-specific work allowed windows.

21. Heavy Equipment in Wetlands. Operating heavy equipment (drill rigs, fixed cranes, etc.) within wetlands shall be minimized, and such equipment shall not be stored, maintained, or repaired in wetlands, to the maximum extent practicable. Where construction requires heavy equipment operation in wetlands, the equipment shall:

i. Have low ground pressure (typically ≤3 psi);

ii. Be placed on swamp/construction/timber mats (herein referred to as "construction mats" or "mats") that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation. See GC 22 for information on the placement of construction mats; or

iii. Be operated on adequately dry or frozen wetlands such that shear pressure does not cause subsidence of the wetlands immediately beneath the equipment and upheaval of adjacent wetlands. Construction mats are to be placed in the wetland from the upland or from equipment positioned on mats if working within a wetland. Dragging construction mats into position is prohibited. Other support structures that are capable of safely supporting equipment may be used with written USACE authorization.

22. Temporary Fill, Work & Construction Mats.

a. *Construction mats in non-tidal waters*: Temporary construction mats shall be in place ≤1 year *and* for one growing season or less to be SV eligible. A PCN is required if construction mats are in place >1 year *or* for more than one growing season. Construction mats can be placed in an area of any size in non-tidal waters. The activity may occur in segments to ensure the requirements for SV above are met, otherwise a PCN is required.

b. *Construction mats in tidal waters*: Temporary construction mats placed in an area <5,000 SF in tidal waters are SV eligible, provided those mats are in place ≤6 months. Temporary construction mats placed in an area ≥5,000 SF or in place >6 months in tidal waters require a PCN.

c. *Management of construction mats:* At a minimum, construction mats shall be managed in accordance with the following construction mat best management practices (BMPs):

1. Mats shall be in good condition to ensure proper installation, use, and removal.
2. As feasible, mats shall be placed in a location that will minimize the amount of mats needed for the wetland crossing(s).
3. Inspect mats prior to their re-use and remove any plant debris. Mats are to be thoroughly cleaned before re-use to prevent the spread of invasive plant species.
4. Impacts to wetland areas shall be minimized during installation, use, and removal of the mats.
5. Adequate erosion & sediment controls shall be installed at approaches to mats to promote a smooth transition to, and minimize sediment tracking onto, the mats.
6. In most cases, mats should be placed along the travel area so that the individual boards are resting perpendicular to the direction of traffic. No gaps should exist between mats. Place mats far enough on either side of the resource area to rest on firm ground.

d. A PCN is required for temporary fills in place >2 years. All temporary fills and disturbed soils shall be stabilized to prevent the material from eroding into waters of the U.S. where it is not authorized. Work shall include phased or staged development to ensure only areas under active development are exposed and to allow for stabilization practices as soon as practicable. Temporary fill must be placed in a manner that will prevent it from being eroded by expected high flows.

e. Activities that require unconfined temporary fill and are authorized for discharge into waters of the U.S. shall consist of material that minimizes effects to water quality.
f. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable when temporary structures, work, and discharges of dredged or fill material, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Materials shall be placed in a location and manner that does not adversely impact surface or subsurface water flow into or out of the wetland. Temporary fill authorized for discharge into wetlands shall be placed on geotextile fabric or other appropriate material laid on the pre-construction wetland grade where practicable to minimize impacts and to facilitate restoration to the original grade. Construction mats are excluded from this requirement.
g. Construction debris and deteriorated materials shall not be located in waters of the U.S.
h. Temporary fills, construction mats, and corduroy roads shall be entirely removed as soon as they are no longer needed to construct the authorized activity and the disturbed areas be restored to pre-construction contours and conditions.
i. Construction equipment, such as temporary barges in tidal waters, shall provide clearance above the substrate to avoid grounding onto the substrate during all tides.

23. Restoration of Wetland Areas.
a. Upon completion of construction, all disturbed wetland areas shall be stabilized with a wetland seed mix or plant plugs containing only plant species native to New England, and be appropriate for site conditions, including salinity and frequency of inundation, and shall not contain any species listed in the “Invasive and Other Unacceptable Plant Species” Appendix K of the New England District “Compensatory Mitigation Standard Operating Procedures” found at https://www.nae.usace.army.mil/Missions/Regulatory/Mitigation.aspx.
b. The introduction or spread of invasive plant species in disturbed areas shall be prevented and controlled. Equipment shall be thoroughly cleaned before and after project construction to prevent the spread of invasive species. This includes, but is not limited to, tire treads and construction mats.
c. In areas of authorized temporary disturbance, if trees are cut in USACE jurisdiction, they shall be cut at or above ground level and not uprooted in order to prevent disruption of any kind to the wetland soil structure and to allow stump sprouts to revegetate the work area, unless otherwise authorized.
d. Wetland areas where permanent disturbance is not authorized shall be restored to their original condition and elevation, which under no circumstances shall be higher than the pre-construction elevation. Original condition means careful protection and/or removal of existing soil and vegetation, and replacement back to the original location such that the original soil layering and vegetation schemes are approximately the same, unless otherwise authorized.

24. Bank Stabilization.
a. Projects involving construction or reconstruction/maintenance of bank stabilization within USACE jurisdiction shall be designed to minimize environmental effects, effects to neighboring properties, scour, conversion of natural shoreline to hard armoring, etc. to the maximum extent practicable.
b. Projects involving the construction of new bank stabilization within USACE jurisdiction shall use bioengineering techniques and natural materials in the project design to the maximum extent practicable. Use of hard structures shall be eliminated or minimized unless the prospective permittee can demonstrate that use of bioengineering techniques is not practicable due to site conditions.
c. Where possible, bank stabilization projects shall optimize the natural function of the shoreline, including self-sustaining stability to attenuate flood flows, fishery, wildlife habitat and water quality protection, while protecting upland infrastructure from storm events that can cause erosion as well as impacts to public and private property.
d. No material shall be placed in excess of the minimum needed for erosion protection.
e. No material shall be placed in a manner that will be eroded by normal or expected high flows (properly anchored native trees and treetops may be used in low energy areas).

f. Native plants appropriate for current site conditions, including salinity, must be used for bioengineering or vegetative bank stabilization.
g. The activity must be properly maintained, which may require repairing it after severe storms or erosion events.

25. Soil Erosion and Sediment Controls.
a. Appropriate soil erosion and sediment controls[1] (hereinafter referred to as "controls") must installed prior to earth disturbance and maintained in effective operating condition during construction. Biodegradable wildlife friendly erosion controls should be used whenever practicable to minimize effects to water quality.
b. Activities in streams (rivers, streams, brooks, etc.) and tidal waters that are capable of producing sedimentation or turbidity should be done during periods of low-flow or no-flow, when the stream or tide is waterward of the work area. Controls may also be used to obtain dry work conditions (e.g., coffer dam, turbidity curtain). The prospective permittee must demonstrate in the project plans where the controls are proposed and how these controls would avoid and/or minimize turbidity or sedimentation.
c. A PCN is required for controls that encroach: i) >25% of the stream width measured from OHW in non-tidal diadromous streams from March 15 to June 30; or ii) >25% of the waterway width measured from MHW in tidal waters from Feb. 1 to June 30, or >50% of the waterway width measured from MHW in tidal waters from July 1 to Jan. 14. This is to protect upstream fish passage. Proponents must also maintain downstream fish passage throughout the project.
d. No dewatering shall occur with direct discharge to waters or wetlands. Excess water in isolated work areas shall be pumped or directed to a sedimentation basin, tank or other dewatering structures in an upland area adequately separated from waters or wetlands. Suspended solids shall be removed prior to discharge back into waters or wetlands from these dewatering structures. All discharge points back into waters and wetlands shall use appropriate energy dissipaters and erosion and sedimentation control BMPs.
e. Temporary controls shall be removed upon completion of work, but not until all exposed soil and other fills, as well as any work waterward of OHW or the HTL, are permanently stabilized at the earliest practicable date. Sediment and debris collected by these devices shall be removed and placed at an upland location in a manner that will prevent its later erosion into a waterway or wetland. Controls may be left in place if they are biodegradable and flows and aquatic life movements are not disrupted.

26. Aquatic Life Movements and Management of Water Flows.
a. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies and wetlands shall be:
i. Suitably spanned, bridged, culverted, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species; and
ii. Properly aligned and constructed to prevent bank erosion or streambed scour both adjacent to and inside the crossing.

[1] Appropriate soil erosion, sediment and turbidity controls include cofferdams, bypass pumping around barriers immediately up and downstream of the work footprint (i.e., dam and pump), installation of sediment control barriers (i.e., silt fence, vegetated filter strips, geotextile silt fences, filter tubes, erosion control mixes, hay bales or other devices) downhill of all exposed areas, stream fords, retention of existing vegetated buffers, application of temporary mulching during construction, phased construction, and permanent seeding and stabilization, etc.

b. To avoid adverse impacts on aquatic organisms, the low flow channel/thalweg shall remain unobstructed during periods of low flow, except when necessary to perform the authorized work.
c. For work in tidal waters, in-stream controls (e.g., cofferdams) should be installed in such a way as to not obstruct fish passage.
d. Riprap and other stream bed materials shall be installed in a manner that avoids organism entrapment in rock voids or water displaced to subterranean flow with crushed stone and riprap.
e. To the maximum extent practicable, the preconstruction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity shall not restrict or impede the passage of normal or high flows unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

27. Spawning, Breeding, and Migratory Areas.
a. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized under these GPs.
b. Activities in waters of the U.S. that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.
c. The applicant is responsible for obtaining any "take" permits required under the USFWS's regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The applicant should contact the appropriate local office of the USFWS to determine if such "take" permits are required for a particular activity.
d. Information on spawning habitat for species managed under the Magnuson-Stevens Fishery Conservation and Management Act (i.e., EFH for spawning adults) can be obtained from NAE Regulatory website, Essential Fish Habitat section, at: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.
e. Information regarding diadromous fish habitat can be obtained from the following DMF website at: https://www.mass.gov/info-details/massgis-data-diadromous-fish.

28. Vernal Pools.
a. A PCN is required if a discharge of dredged or fill material is proposed within a vernal pool depression that is also a water of the U.S.
b. Vernal pools must be identified on the plans that show aquatic resource delineations.
c. Adverse impacts to vernal pools shall be avoided & minimized to the maximum extent practicable.

29. Invasive Species.
a. The introduction, spread or the increased risk of invasion of invasive plant or animal species on the project site, into new or disturbed areas, or areas adjacent to the project site caused by the site work shall be avoided. Construction mats shall be thoroughly cleaned before reuse to avoid spread of invasive species.
b. Unless otherwise directed by USACE, all applications for PCN non-tidal projects proposing fill in USACE jurisdiction shall include an Invasive Species Control Plan. Additional information can be found at: https://www.nae.usace.army.mil/Missions/Regulatory/Invasive-Species/, https://www.nae.usace.army.mil/Missions/Regulatory/Mitigation/.

30. Fills Within 100-Year Floodplains. The activity shall comply with applicable Federal Emergency Management Agency (FEMA) approved, Massachusetts Emergency Management

Agency (MEMA) approved and/or local floodplain management requirements. Applicants should contact FEMA and/or MEMA regarding floodplain management requirements.

31. Stream Work and Crossings & Wetland Crossings.
a. When feasible, all temporary and permanent crossings of waterbodies and wetlands (hereinafter referred to as "crossings") shall conform to the "Massachusetts River and Stream Crossing Standards" located at: https://www.mass.gov/doc/massachusetts-river-and-stream-crossing-standards/download or https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/. Projects that do not conform to these guidelines shall be reviewed under PCN or IP procedures.
b. Crossings shall be suitably culverted, bridged, or otherwise designed to withstand and to prevent the restriction of high flows, to maintain existing low flows, maintain water quality, and not obstruct the movement of aquatic life indigenous to the waterbody beyond the duration of construction.
c. Crossings shall be installed in such a manner as to preserve hydraulic capacity and flow, sediment transport, and organism passage at its present level, between the wetlands on either side of the road. The applicant shall take necessary measures to correct any wetland damage resulting from deficiencies in hydraulic capacity, sediment transport and organism passage.
d. Stream crossings shall utilize a natural mixed grain-size streambed material composition that matches upstream and downstream substrates to create a stable streambed. Substrate should function appropriately during normal and high flows without washing out. If natural streambed material is not utilized, a PCN is required.
e. Activities involving open trench excavation in flowing waters require a PCN. Work should not occur in flowing waters (requires using management techniques such as temporary flume pipes, culverts, cofferdams, etc.). Normal flows should be maintained within the stream boundary's confines when practicable. Projects utilizing these management techniques must meet all applicable terms and conditions of the GP, including the GCs in Section IV.

32. Utility Line Installation and Removal
a. Subsurface utility lines must be installed at a sufficient depth to avoid damage from anchors, dredging, etc., and to prevent exposure from erosion and stream adjustment.
b. When utility lines are installed via horizontal directional drilling, a frac-out contingency plan shall be present on site for the duration of construction. As necessary, the applicant shall immediately contain, control, recover, and remove drilling fluids released into the environment.
c. Abandoned or inactive utility lines must be removed and faulty lines (e.g., leaking hazardous substances, petroleum products, etc.) must be removed or repaired. A written verification from the USACE is required if they are to remain in place, e.g., to protect sensitive areas or ensure safety.
d. Utility lines shall not adversely alter existing hydrology, and trenches cannot be constructed or backfilled in such a manner as to drain waters of the U.S. (e.g., backfilling with extensive gravel layers, creating a French drain effect). In wetland areas, structures such as ditch plugs, cut-off walls, clay blocks, bentonite, or other suitable material shall be used within utility trenches to ensure that the trench through which the utility line is installed does not drain waters of the U.S. including wetlands.
e. Stockpiling of tree debris, to the extent where it has the effect of fill material, shall not occur in waters of the U.S. Tree debris shall be removed from waters of the U.S. and placed in uplands without causing additional disturbance to aquatic resources. Failure to meet this condition could change the bottom elevation of the wetland and be considered a discharge of fill material, and depending on the area of alteration, may require a PCN or IP.

33. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

34. Coral Reefs. Impacts to coral reefs are not authorized under these GPs. Coral reefs consist of the skeletal deposit, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef.

35. Blasting. Blasting in waters of the U.S. associated with work such as dredging, trenching, pile installation, etc. is not authorized under these GPs.

36. Inspections. The permittee shall allow USACE to make periodic inspections at any time deemed necessary to ensure that the work is being or has been performed in accordance with the terms and conditions of this permit. To facilitate these inspections, for activities requiring a PCN, the permittee shall complete and return the Certificate of Compliance when it is provided with a PCN verification letter. For SV-eligible activities, the permittee shall complete and submit the SVN to USACE within 30 days of initiating project construction, at which point, USACE may opt to inspect the activity to verify compliance with the terms and conditions of the GP. Post-construction engineering drawings may be required by USACE for completed work. This includes post-dredging survey drawings for any dredging work.

37. Maintenance. The permittee shall maintain the activity authorized by these GPs in good condition and in conformance with the terms and conditions of this permit. Some maintenance activities may not be subject to federal regulation under Section 404 in accordance with 33 CFR 323.4(a)(2). This condition is not applicable to maintenance of dredging projects. Prospective permittees should contact USACE to inquire about maintenance of dredging projects, and its eligibility under these GPs. Maintenance dredging is subject to the review thresholds in GP #7 as well as any conditions included in a written USACE authorization. Maintenance dredging includes only those areas and depths previously authorized and dredged.

38. Property Rights. Per 33 CFR 320.4(g)(6), these GPs do not convey any property rights, either in real estate or material, or any exclusive privileges, nor do they authorize any injury to property or invasion of rights or any infringement of Federal, State, or local laws or regulations.

39. Transfer of GP Verifications. When the work authorized by these GPs is still in existence at the time the property is transferred, the terms and conditions of these GPs, including any special conditions, will continue to be binding on the entity or individual who received the GP authorizations, as well as the new owner(s) of the property. If the permittee sells the property associated with a GP authorization, the applicant may transfer the GP authorization to the new owner by submitting a letter to USACE to validate the transfer. A copy of the GP authorization letter must be attached to the letter, and the letter must include the following statement: “The terms and conditions of these general permits, including any special conditions, will continue to be binding on the new owner(s) of the property.” This letter shall be signed by both the seller and new property owner(s).

40. Modification, Suspension, and Revocation. These GPs and any individual authorization issued thereof may be either modified, suspended, or revoked in whole or in part pursuant to the policies and procedures of 33 CFR 325.7; and any such action shall not be the basis for any claim for damages against the U.S.

41. Special Conditions. The USACE may impose other special conditions on a project authorized pursuant to these GPs that are determined necessary to minimize adverse navigational and/or environmental effects or based on any other factor of the public interest. Failure to comply with all conditions of the authorization, including special conditions, constitutes a permit violation and may subject the applicant to criminal, civil, or administrative penalties or restoration.

42. False or Incomplete Information. If USACE makes a determination regarding the eligibility of a project under these GPs, and subsequently discovers that it has relied on false, incomplete, or inaccurate information provided by the applicant, the authorization will not be valid, and the U.S. Government may institute appropriate legal proceedings.

43. Abandonment. If the permittee decides to abandon the activity authorized under these GPs, unless such abandonment is merely the transfer of property to a third party, he/she/they may be required to restore the area to the satisfaction of USACE.

44. Enforcement cases. These GPs do not apply to any existing or proposed activity in USACE jurisdiction associated with an on-going USACE or EPA enforcement action, until such time as the enforcement action is resolved or USACE or EPA determines that the activity may proceed independently without compromising the enforcement action.

45. Previously Authorized Activities.

a. Completed projects that received prior authorization from USACE (SV or PCN), shall remain authorized in accordance with the original terms and conditions of those authorizations, including their terms, GCs, and any special conditions provided in a written verification.

b. Activities authorized pursuant to 33 CFR 330.3 (activities occurring before certain dates) are not affected by these GPs.

46. Duration of Authorization.

These GPs expire on June 1, 2028. Activities authorized under these GPs will remain authorized until the GPs expire, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend, or revoke the authorization in accordance with 33 CFR 325.2(e)(2). Activities authorized under GPs 1-25 that have either commenced (i.e., are under construction) or are under contract to commence in reliance upon this authorization will have until June 1, 2029 to complete the work. If requested by USACE, the permittee shall furnish documentation that demonstrates the project was under construction or under contract to commence by June 1, 2028. If work is not completed before June 1, 2029, the permittee must contact USACE. The USACE may issue a new authorization provided the project meets the terms and conditions of the MA GPs in effect at the time. Activities completed under the SV or PCN authorizations of these GPs will continue to be authorized after their expiration date.

SECTION V: MITIGATION STANDARDS

1. Mitigation Types

For all activities, applicants must (a) demonstrate how the project has been designed to avoid or minimize impacts to aquatic resources; and (b) describe measures taken to avoid or minimize impacts to aquatic resources through construction techniques and/or site access. Please see https://www.nae.usace.army.mil/Missions/Regulatory/Mitigation/ for assistance with preparing mitigation in accordance with the 2008 Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (33 CFR 332.3), hereafter referred to as "2008 Mitigation Rule."

Avoidance - Avoidance of impacts (direct and indirect) to aquatic resources means that project activities would not result in the placement of fill material or installation of a structure that could impact the resource area. Avoidance can include, but is not limited to, designing the project to avoid impacts to all or a portion of the aquatic resource areas.

Minimization - Minimization of impacts (direct and indirect) to aquatic resources means that measures are taken to ensure the amount and duration of impacts are limited to the maximum extent practicable. There are many minimization measures that could be implemented, prior to, during, or after the proposed activity, to ensure impacts are minimized. Examples include, but are not limited to:

- Permanent preservation of avoided aquatic features and buffer zone, in perpetuity. In these cases, the preserved area would be under a conservation easement and managed by conservation oriented third-party manager.
- Utilization of best management practices (BMPs) to ensure impacts are limited, and do not result in adverse impacts to the integrity and long-term functions of preserved/avoided features.

Compensatory Mitigation - Compensatory mitigation is generally required for PCN activities in which the impacts to the aquatic resources have been avoided and minimized to the maximum extent practicable but would still result in unavoidable adverse effects to the environment that are considered more than minimal or are contrary to the public interest. *Whatever the case may be, compensatory mitigation is no substitute for avoidance and minimization.*

2. Thresholds for Compensatory Mitigation

The basic objective of compensatory mitigation in the USACE Regulatory Program is to offset environmental losses resulting from unavoidable impacts to waters of the U.S. authorized by Department of the Army permits. **The following compensatory mitigation thresholds apply to all PCN activities that result in loss[1] of the resource area types listed below. Activities[2] in waters of the U.S. associated with the restoration, enhancement, and establishment of tidal and non-tidal aquatic resources are not considered loss and are not subject to the thresholds below.** Thresholds for different resource areas may not be combined to exceed 5,000 SF of total loss of all waters. The USACE will continue to evaluate projects on a case-by-case basis, and may in some cases require compensatory mitigation below these thresholds (e.g. minor impacts that add to a cumulative loss).

[1] See definition of loss in Section VII.
[2] These activities must result in net increases in aquatic resource functions and services to be exempted from the thresholds above.

Compensatory Mitigation Thresholds in Massachusetts		
Resource Area	**Non-Tidal Threshold**	**Tidal Threshold**
Stream	200 LF	200 LF
Bank Stabilization	500 LF	500 LF
Open Water	Project Dependent	Project Dependent
Wetland	5,000 SF	500 SF
Vernal Pool	All	N/A
SAV	Project dependent	25 SF
Mudflat	N/A	1,000 SF
Intertidal	N/A	1,000 SF

These thresholds can be utilized to determine at what point compensatory mitigation is required but are not used to determine how much mitigation may be needed to offset impacts to resources. Per the 2008 Mitigation Rule (33 CFR 332.3(f)(1)) "the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace lost aquatic resource functions. In cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratios must be used."

3. Compensatory Mitigation Hierarchy

Compensatory mitigation should follow the hierarchy as outlined in 33 CFR 332.3(b)(2-6) or current regulation. This hierarchy in order of preference includes: (1) Mitigation Bank credits, (2) In-Lieu Fee program credits, (3) permittee-responsible mitigation under a watershed approach, (4) permittee-responsible mitigation through on-site and in-kind mitigation, and (5) permittee-responsible mitigation through off-site and/or out-of-kind mitigation. If the proposed mitigation deviates from this mitigation hierarchy, the applicant **must** justify in writing why the proposed mitigation is environmentally preferable to the preferred method of compensatory mitigation (See 2008 Mitigation Rule). **In order for your application to be considered complete, you must provide a statement that discusses how your project will compensate for the loss or impact to aquatic resources.** If you are proposing permittee responsible mitigation, the 12 components of a mitigation plan (33 CFR 332.4(c)(2-14) must be addressed for your application to be considered complete. Prospective applicants are encouraged to contact USACE with questions at any time. Addressing the 12 components of a mitigation plan is commensurate with the amount of compensatory mitigation required, and USACE can assist prospective applicants with the level of information needed to satisfy each component.

For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee.

4. In-Lieu Fee (ILF)

The purchase of credits from the Massachusetts In-Lieu Fee Program (MA ILFP) is the ***preferred*** method of compensatory mitigation in Massachusetts since, as of the issuance date of this GP, there are no mitigation banks available in Massachusetts. The applicant shall develop a mitigation plan that addresses the baseline conditions at the impact site and the number of credits to be provided (see 33 CFR 332.4(c)(1)(ii)).

The MA ILFP is administered by the Massachusetts Department of Fish & Game (DFG) in accordance with the 2008 Mitigation Rule at 33 CFR 332. The Mitigation Rule governs in-lieu fee compensatory mitigation associated with USACE permits under §404 of the Clean Water Act and/or §9 or §10 of the Rivers and Harbors Act of 1899.

MA ILFP Website: https://www.mass.gov/in-lieu-fee-program

Acceptance of an ILF payment into the ILFP established by the 2014 MA ILFP Instrument (link below) is an acknowledgement by DFG that it assumes all legal responsibility for satisfying the mitigation requirements of the USACE (i.e., the implementation, performance, and long-term management and monitoring of the compensatory mitigation project(s) approved under this Instrument and subsequent Compensatory Mitigation Plans). This transfer of legal responsibility is established by: 1) the approval of this In-Lieu Fee Instrument; 2) receipt by the district engineer of a Notice of Credit Sale and Transfer of Legal Responsibility to DFG that is signed by the DFG and the permittee and dated; and 3) the transfer of fees from the permittee to DFG.

MA ILFP Fact Sheet: https://www.mass.gov/files/documents/2017/01/sj/ilfp-fact-sheet-ma-ilfp-fees.pdf

MA ILFP Instrument: https://www.mass.gov/files/documents/2016/08/nd/ilfp-final-instrument-dfg.pdf

5. Permittee-Responsible

The USACE may determine that the proposed permittee-responsible compensatory mitigation is appropriate on a case-by-case basis. As described in the Compensatory Mitigation Hierarchy section above, applicants must justify in writing why the proposed mitigation is environmentally preferable to the purchase of ILF credits. Applicants are encouraged to contact the USACE prior to submission of a permit application to seek further guidance regarding USACE mitigation requirements.

Applicants will demonstrate their proposed compensatory mitigation in writing by addressing the 12 components of a mitigation plan (33 CFR 332.4(c)(2-14). *Please note that all elements must be addressed, or the permit application will be deemed incomplete.* In certain circumstances, the district engineer may determine that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). Guidance on how to address these components can be found on the New England District Mitigation webpage: https://www.nae.usace.army.mil/Missions/Regulatory/Mitigation/

Performance standards will be used to measure the successfulness of the mitigation project. A successful mitigation project is one that is self-sustaining. For a mitigation project that will restore, enhance, or create wetlands, proper performance standards must address hydrology, hydric soils, and hydrophytic vegetation. The mitigation proposal must include an explanation of quantitative methods used to measure the success of performance standards (i.e., percent cover may be measured using vegetation plots, hydrology may be measured using data loggers, soil cores may be taken and evaluated for hydric soil indicators).

Monitoring methods should include quantitative sampling methods following established, scientific protocols. Sampling documentation, as part of monitoring reports, should include maps and coordinates (also shapefiles, if available) showing locations of sampling points, transects, quadrats, etc. In addition, permanent photo stations should be established coincident with sampling locations.

SECTION VI: FEDERAL & STATE AGENCY CONTACT INFORMATION & ORGANIZATIONAL WEBSITES

Federal Agencies

U.S. Army Corps of Engineers
Regulatory Division
696 Virginia Road
Concord, Massachusetts 01742-2751
(978) 318-8338 (phone); (978) 318-8303 (fax)
www.nae.usace.army.mil/missions/regulatory

U.S. Army Corps of Engineers
Navigation Division – Section 408
696 Virginia Road
Concord, Massachusetts 01742-2751
See link below for contact information:
https://www.nae.usace.army.mil/Missions/Section-408/

National Marine Fisheries Service
55 Great Republic Drive
Gloucester, Massachusetts 01930
(978) 281-9300 (phone)
(*Federal endangered species & EFH)*

U.S. Fish & Wildlife Service
70 Commercial Street, Suite 300
Concord, New Hampshire 03301
(603) 223-2541 (phone)
(Federal endangered species)

National Park Service
15 State Street
Boston, Massachusetts 02109
(617) 223-5191 (phone)
(*Wild and Scenic Rivers*)

Bureau of Ocean and Energy Management
1849 C Street, NW
Washington D.C. 20240
202-208-6474 (phone)
(*Offshore Wind Facilities)*

Chief, Risk Analysis Branch
FEMA Region 1
99 High Street, 6th Floor
U.S. Department of Homeland Security
Boston, Massachusetts 02110
(617) 956-7576 (phone)

Commander (dpb)
First Coast Guard District
Battery Building
One South Street
New York, New York 10004-1466
(212) 514-4331 (phone); (212) 514-4337 (fax)
(*Bridge permits*)

U.S. Environmental Protection Agency
5 Post Office Square
Suite 100 (OEP06–3)
Boston, Massachusetts 02109-3912
(617) 918-1692 (phone)

State Agencies in Massachusetts

Massachusetts Department of Environmental Protection (MassDEP)	
DEP Division of Wetlands & Waterways	100 Cambridge Street, Suite 900 Boston, Massachusetts 02114 (617) 292-5695
Northeast Region	150 Presidential Way, Suite 300 Woburn, Massachusetts 01801 (978) 694-3200
Southeast Region	20 Riverside Drive, Route 105 Lakeville, Massachusetts 02347 (508) 946-2800
Central Region	8 New Bond Street Worcester, Massachusetts 01606 (508) 792-7650
Western Region	436 Dwight Street Springfield, Massachusetts 01103 (413) 784-1100

Massachusetts Office of Coastal Zone Management (CZM) Emails may be sent to: czm@mass.gov	
MA Office of Coastal Zone Management	100 Cambridge Street, Suite 900 Boston, Massachusetts 02114 (617) 626-1200
North Shore Region	2 State Fish Pier Gloucester, Massachusetts 01930 (978) 281-3972
South Shore Region	175 Edward Foster Road Scituate, Massachusetts 02066
Cape Cod and Islands Region	3195 Main Street, P.O. Box 220 Barnstable, MA 02630
South Coastal Region	81-B County Road, Suite E Mattapoisett, MA 02739

Massachusetts Historical Commission (MHC)	
Office Location:	220 Morrisey Boulevard Boston, Massachusetts 02125 (617) 727-8470

Massachusetts Board of Underwater Archaeological Resources (BUAR) Emails may be sent to: david.s.robinson@mass.gov	
Office Location:	100 Cambridge Street, Suite 900 Boston, Massachusetts 02114 (617) 626-1014

SECTION VII: Definitions & Acronyms

Artificial or Living Reef: A structure which is constructed or placed in waters for the purpose of enhancing fishery resources and commercial and recreational fishing opportunities.
Attendant Features: Occurring with or as a result of; accompanying.
Biodegradable: A material that decomposes into elements found in nature within a reasonably short period of time and will not leave a residue of plastic or a petroleum derivative in the environment after degradation. In contrast, degradable plastics break down into plastic fragments that remain in the environment after degradation. Examples of biodegradable materials include jute, sisal, cotton, straw, burlap, coconut husk fiber (coir) or excelsior. In contrast, degradable plastics break down into plastic fragments that remain in the environment after degradation. Photodegradable, UV degradable or Oxo-(bio)degradable plastics are not considered biodegradable under this GP.
Boating facilities: These provide, rent or sell mooring space, such as marinas, yacht clubs, boat yards, dockominiums, municipal facilities, land/home owners, etc. Not classified as boating facilities are piers shared between two abutting properties or municipal mooring fields that charge an equitable user fee based on the actual costs incurred.
Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. Must comply with the applicable provisions of 33 CFR 332. See also the New England District Compensatory Mitigation Guidance at http://www.nae.usace.army.mil/Missions/Regulatory/Mitigation.aspx.
Construction mats: Constructions, swamp and timber mats (herein referred to as “construction mats”) are generic terms used to describe structures that distribute equipment weight to prevent wetland damage while facilitating passage and providing work platforms for workers and equipment. They are comprised of sheets or mats made from a variety of materials in various sizes. A timber mat consists of large timbers bolted or cabled together. Corduroy roads, which are not considered to be construction mats, are cut trees and/or saplings with the crowns and branches removed, and the trunks lined up next to one another. Corduroy roads are typically installed as permanent structures. Like construction mats, they are considered as fill whether they are installed temporarily or permanently.
Cumulative Impacts: The impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.1). Although the impact of a particular discharge may constitute a minor change in itself, the cumulative effect of numerous such piecemeal changes can result in a major impairment of the water resources and interfere with the productivity and water quality of existing aquatic ecosystems. See 40 CFR 230.11(g).
Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.
Dredging:
Improvement Dredging: For the purposes of these GPs, this is dredging deeper than previously authorized by the USACE and dredged under that authorization.
Maintenance Dredging: For the purposes of these GPs, this is dredging from an area previously authorized by the USACE and dredged under that authorization. The USACE may require proof of authorization and dredging. Maintenance dredging typically refers to the routine removal of accumulated sediment to maintain the design depths of serviceable navigation channels, harbors, marinas, boat launches and port facilities. Maintenance dredging is conducted for navigational purposes and does not include any expansion of the previously dredged area. The USACE may

review a maintenance dredging activity as new dredging if sufficient time has elapsed to allow for the colonization of SAS, shellfish, etc.
New Dredging: For the purposes of these GPs, this is a) first time the USACE authorizes dredging of a particular location or b) dredging has not occurred for an extended period of time, and this has allowed for aquatic resources (i.e., eelgrass, shellfish, etc.) to redevelop in the area.
Dredged material & discharge of dredged material: These are defined at 33 CFR 323.2(c) and (d). The term dredged material means material that is excavated or dredged from waters of the U.S.
Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s) but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.
Ephemeral stream: A stream with flowing water only during, and for a short duration, after precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.
Erosion Controls: Appropriate soil erosion, sediment and turbidity controls include cofferdams, bypass pumping around barriers immediately up and downstream of the work footprint (i.e., dam and pump), installation of sediment control barriers (i.e., silt fence, vegetated filter strips, geotextile silt fences, filter tubes, erosion control mixes, hay bales or other devices) downhill of all exposed areas, stream fords, retention of existing vegetated buffers, application of temporary mulching during construction, phased construction, and permanent seeding and stabilization, etc.
Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area (33 CFR 332.2).
Expansions: Work that increases the footprint of fill, structures, depth of basin or drainage features, or floats, or slip capacity.
Essential Fish Habitat (EFH): The Federal Magnuson-Stevens Fishery Management and Conservation Act broadly defines EFH to include those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. See www.greateratlantic.fisheries.noaa.gov/habitat for more information.
Fill material & discharge of fill material: Material placed in waters of the U.S. where the material has the effect of either replacing any portion of a water of the U.S. with dry land or changing the bottom elevation of any portion of a water of the U.S. Fill material does not include any pollutant discharged into the water primarily to dispose of waste. These are defined at 33 CFR 323.2 (e) & (f).
Federal navigation projects (FNPs): These areas are maintained by the USACE; authorized, constructed and maintained on the premise that they will be accessible and available to all on equal terms; and comprised of USACE Federal anchorages, Federal channels and Federal turning basins. The buffer zone is equal to three times the authorized depth of a FNP. The following are FNPs in MA and more information, including the limits, is provided at www.nae.usace.army.mil/missions/navigation >> Navigation Projects:

- Andrews River, Harwich, MA
- Aunt Lydia's Cove
- Beverly Harbor
- Boston Harbor
- Buttermilk Bay Channel
- Canapitsit Channel
- Cape Cod Canal
- Chatham Harbor
- Cohasset Harbor
- Cross Rip Shoals, Nantucket Sound
- Cuttyhunk Harbor
- Dorchester Bay and Neponset River
- Duxbury Harbor
- Edgartown Harbor
- Essex River
- Fall River Harbor
- Falmouth Harbor
- Gloucester Harbor and Annisquam River
- Green Harbor
- Hingham Harbor
- Hyannis Harbor
- Ipswich River
- Island End River (Chelsea, MA)
- Kingston Harbor
- Lagoon Pond
- Little Harbor Woods Hole

Lynn Harbor
Malden River
Menemsha Creek
Merrimack River
Mystic River
Nantucket Harbor of Refuge
New Bedford and Fairhaven Harbor
Newburyport Harbor
Oak Bluffs Harbor
Pigeon Cove Harbor
Plymouth Harbor
Pollock Rip Shoals, Nantucket Sound
Provincetown Harbor
Red Brook Harbor
Rockport Harbor
Salem Harbor
Sandy Bay Harbor of Refuge
Saugus River
Scituate Harbor
Sesuit Harbor
Taunton River
Vineyard Haven Harbor
Wareham Harbor
Wellfleet Harbor
Westport River and Harbor
Weymouth Back River
Weymouth Fore and Town Rivers
Winthrop Harbor
Woods Hole Channel

Flume: An open artificial water channel, in the form of a gravity chute, which leads water from a diversion dam or weir alongside a natural flow. A flume can be used to measure the rate of flow.
FNP buffer zone: The buffer zone of a USACE Federal Navigation Project (FNP) is equal to three times the authorized depth of the FNP.
Frac out: During horizontal directional drilling (HDD) operations, drilling fluid travels up the borehole into a pit. When the borehole becomes obstructed or the pressure becomes too great inside the borehole, the ground fractures and fluid escapes to the surface and may affect surface waters.
Ground disturbance: Any activity that compacts, relocates, overturns, removes, mixes, or otherwise disturbs the ground, including under water. Ground disturbance can be caused by the use of hand tools (shovels, pick axe, posthole digger, etc.), heavy equipment (excavators, backhoes, bulldozers, dredgers, trenching and earthmoving equipment, etc.), and heavy trucks (large four wheel drive trucks, dump trucks and tractor trailers, etc.). Trenching, bulldozing, dredging, excavating, scraping, and plowing are typical examples of ground disturbance activities.
Height:width ratio: The height of structures shall at all points be equal to or exceed the width of the deck. For the purpose of this definition, height shall be measured from the marsh substrate to the bottom of the longitudinal support beam.
High Tide Line (HTL): The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides 58 that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds. (33 CFR 328). Refer to the highest predicted tide for the current year at the nearest NOAA tide gage. https://tidesandcurrents.noaa.gov/map/index.html
Historic Property: Any prehistoric or historic site (including archaeological sites), district, building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).
Impacts:
Direct Impacts: Effects that are caused by the activity and occur at the same time and place (40 CFR 1508.7).
Indirect impacts: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.
Secondary impacts: Effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material.

Information about secondary effects on aquatic ecosystems shall be considered prior to the time final section 404 action is taken by permitting authorities. Some examples of secondary effects on an aquatic ecosystem are: aquatic areas drained, flooded, fragmented; fluctuating water levels in an impoundment and downstream associated with the operation of a dam; septic tank leaching and surface runoff from residential or commercial developments on fill; and leachate and runoff from a sanitary landfill located in waters of the U.S. See 40 CFR 230.11(h).

Incidental Fallback: Incidental fallback is the redeposit of small volumes of dredged material that is incidental to excavation activity in waters of the U.S. when such material falls back to substantially the same place as the initial removal (33 CFR 323.2(d)(2)(iii)).

In the dry: Work that is done under dry conditions, e.g., work behind cofferdams or when the stream or tide is waterward of the work.

Independent utility: A test to determine what constitutes a single and complete non-linear project in the USACE Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Individual permit: A Department of the Army authorization that is issued following a case-by-case evaluation of a specific structure or work in accordance with the procedures of 33 CFR 322, or a specific project involving the proposed discharge(s) in accordance with the procedures of 33 CFR 323, and in accordance with the procedures of 33 CFR 325 and a determination that the proposed discharge is in the public interest pursuant to 33 CFR 320.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Intertidal: The area in between mean low water and the high tide line.

Living reef: See the definition of “artificial or living reef.”

Living shoreline: A term used to describe a low-impact approach with a substantial biological component to shoreline protection and restoration along coastal shores, riparian zones, lacustrine fringe wetlands, or oyster or mussel reef structures. This approach integrates natural features to restore, enhance, maintain, or create habitat, functions, and processes while also functioning to mitigate flooding or shoreline erosion. Living shorelines may stabilize banks and shores with small fetch and gentle slopes that are subject to low-to mid-energy waves. A living shoreline has a footprint that is made up mostly of native material. It incorporates vegetation or other living, natural “soft” elements alone or in combination with some type of harder shoreline structure (e.g., oyster or mussel reefs or rock sills) for added protection and stability. Living shorelines should maintain the natural continuity of the land-water interface and retain or enhance shoreline ecological processes.

Loss of waters of the United States: Waters of the U.S. that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. The loss of stream bed includes the acres of stream bed that are permanently adversely affected by filling or excavation because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the U.S. is a threshold measurement of the impact to jurisdictional waters or wetlands for determining whether a project may qualify for a GP; it is not a net threshold that is calculated after considering compensatory mitigation that maybe used to offset losses of aquatic functions and services. Waters of the U.S. temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the U.S. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the U.S.

Maintenance: The repair, rehabilitation, or in-kind replacement of any previously authorized, currently serviceable structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3 – "Activities occurring before certain dates," provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Maintenance includes minor deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, or current construction codes or safety standards that are necessary to make repair, rehabilitation, or replacement are authorized. Currently serviceable means useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.
Maintenance Exemption: In accordance with 33 CFR 323.4(a)(2), any discharge of dredged or fill material that may result from any of the following activities is not prohibited by or otherwise subject to regulation under Section 404 of the CWA: "Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design."
Mean high water: Line on the shore reached by the plane of the average high water. Where precise determination of the actual location of the line becomes necessary, it must be established by survey with reference to the available tidal datum, preferably averaged over a period of 18.6 years. Less precise methods, such as observation of the "apparent shoreline" which is determined by reference to physical markings, lines of vegetation, or changes in type of vegetation, may be used only where an estimate is needed of the line reached by the mean high water.
Mechanized land clearing: Land clearing activities using mechanized equipment such as backhoes or bulldozers with sheer blades, rakes or discs constitute point source discharges and are subject to section 404 jurisdiction when they take place in wetlands or waters of the U.S (Regulatory Guidance Letter 90-05).
Metallic mineral: Any ore or material to be excavated from the natural deposits on or in the earth for its metallic mineral content to be used for commercial or industrial purposes. "Metallic mineral" does not include thorium or uranium.
Minor deviations: Deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, or current construction codes or safety standards, which are necessary to make repair, rehabilitation, or replacement are permitted, provided the adverse environmental effects resulting from such repair, rehabilitation, or replacement are minimal.
Natural Rocky Habitats: Intertidal and subtidal substrates of pebble-gravel, cobble, boulder, or rock ledge and outcrops. Manufactured stone (e.g., cur or engineered riprap) is not considered a natural rocky habitat. Natural rocky habitats are either found as pavement (consolidated pebble-gravel, cobble, or boulder areas) or as a mixture with fines (i.e., clay and sand) and other substrates. Rocky habitats as EFH are defined as follows: (1) All pebble-gravel, cobble, or boulder pavements; (2) Pebble-gravel mixed with fines: mixed substrate of pebble-gravel and fines where pebble-gravel is an evident component of the substrate (either through visual observation or within sediment samples). Sediment samples with a content of 10% or more of pebble-gravel in the top layer (6-12 inches) should be delineated; (3) Scattered cobble, scattered boulder, scattered cobble/boulder: mixed substate of cobble and/or boulder and other substrates. The aerial extent of cobbles and/or boulders should be delineated; and (4) All rock ledge outcrops: area should be delineated along the edge of the ledge/outcrop (as defined by NMFS Habitat and Ecosystems Services Branch, Gloucester, MA).
Navigable waters or Navigable waters of the U.S.: These waters are subject to section 10 of the Rivers and Harbors Act of 1899 and are defined as those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 CFR Part 329). Work or structures in navigable

waters require permits pursuant to §9 and §10 of the Rivers and Harbors Act of 1899. Also see the definition of “waters of the U.S.” below.
Note: Currently the following non-tidal waters have been determined to be navigable waters of the U.S. subject to permit jurisdiction in Massachusetts: Merrimack River, Connecticut River, and Charles River to the Watertown Dam.
Nearshore disposal: This is defined in the USACE Coastal Engineering Manual as “(1) In beach terminology an indefinite zone extending seaward from the shoreline well beyond the breaker zone. (2) The zone which extends from the swash zone to the position marking the start of the offshore zone, typically at water depths of the order of 20m.” A nearshore berm is an artificial berm built in shallow water using dredged material. Often, the berm is intended to renourish the adjacent and downdrift shore over time under the influence of waves and currents.
Non-regulated activity: Only structures or fills that were previously authorized and are in compliance with the terms and condition of the original authorization can be maintained as a non-regulated activity under 33 CFR 323.4(a)(2). Minor deviations from the previously authorized footprint do not qualify as a non-regulated activity and require new authorization from the USACE. The state’s maintenance provisions may differ from the USACE and a project may require reporting and written authorization from the state.
Non-tidal wetlands: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the HTL (*i.e.,* spring HTL). Also see the definition of “Waters of the U.S.” below.
Oil or natural gas pipeline: Any pipe or pipeline for the transportation of any form of oil or natural gas, including products derived from oil or natural gas, such as gasoline, jet fuel, diesel fuel. heating oil, petrochemical feedstocks, waxes, lubricating oils, and asphalt.
Ordinary High Water Mark (OHWM): A line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas. See 33 CFR 328.3(e).
Overall project: The overall project, for purposes of these GPs, includes all regulated activities that are reasonably related and necessary to accomplish the project purpose. Also see the definition of “single and complete linear project.”
Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.
Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.
Permanent impacts: Permanent impacts means waters of the U.S. that are permanently affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent impacts include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody.
Preconstruction notification (PCN): A request submitted by the applicant to the USACE for confirmation that a particular activity is authorized by these GPs. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Preconstruction notification may be required by the terms and conditions of these GPs. A PCN may be voluntarily submitted in cases where PCN is not required and the applicant wants confirmation that the activity is authorized under these GPs.
Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions (33 CFR 332.2).
Real estate subdivision: Includes circumstances where a landowner or developer divides a tract of land into smaller parcels for the purpose of selling, conveying, transferring, leasing, or

developing said parcels. This would include the entire area of a residential, commercial or other real estate subdivision, including all parcels and parts thereof

Reconfiguration zone: A USACE authorized area in which permittees may rearrange pile-supported structures and floats without additional authorizations. A reconfiguration zone does not grant exclusive privileges to an area or an increase in structure or float area.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/ historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in again in aquatic resource area and functions (33 CFR 332.2).

Reference Site: Reference sites - Compensatory restoration, rehabilitation, and creation mitigation projects should seek to duplicate the features of reference aquatic resources or enhance connectivity with adjacent natural upland and aquatic resource landscape elements. Performance standards related to reference sites are encouraged. Mitigation project sites must be selected based on their ability to be, and continue to be, resistant to disturbance from the surrounding landscape, by locating them adjacent to refuges, buffers, green spaces, and other preserved natural elements of the landscape. In general, aquatic resource mitigation projects must be designed to be self-sustaining, natural systems within the landscape and climate in which they are located, with little or no ongoing maintenance and/or hydrologic manipulation.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area (33 CFR 332.2).

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation (33 CFR 332.2).

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Sedimentation: Sedimentation is defined as the process of deposition of a solid material from a state of suspension. Deposited sediments may accumulate and have temporal impacts to aquatic resource areas. See secondary effects definition above. For the purposes of this document, “greater than minimal sedimentation” is generally not considered to occur when using proper erosion controls (GC 25) or when sedimentation is considered “de minimis” 33 CFR 323.2(d)(5).

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term “single and complete project” is defined as that portion of the total linear project proposed or accomplished by one owner/ developer or partnership or other association of owners/developers that includes all crossings of a single water of the U.S. (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for the purposes of these GPs. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term “single and complete project” is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete

non-linear project must have independent utility (see the definition of “independent utility”). Single and complete non-linear projects may not be “piecemealed” to avoid the limits in a GP authorization.
Special aquatic sites (SAS): These include inland and saltmarsh wetlands, mud flats, vegetated shallows, sanctuaries and refuges, coral reefs, and riffle and pool complexes. These are defined at 40 CFR 230.3 and listed in 40 CFR 230 Subpart E.
Streambed: The stream substrate between the OHW marks on each side. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the streambed, but outside of the OHW marks, are not considered part of the streambed.
Stream channelization: The manipulation of a stream’s course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the U.S.
Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.
Temporal loss: The time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site(s) (33 CFR 332.2).
Temporary impacts: Temporary impacts include, but are not limited to, jurisdictional waters that are temporarily filled, flooded, excavated, or drained because of the regulated activity. Impacts are considered temporary when they are removed immediately upon completion of the activity. Note: An impact is considered temporary when the aquatic resource is restored to pre-project conditions, but effects to archaeological and/or cultural resources may be permanent in duration.
Tidal wetlands: A wetland that is subject to the ebb and flow of the tide. See the definition of “Waters of the U.S.” below.
Tide gates: Structures such as duckbills, flap gates, manual and self-regulating tide gates, etc. that regulate or prevent upstream tidal flows.
Turbidity: A measure of the level of particles such as sediment, plankton, or organic by-products, in a body of water. As the turbidity of water increases, it becomes denser and less clear due to a higher concentration of these light-blocking particles. Suspended solids are more likely to carry toxic chemicals, and can also negatively affect aquatic organisms, water temperature, and dissolved oxygen levels.
Utility line: Any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose that is not oil, natural gas, or petrochemicals. A utility line also includes any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and radio and television communication. The term ‘utility line’ does not include activities that drain a water of the U.S., such as drainage tile or French drains, but it does apply to pipes conveying drainage from another area.
Vegetated shallows: Permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as eelgrass *(Zostera marina)* and widgeon grass (*Rupia maritima*) in marine systems (does not include salt marsh) as well as a number of freshwater species in rivers and lakes. These are a type of SAS defined at 40 CFR 230.43. Vegetated shallows are commonly referred to as submerged aquatic vegetation or SAV. Vegetated shallow survey guidance is located at www.nae.usace.army.mil/missions/regulatory /jurisdiction-and-wetlands. Maps of vegetated shallows in Massachusetts are located at www.nae.usace.army.mil/missions/regulatory/state-general-permits/massachusetts-general-permit.
Vernal pools: For the purposes of these GPs, vernal pools are depressional wetland basins that typically dry up in most years and may contain inlets or outlets, typically of intermittent flow. Vernal pools range in both size and depth depending upon landscape position and parent material(s). In

most years, vernal pools support one or more of the following obligate indicator species: wood frog, spotted salamander, blue-spotted salamander, marbled salamander, Jefferson's salamander and fairy shrimp. However, they should preclude sustainable populations of predatory fish.

Water diversions: Water diversions are activities such as bypass pumping (e.g., "dam and pump") or water withdrawals. Temporary flume pipes, culverts or cofferdams where normal flows are maintained within the stream boundary's confines aren't water diversions. "Normal flows" are defined as no change in flow from pre-project conditions.

Waters of the United States (U.S.) These waterbodies are the waters where permits are required for the discharge of dredged or fill material pursuant to §404 of the CWA. These waters include but are not limited to navigable waters of the U.S. and tidal wetlands and include many non-tidal wetlands and other waterbodies. See definitions for navigable waters of the U.S., tidal wetlands, waterbody, and non-tidal wetlands. (33 CFR 328)

Waterbody: Examples of "waterbodies" include oceans, coastal waters, rivers, streams, ditches, lakes, ponds, and wetlands. If a wetland is adjacent to a waterbody determined to be a water of the U.S., that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)).

Weir: A barrier across a river designed to alter the flow characteristics. In most cases, weirs take the form of a barrier, smaller than most conventional dams, across a river that causes water to pool behind the structure and allows water to flow over the top. Weirs are commonly used to alter the flow regime of a river, prevent flooding, measure discharge and help render a river navigable.

Wetland: Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. The Corps of Engineers Wetlands Delineation Manual in conjunction with the associated regional supplement should be used to determine if a wetland is present and delineate wetland boundaries.

Acronyms

BMPs	Best Management Practices
BUAR	Massachusetts Board of Underwater Archaeological Resources
CWA	Clean Water Act
CZM	Coastal Zone Management
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EFH	Essential Fish Habitat
FNP	Federal Navigation Project
GC	General Condition
GP	General Permit
HTL	High Tide Line
IP	Individual Permit
LID	Low impact development
MassDEP	Massachusetts Department of Environmental Protection
MA DMF	Massachusetts Division of Marine Fisheries
MHC	Massachusetts Historical Commission
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
OHW	Ordinary High Water Mark
PCN	Preconstruction Notification
SAS	Special Aquatic Sites
SF	Square Feet
SV	Self-Verification
SHPO	State Historic Preservation Officer
THPO	Tribal Historic Preservation Officer
USFWS	U.S. Fish and Wildlife Service
USCG	U.S. Coast Guard
USFS	U.S. Forest Service
USGS	U.S. Geological Service
WQC	Water Quality Certification

Appendix A: Guidance for NHPA Section 106 Compliance in Massachusetts

1. Purpose & Applicability

Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C § 306108), requires Federal agencies to take into account the effects of their undertakings on Historic Properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. Therefore, in order for an activity to be eligible for authorization under the 2023 Massachusetts General Permit, the USACE must consider the effect the activity may have on historic properties. Historic properties may include, but are not limited to, historic districts, archaeological districts, sites, buildings, structures, objects, sacred sites, traditional cultural places, and traditional cultural landscapes that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

This guidance applies to projects that require authorization under Section 404 of the Clean Water Act (33 U.S.C. § 1344) and/or Section 10 of the Rivers and Harbors Act (33 U.S.C. §403) and will assist applicants when evaluating and documenting the presence of historic properties within or near their project site(s). The prospective applicant will evaluate their proposed project using the criteria below to determine if their project has the potential to affect historic properties and if so, whether or not historic properties are present or are likely to be present. All activities authorized under these GPs shall follow the terms outlined in General Condition 14: Historic Properties and General Condition 6: Tribal Rights & Burial Sites. Prospective applicants shall complete their due diligence according to the procedures below for their application to be deemed complete.

2. No Potential to Affect Historic Properties

Certain activities do not have the potential to cause effects on historic properties, assuming such historic properties were present, based on the nature of the activity and site-specific conditions. Therefore, these activities **do not** require historic property identification efforts or notification of the SHPO, THPOs, and/or BUAR under Section 106. The USACE has determined the following activities within the stated parameters have no potential to affect historic properties:

General Permit	Activity Parameters
1	Temporary buoys, markers and similar structures that are placed during winter events on ice and removed before spring thaw.
2	Repair or rehabilitation of structures that are less than 45 years in age. Any temporary structures or fills or work necessary to complete repairs or rehabilitation must not result in any ground disturbance.
3	Maintenance and replacement of moorings that are less than 45 years in age.
6	Maintenance, repair, replacement, or removal of utility lines, oil or natural gas pipelines, outfall or intake structures, and/or appurtenant features that are less than 45 years in age when all access, staging, and ground disturbance is strictly limited to previously disturbed areas (including any previous ground disturbance). Replacement must be in kind or smaller in size. Installation of tide gates on outfall structures that are less than 45 years in age.
7	Maintenance dredging of previously dredged areas where dredging does not extend beyond the original bottom elevations.

	Disposal of dredged material at an existing established and USACE-approved confined aquatic disposal cell. Beach nourishment in ongoing existing nourishment areas.
11	Fish and wildlife harvesting and attraction devices and activities.
13	Cleanup of hazardous and toxic waste materials, including contaminated sediments, that are less than 45 years in age.
16	Removal of land-based and water-based renewable energy generation facilities and hydropower projects that are less than 45 years in age.
18	Installation of buoys, floats, racks, trays, nets, lines, tubes, containers, and other structures for previously authorized by the USACE and ongoing aquaculture activities. Discharges of dredged or fill material into tidal or non-tidal waters necessary for shellfish seeding, rearing, cultivating, transplanting, and harvesting activities for previously authorized and ongoing aquaculture activities.
20	Maintenance activities for existing living shorelines excluding maintenance activities that require new ground disturbance such as excavation or re-sloping of the bank/shoreline.
22	Reshaping or maintenance of existing drainage ditches less than 45 years in age excluding ditch enlargement.
23	Placement of temporary and removable linear transportation and wetland/stream crossings that have no ground disturbance prior to placement, during placement, and during removal (i.e., placed on the surface and subsequently removed within one year of placement).
24	Placement of temporary and removable crossings and cofferdams that have no ground disturbance prior to placement, during placement, and during removal (i.e., placed on the surface and subsequently removed within one year of placement).
25	Emergency repair of existing structures and/or fills less than 45 years in age.

3. Historic Property Identification

If the activity does not fit under the criteria above, the following historic property identification efforts must be completed to demonstrate compliance with Section 106 of the NHPA. This includes documenting previously identified and unidentified historic properties in the project area.

a. Previously Identified Historic Properties: The prospective applicant shall document if previously identified historic properties are present on or adjacent to the project site by notifying the Massachusetts Historical Commission (MHC) and the Massachusetts Board of Underwater Archaeological Resources (BUAR), as appropriate, of the proposed project. The MHC and BUAR will check their records for the presence of any previously identified historic properties. The following outlines how prospective applicants should notify the MHC and BUAR.

i. The prospective applicant will notify the SHPO and BUAR to identify any previously recorded cultural resources. Applicants shall mail a completed Project Notification Form[18], project narrative, location (coordinates), plans, soil maps, and information on known cultural resources to the MHC. The MHC does not accept submissions via email. Applicants shall email or mail this information to the BUAR when the activity is located in lakes, ponds, rivers, and/or navigable waters in MA. Emailed file attachments should be <10MB. Any files >10MB shall be delivered via a file exchange system or the hard copy documents shall be mailed. Preferred contact information is listed below.

ii. **When sending this information, applicants must also document proof of receipt OR proof the information was delivered.** Proof of receipt constitutes a certified mail receipt, read email receipt, or other mail/email/online tracking services that document the information has reached the intended recipient(s). Proof the information was delivered constitutes a certificate of mailing, email delivery receipt, or other mail/email/online services that document the information was sent at a particular time. When using proof of delivery such (e.g., certificate of mailing), applicants should add 5 days to the 30-day notification period so the mail has time to reach its intended recipient. When using proof of receipt, the applicant may begin the 30-day notification period from the date received by the intended recipient.

iii. When mailing or emailing the application materials, applicants should include the following statement: “Please send responses to this notification directly to the USACE via email: cenae-r-ma@usace.army.mil or address regular mail responses to: Regulatory Division, U.S. Army Corps of Engineers, New England District, 696 Virginia Road, Concord, Massachusetts 01742-2751.” Email responses to the USACE are strongly preferred. The SHPO and BUAR will contact the USACE and cc the applicant(s) within 30 days of receiving the notification if their records indicate that historic properties are located in the project vicinity, and if additional review and/or surveys are recommended to ensure NHPA compliance. If the SHPO and/or BUAR do not respond within 30 days of receiving the notification, is it presumed that no known historic properties are present.

b. Previously Unidentified Historic Properties: The prospective applicant shall evaluate the project site and determine the sensitivity for the presence of historic properties if the project site has not been previously surveyed for cultural resources within the last 10 years. If the sensitivity is determined to be moderate to high, an intensive archaeological and/or architectural survey is required to investigate the potential presence of historic properties. The individual conducting this survey must meet the Secretary of the Interior’s Standards for Professional Qualifications (48 FR 44738-44739) in the discipline relevant to a particular resource type. For example, archeologists should not document and evaluate buildings or structures and architectural historians should not document and evaluate archaeological sites. The identification and qualifications for those participating in any survey and evaluation of resources should be included with the survey results. The criteria listed below are indicators of low sensitivity for the presence of historic properties for consideration when determining if an archaeological or architectural survey is needed.

Low sensitivity indicators:

- Previous archaeological and/or architectural survey within the last 10 years with negative results.
- In a location created in modern times (i.e., built on fill placed within the last 45 years or within an area excavated within the last 45 years).
- USACE has reviewed the project description and determined that a survey is not warranted based on the proposed activity and its location.

State survey guidance and standards are provided in the September 1995 Historic Properties Survey Manual Guidelines for the Identification of Historical and Archaeological Resources in Massachusetts available. State survey guidance and standards for underwater surveys are provided

[18] https://www.sec.state.ma.us/mhc/mhcform/formidx.htm

in the Board of Underwater Archaeological Resources' 2022 Policy Guidance on Archaeological Investigations and Related Survey Standards for the Discovery of Underwater Archaeological Resources. This guidance is available on the NAE Regulatory website: https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit/.

Please note, a negative result from MHC and/or BUAR does not necessarily mean no historic properties are present. Often proposed project sites have not been previously subject to a survey, so historic properties which may be present have not been previously recorded.

4. Tribal Coordination

Prospective applicants shall mail the Project Notification Form, project narrative, location (coordinates), plans with locus map, soil maps, and information on cultural resources to the Wampanoag Tribe of Gay Head (Aquinnah), Mashpee Wampanoag Tribe, Narragansett Indian Tribe, and/or Stockbridge-Munsee Community Band of Mohican Indians with interests in the project location. Preferred tribal contact information, including their respective areas of interest, can be found below. Applicants shall follow the same procedures as identified in Section 3(a)i-iii above when notifying Tribes of the proposed activity. Applicants shall provide the USACE with any responses received from the tribe(s) with their PCN application. If a tribe does not respond within 30 days of receiving the notification, the applicant shall provide USACE with all documentation of tribal outreach with their SV or PCN submission (e.g., emails, letters, phone call log, etc.). If the tribe indicates the presence of a previously unrecorded cultural resource, including a traditional cultural property (TCP) or traditional cultural landscape (TCL), a PCN is required.

5. Effect Determination

The project may have the potential to affect historic properties and/or tribal resources if 1) notification recipients respond within 30 calendar days of notification with concerns, 2) historic properties eligible for listing, or potentially eligible for listing in the NRHP, are present or 3) tribal resources are known to be present. The USACE may need to further review the project to confirm potential effects to historic properties and/or tribal resources. A PCN is required for any activity that may affect a historic property.

The USACE may determine the project will have 'no effect' on historic properties (i.e., no historic properties affected) when procedures outlined in Section 3 above are followed and no cultural resources are identified. Similarly, if historic properties are identified and will be completely avoided, the USACE may determine 'no effect.'

6. Contact Information:

Massachusetts Historical Commission

The Massachusetts Archives Building
220 Morrissey Boulevard
Boston, Massachusetts 02125

No email. Applicants or their representatives must send project information via certified mail and submit the certified mail receipt to the USACE or send via regular mail and submit proof of delivery.

Area of concern: All of Massachusetts.

Massachusetts Board of Underwater Archaeological Resources (BUAR)

100 Cambridge Street, Suite 900
Boston, Massachusetts 02114
Email: david.s.robinson@mass.gov

Applicants or their representatives must send project information via email (***strongly preferred***) or regular mail and provide proof of receipt or proof of delivery.

Area of concern: All waterbodies in Massachusetts.

Wampanoag Tribe of Gay Head (Aquinnah)

Bettina Washington
Tribal Historic Preservation Officer (THPO)
20 Black Brook Road
Aquinnah, Massachusetts 02535
Email: thpo@wampanoagtribe-nsn.gov

Applicants or their representative must send project information via email (***preferred***) or regular mail and provide proof of receipt or proof of delivery.

Area of concern: All of Massachusetts.

Mashpee Wampanoag Tribe

ATTN: David Weeden
Tribal Historic Preservation Officer (THPO)
483 Great Neck Road South
Mashpee, Massachusetts 02649
Email: 106review@mwtribe-nsn.gov
Cc: David.weeden@mwtribe-nsn.gov

Applicants or their representative must send project information via email (***preferred***) or regular mail and provide proof of receipt or proof of delivery.

Area of concern: All of Massachusetts.

Narragansett Indian Tribe

ATTN: John Brown
Tribal Historic Preservation Officer (THPO)
Narragansett Indian Longhouse
4425 South County Trail
Charlestown, Rhode Island 02813
Email: tashtesook@aol.com

Applicants or their representative must send project information via email (***preferred***) or regular mail and provide proof of receipt or proof of delivery.

Area of concern: Massachusetts east of the Connecticut River.

Stockbridge-Munsee Community Band of Mohican Indians

ATTN: Jeff Bendremer
Tribal Historic Preservation Manager
Stockbridge-Munsee Community
Tribal Historic Preservation Extension office
86 Spring Street
Williamstown, Massachusetts 01267
Email: thpo@mohican-nsn.gov

Applicants or their representative must send project information via email (***preferred***) or regular mail and provide proof of receipt or proof of delivery.

Area of concern: West of the Connecticut River and Northfield, Montague, Miller's Falls, Turner's Falls, Sunderland, Amherst, Hadley, South Hadley, Chicopee, Springfield and Longmeadow.

APPENDIX B PRE-CONSTRUCTION NOTIFICATION

U.S. Army Corps of Engineers (USACE), New England District (NAE)

PRE-CONSTRUCTION NOTIFICATION (PCN)

DATA REQUIRED BY THE PRIVACY ACT OF 1974

Authority Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332.

Principal Purpose The information provided will be used in evaluating activities under Pre-Construction Notification procedures within New England.

Routine Uses This information may be shared with other federal, state, and local government agencies during the application review process. Submission

Disclosure of requested information is voluntary. However, if information is not provided the PCN application cannot be fully evaluated nor can USACE render a permit decision.

Instructions The applicant must complete ALL required sections of this document before their submission to USACE. The PCN submission to USACE shall include one set of drawings which show the location and character of the proposed activity, statements that address each required field below, and documentation that supports each field (e.g., emails, letters, description/narrative, phone calls, surveys, reports, etc.). Electronic submissions to the following address are strongly preferred: cenae-r-ma@usace.army.mil. The email subject line shall contain the following: General Permit #, PCN, City/Town, and date submitted. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY USACE)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (*agent is not required*)
First - Middle - Last -	First - Middle - Last -
Company -	Company -
E-mail Address -	E-mail Address -
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address-	Address-
City - State - Zip - Country -	City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. with AREA CODE	10. AGENT'S PHONE NOs. with AREA CODE
a. Residence b. Business c. Fax d. Mobile	a. Residence b. Business c. Fax d. Mobile

STATEMENT OF AUTHORIZATION

11. I hereby authorize, _____ to act on my behalf as my agent in the processing of this general permit PCN application and to furnish, upon request, supplemental information in support of this general permit PCN application.

_____ _____

SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME or TITLE (*see instructions*)

13. NAME OF WATERBODY, IF KNOWN (*if applicable*)	14. PROPOSED ACTIVITY STREET ADDRESS (*if applicable*)
15. LOCATION OF PROPOSED ACTIVITY (*see instructions*)	City: State: Zip:
Latitude: °N Longitude: °W	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (*see instructions*)

State Tax Parcel ID: Municipality:

Section: Township: Range:

17. DIRECTIONS TO THE SITE.

18. IDENTIFY THE SPECIFIC GENERAL PERMIT(S) YOU PROPOSE TO USE:

19. DESCRIPTION OF PROPOSED GENERAL PERMIT ACTIVITY (*see instructions*)

20. DESCRIPTION OF PROPOSED MITIGATION MEASURES (*see instructions*)

21. PURPOSE OF GENERAL PERMIT ACTIVITY (*Describe the reason or purpose of the project, see instructions*)

22. Quantity of Wetlands, Streams, or Other Types of Waters Directly Affected by Proposed General Permit Activity (*see instructions*)

Area (square feet)	Length (linear feet)	Volume (cubic yards)	Duration	Purpose

Each PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site.

23. List any other GP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project on any related activity (*see instructions*)

24. If the proposed activity will result in the loss of aquatic resources that exceed those identified in the New England District Compensatory Mitigation Thresholds, explain how the compensatory mitigation requirement will be satisfied. (*see instructions*)

25. Is Any Portion of the General Permit Activity Already Complete? ☐ Yes ☐ No If Yes, describe the completed work:

26. List the name(s) of any species listed as endangered or threatened under the Endangered Species Act that might be affected by the proposed GP activity or utilize the designated critical habitat that might be affected by the proposed GP activity. (*see instructions*)

27. List any historic properties that have the potential to be affected by the proposed GP activity or include a vicinity map indicating the location of the historic property or properties. Attach relevant project information, along with any responses received from project notifications to this submittal. (*see instructions*)

28. For a proposed GP activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, identify the Wild and Scenic River or the "study river":

29. If the proposed GP activity also requires permission from the USACE pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, have you submitted a written request for section 408 permission from the USACE district having jurisdiction over that project? ☐ Yes ☐ No

If "yes", please provide the date your request was submitted to the USACE District:

30. Does the activity require a 401 Water Quality Certification (WQC)? If so, specify the type of 401 WQC that is required (general or individual). In cases where an individual 401 WQC is required, provide the date the 401 WQC certification request was submitted to the certifying authority and their contact information.

31. If the terms of the GP(s) you want to use require additional information to be included in the PCN (i.e. sampling and analysis plan), please include that information in this space or provide it on an additional sheet of paper marked Block 30. (*see instructions*)

32. I certify that the information in this pre-construction notification is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The Pre-Construction Notification must be signed by the person who desires to undertake the proposed activity (applicant) and, if the statement in block 11 has been filled out and signed, the authorized agent.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Instructions for Preparing a

Department of the Army

General Permit (GP) Pre-Construction Notification (PCN)

Blocks 1 through 4. To be completed by the U.S. Army Corps of Engineers.

Block 5. Applicant' Name. Enter the name and the e-mail address of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the PCN, please attach a sheet of paper with the necessary information marked Block 5.

Block 6. Address of Applicant. Please provide the full address of the party or parties responsible for the PCN. If more space is needed, attach an extra sheet of paper marked Block 6.

Block 7. Applicant Telephone Number(s). Please provide the telephone number where you can usually be reached during normal business hours.

Blocks 8 through 11. To be completed, if you choose to have an agent.

Block 8. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, consultant, or any other person or organization. Note: An agent is not required.

Blocks 9 and 10. Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone number where they can be reached during normal business hours.

Block 11. Statement of Authorization. To be completed by the applicant, if an agent is to be employed.

Block 12. Proposed General Permit Activity Name or Title. Please provide a name identifying the proposed GP activity, e.g., Windward Marina, Rolling Hills Subdivision, or Smith Commercial Center.

Block 13. Name of Waterbody. Please provide the name (if it has a name) of any stream, lake, marsh, or other waterway to be directly impacted by the GP activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 14. Proposed Activity Street Address. If the proposed GP activity is located at a site having a street address (not a box number), enter it in Block 14.

Block 15. Location of Proposed Activity. Enter the latitude and longitude of where the proposed GP activity is located. Indicate whether the project location provided is the center of the project or whether the project location is provided as the latitude and longitude for each of the "corners" of the project area requiring evaluation. If there are multiple sites, please list the latitude and longitude of each site (center or corners) on a separate sheet of paper and mark as Block 15.

Block 16. Other Location Descriptions. If available, provide the Tax Parcel Identification number of the site, Section, Township, and Range of the site (if known), and / or local Municipality where the site is located.

Block 17. Directions to the Site. Provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site. You may also provide a description of the location of the proposed GP activity, such as lot numbers, tract numbers, or you may choose to locate the proposed GP activity site from a known point (such as the right descending bank of Smith Creek, one mile downstream from the Highway 14 bridge). If a large river or stream, include the river mile of the proposed GP activity site if known. If there are multiple locations, please indicate directions to each location on a separate sheet of paper and mark as Block 17.

Block 18. Identify the Specific General Permit(s) You Propose to Use. List the number(s) of the General Permit(s) you want to use to authorize the proposed activity (e.g., GP 4).

Block 19. Description of the Proposed General Permit Activity. Describe the proposed GP activity, including the direct and indirect adverse environmental effects of the proposed activity. The description of the proposed activity should be sufficiently detailed for USACE to determine that the adverse environmental effects of the activity will be no more than minimal. Identify the materials to be used in construction, as well as the methods by which the work is to be done.

Provide drawings to show that the proposed GP activity complies with the terms of the applicable GP(s). Drawings should contain sufficient detail to provide an illustrative description of the proposed GP activity, but do not need to be detailed engineering plans. The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked Block 19.

Block 20: Description of Proposed Mitigation Measures. Describe any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed GP activity. The description of any proposed mitigation measures should be sufficiently detailed for USACE to determine how the measures would avoid and minimize adverse environmental effects. If adverse effects exceed the New England District compensatory mitigation thresholds, you must document how compensatory mitigation would be satisfied in Block 24.

Block 21. Purpose of General Permit Activity. Describe the purpose and need for the proposed GP activity. What will it be used for and why? Also include a brief description of any related activities associated with the proposed project. Provide the approximate dates you plan to begin and complete all work.

Block 22. Quantity of Wetlands, Streams, or Other Types of Waters Directly Affected by the Proposed General Permit Activity. For discharges of dredged or fill material into Waters of the U.S., provide the amount of wetlands, streams, or other types of waters filled, flooded, excavated, or drained by the proposed GP activity. For structures or work in Navigable Waters of the U.S. subject to Section 10 of the Rivers and Harbors Act of 1899, provide the amount of navigable waters filled, dredged, occupied by one or more structures (e.g., aids to navigation, mooring buoys) by the proposed GP activity. The area of impact includes the structures or fills with direct or indirect effects to waters of the U.S. The length of impact includes the length of a stream, including is banks, that are directly affected by the structures or fills. The duration of impact should be identified as temporary (xx days) or permanent. The impact purpose should briefly describe what structure or fill is responsible for the impact.

Block 23. Identify Any Other General Permit(s), Regional General Permit(s), or Individual Permit(s) Used to Authorize Any Part of Proposed Activity or Any Related Activity. List any other GP(s) or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. For linear projects, list other separate and distant crossings of waters and wetlands authorized by these GPs that do not require PCNs. If more space is needed, attach an extra sheet of paper marked Block 23.

Block 24. Compensatory Mitigation Statement for Losses Greater Than the New England District Compensatory Mitigation Thresholds. New England District requires compensatory mitigation at a minimum one for one replacement ratio or greater for all aquatic resource losses that require a PCN and exceed the New England District Compensatory Mitigation Thresholds, unless USACE determines in writing that either some other form of mitigation is more environmentally appropriate or the adverse environmental effects of the proposed GP activity are no more than minimal without compensatory mitigation, and provides an activity specific waiver of this requirement. Describe the proposed compensatory mitigation for wetland losses greater than the New England District Compensatory Mitigation Thresholds or provide an explanation of why USACE should not require wetland compensatory mitigation for the proposed GP activity. If more space is needed, attach an extra sheet of paper marked Block 24.

Block 25. Is Any Portion of the General Permit Activity Already Complete? Describe any work that has already been completed for the GP activity.

Block 26. List the Name(s) of Any Species Listed As Endangered or Threatened under the Endangered Species Act that Might be Affected by the General Permit Activity. If you are not a federal agency, and if any listed species or designated critical habitat might be affected or is in the vicinity of the proposed GP activity, or if the proposed GP activity is located in designated critical habitat, list the name(s) of those endangered or threatened species that might be affected by the proposed GP activity or utilize the designated critical habitat that might be affected by the proposed GP activity. If you are a Federal agency, and the proposed GP activity requires a PCN, you must provide documentation demonstrating compliance with Section 7 of the Endangered Species Act.

Block 27. List Any Historic Properties that Have the Potential to be Affected by the General Permit Activity. If you are not a federal agency, and if any historic properties have the potential to be affected by the proposed GP activity, list the name(s) of those historic properties that have the potential to be affected by the proposed GP activity. Provide all relevant documentation about these historic properties in the PCN submittal. If you are a Federal agency, and the proposed GP activity requires a PCN, you must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

Block 28. List the Wild and Scenic River or Congressionally Designated Study River if the General Permit Activity Would Occur in such a River. If the proposed GP activity will occur in a river in the National Wild and Scenic River System or in a river officially designated by Congress as a “study river” under the Wild and Scenic Rivers Act, provide the name of the river. For a list of Wild and Scenic Rivers and study rivers, please visit http://www.rivers.gov/

Block 29. General Permit Activities that also Require Permission from the USACE Under 33 U.S.C. 408. If the proposed GP activity also requires permission from the USACE under 33 U.S.C. 408 because it will temporarily or permanently alter, occupy, or use a USACE federal authorized civil works project, indicate whether you have submitted a written request for section 408 permission from the USACE district having jurisdiction over that project.

Block 30. 401 Water Quality Certification. As described above, specify if the activity requires a 401 WQC from the certifying authority.

Block 31. Other Information Required For General Permit Pre Construction Notifications. The terms of some of the General Permits include additional information requirements for preconstruction notifications:

* Maintenance – information regarding the original design capacities and configurations of the outfalls, intakes, small impoundments, and canals.
* Temporary Construction, Access, and Dewatering – a restoration plan showing how all temporary fills and structures will be removed and the area restored to pre-project conditions.
* Repair of Uplands Damaged by Discrete Events – documentation, such as a recent topographic survey or photographs, to justify the extent of the proposed restoration.
* Commercial Shellfish Aquaculture Activities – (1) a map showing the boundaries of the project area, with latitude and longitude coordinates for each corner of the project area; (2) the name(s) of the species that will be cultivated during the period this GP is in effect; (3) whether canopy predator nets will be used; (4) whether suspended cultivation techniques will be used; and (5) general water depths in the project area (a detailed survey is not required).Dredging – (1) a proposed sampling and analysis plan shall be provided to USACE for approval prior to its execution. Pre-application meetings are encouraged.
* Beach Nourishment – sediment grain size should be determined for the length of the beach where nourishment is proposed. The frequency and locations of sediment sampling shall be sufficient to identify the sediment composition of the beach profile. This data shall be consolidated to generate a sediment gradation curve for each sampled transect. Each sampled transect should also be identified on the project plans (drawings).

If more space is needed, attach an extra sheet of paper marked Box 31.

Block 32. Signature of Applicant or Agent. The PCN must be signed by the person proposing to undertake the GP activity, and if applicable, the authorized party (agent) that prepared the PCN. The signature of the person proposing to undertake the GP activity shall be an affirmation that the party submitting the PCN possesses the requisite property rights to undertake the GP activity (including compliance with special conditions, mitigation, etc.).

DELINEATION OF WETLANDS, OTHER SPECIAL AQUATIC SITES, AND OTHER WATERS

Each PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current wetland delineation manual and regional supplement published by the USACE. The permittee may ask the USACE to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the USACE does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. The 60-day PCN review period will not start until a delineation has been completed.

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a Vicinity Map, a Plan View or a Typical Cross Section Map. Identify each illustration with a figure or attachment number. For linear projects (e.g. roads, subsurface utility lines, etc.) gradient drawings should also be included. Please submit one copy of all drawings on 8½ x 11 inch plain white paper (electronic submissions preferred). Use the fewest number of sheets necessary for your drawings or illustrations. Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross section). While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.

ADDITIONAL INFORMATION AND REQUIREMENTS

For proposed GP activities that involve discharges into waters of the United States, water quality certification from the State, Tribe, or EPA must be obtained or waived. Some States, Tribes, or EPA have issued water quality certification for one or more GPs. Please check the New England District website to see if water quality certification has already been issued for the GP(s) you wish to use. For proposed GP activities in coastal states, state Coastal Zone Management Act consistency concurrence must be obtained, or a presumption of concurrence must occur. Some States have issued Coastal Zone Management Act consistency concurrences for one or more GPs. Please check the New England District website to see if Coastal Zone Management Act consistency concurrence has already been issued for the GP(s) you wish to use.

APPENDIX C SELF-VERIFICATION NOTIFICATION

U.S. Army Corps of Engineers (USACE)

SELF-VERIFICATION NOTIFICATION (SVN)

DATA REQUIRED BY THE PRIVACY ACT OF 1974

Authority Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332.

Principal Purpose This information will be used in evaluating activities under Self-Verification procedures within Massachusetts.

Routine Uses Routine uses will include: (1) Documenting compliance with the terms and conditions of the General Permit (GP) for activities that may require authorization pursuant to one or more of USACE's Regulatory authorities. (2) Records may be referred to other Federal, State, and local agencies for evaluation and enforcement purposes.

Disclosure Failure to fully comply and abide by the GP terms and conditions prior to commencing work and after completion project may result in formal enforcement action, up to and including monetary penalties and/or legal action, pursuant to 33 CFR Part 326.

Instructions The permittee must complete ALL required sections of this document before commencing USACE-regulated activities. A copy of this completed SVN must be kept on site during construction and be made available for review by USACE and other Federal, State, & Local regulatory authorities at any time. Within 30 days of initiating project construction, the permittee shall submit the completed SVN to USACE. The SVN shall be submitted to USACE as **ONE signed document** that includes project plans and documentation that supports each field (e.g., emails, letters, description, phone calls, surveys). Electronic submissions to the following address are strongly preferred: cenae-r-ma-sv@usace.army.mil. The email subject line shall contain the following: GP #, SVN, City/Town, and date submitted.

(ITEMS 1 THRU 3 TO BE FILLED BY USACE)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED

APPLICANT AND AGENT INFORMATION

4. APPLICANT'S NAME	7. AGENT'S ADDRESS:
First - Middle - Last -	First - Middle - Last -
Company -	Company -
E-mail Address -	E-mail Address -
5. APPLICANT'S ADDRESS:	8. AGENT'S ADDRESS:
Address-	Address-
City - State - Zip - Country -	City - State - Zip - Country -
6. APPLICANT'S PHONE NOs. w/AREA CODE	9. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business c. Fax	a. Residence b. Business c. Fax

NAME, LOCATION, AND DESCRIPTION OF PROJECT SITE

10. PROJECT NAME OR TITLE

11. FILE NUMBER(S) OF PREVIOUS USACE ACTIONS ON THE SITE (if applicable)	12. NAME OF WATERBODY
13. PROJECT COORDINATES (in decimal degrees)	14. PROJECT STREET ADDRESS (if applicable)
Latitude: ◦N Longitude: ◦W	Address
	City - State - Zip -

ACTIVITY TYPE, PROJECT IMPACTS, AVOIDANCE & MINIMIZATION

15. GENERAL PERMIT ACTIVITIES (CHECK ALL THAT APPLY)

1 ☐	6 ☐	11 ☐	16 ☐	21 ☐
2 ☐	7 ☐	12 ☐	17 ☐	22 ☐
3 ☐	8 ☐	13 ☐	18 ☐	23 ☐
4 ☐	9 ☐	14 ☐	19 ☐	24 ☐
5 ☐	10 ☐	15 ☐	20 ☐	25 ☐

16. SUMMARY OF PROJECT IMPACTS (*see instructions*)

Area (square feet)	Length (linear feet)	Volume (cubic yards)	Duration

17. PROJECT PLANS (BY CHECKING THE BOXES BELOW, YOU CERTIFY THESE ITEMS ARE COMPLETE) (*see instructions*)

- ☐ a. Plans shall at least contain the following: Vicinity Map, Plan View, and Typical Cross Section View of the proposed activity.
- ☐ b. All direct, indirect and secondary impacts from USACE regulated activities are shown on the project plans.
- ☐ c. The size of the impact area for each activity (acre, square feet, linear feet) are shown on the project plans.
- ☐ d. For discharges of fill material (§404), the volume of fill material is identified on the project plans.
- ☐ e. The duration of each impact, permanent or temporary (X days), is identified on the project plans.
- ☐ f. Do activities with permanent impacts result in the loss of waters? If so, this is identified on the project plans.
- ☐ g. All aquatic resources in the vicinity of the USACE regulated activities are delineated on the project plans.

18. AVOIDANCE & MINIMIZATION (BY CHECKING THE BOXES BELOW, YOU CERTIFY THESE CRITERIA ARE MET) (*see instructions*)

- ☐ a. The project has been designed to avoid and minimize impacts to aquatic resources.
- ☐ b. The footprint of activities in waters of the U.S. has been reduced to only what is necessary to achieve the overall project purpose.
- ☐ c. All practicable measures have been taken to avoid and minimize impacts to aquatic resources through construction techniques and site access (e.g., Best Management Practices, Time of Year Restrictions).
- ☐ d. All temporary impacts from USACE regulated activities will be restored upon completion of construction and the project area will be returned to pre-construction contours and conditions.

COMPLIANCE WITH FEDERAL REGULATIONS & SUPPLEMENTAL INFORMATION

19. DUE DILIGENCE (*see instructions*)

Complete the entries below to document compliance with the following Federal requirements. Construction may NOT begin if a PCN is/may be required, and you must contact USACE to determine permitting requirements. Documentation that demonstrates how the activity complies with each field below shall be submitted to the USACE as noted in the instructions block. See each General Condition (GC) in the GP for how to comply with each requirement.

a. State Historic Preservation Officer	Select Option		
b. Massachusetts BUAR	Select Option		
c. Tribal Historic Preservation Officers	Select Option		
d. Endangered Species Act - NOAA	Select Option		
e. Endangered Species Act - USFWS	Select Option		
f. Northern Long Eared Bat (ESA)	Select Option		
g. Essential Fish Habitat	Select Option		
h. Wild & Scenic Rivers	Select Option		
i. 401 Water Quality Certification 401	Select Option		
	401 WQC/OOC File Number:	OOC issued:	401 issued:
j. Section 408 Permission	Select Option		
k. Coastal Zone	Select Option		
l. Construction Mats	Select Option		
m.Time of Year Restrictions	Select Option		
n. Vernal Pools	Select Option		
o. Sediment & Erosion Controls	Select Option		
p. Stream/Wetland Crossings	Select Option		

20. AQUACULTURE ACTIVITIES - GP 18 (*see instructions*)

- ☐ a. If required, an Aquaculture Certification from the Massachusetts Division of Marine Fisheries was obtained prior to commencing work.
- ☐ b. Coordination with the U.S. Coast Guard pursuant to Private Aids to Navigation has occurred prior to commencing work.
- ☐ c. If required, a MEPA Certificate was obtained from the Massachusetts Environmental Protection Agency prior to commencing work. Select Option
- ☐ d. The prospective permittee contacted local authorities (e.g. harbormaster, select board, shellfish constable) for authorization of their facility prior to commencing work.

21. ADDITIONAL INFORMATION/ATTACHMENTS (*see instructions*)

- ☐ a. The project plans are enclosed in this SVN submittal (see block 17).
- ☐ b. The activity Select Option funded through the Bipartisan Infrastructure Bill (also known as the Infrastructure Investment and Jobs Act).
- ☐ c. All required state, local and federal approvals were acquired prior to starting construction in USACE jurisdiction.
- ☐ d. After construction of the activity is completed, a complete Certificate of Compliance will be submitted to USACE.

22. IS THERE ANOTHER LEAD FEDERAL AGENCY:

☐ YES ☐ NO

23. STATEMENT OF AUTHORIZATION *(see instructions)*

I certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

24. SIGNATURES *(see instructions)*

I hereby certify that the information in this Self-Verification Notification is complete and accurate. As the applicant or their duly authorized agent, I certify the activity was completed in accordance with the terms and conditions of the GP. This includes all applicable terms, general conditions, and activity-specific GP criteria. I agree to allow the duly authorized representatives of the Corps of Engineers Regulatory Program and other regulatory or advisory agencies to enter upon the premises of the project site at reasonable times to evaluate inspect and photograph site conditions. This consent to enter the property is superior to, takes precedence over, and waives any communication to the contrary. For example, if the property is posted as “no trespassing” this consent specifically supersedes and waives that prohibition and grants permission to enter the property despite such posting.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Instructions for Preparing a
Department of the Army
General Permit (GP) Self-Verification

Blocks 1 through 3. To be completed by the Corps of Engineers.

Block 4. Applicant' Name. Enter the name and the e-mail address of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the self-verification, please attach a sheet of paper with the necessary information marked Block 4.

Block 5. Address of Applicant. Please provide the full address of the party or parties responsible for the self-verification. If more space is needed, attach an extra sheet of paper marked Block 5.

Block 6. Applicant Telephone Number(s). Please provide the telephone number where you can usually be reached during normal business hours.

Blocks 7 through 9. To be completed, if you choose to have an agent.

Block 7. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, consultant, or any other person or organization. Note: An agent is not required.

Blocks 8 and 9. Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone number where they can be reached during normal business hours.

Block 10. Proposed General Permit Activity Name or Title. Please provide a name identifying the proposed GP activity, e.g., Windward Marina, Rolling Hills Subdivision, or Smith Commercial Center.

Block 11. File Number(s) of Previous USACE Actions on the Site Please provide any known USACE file number. If the activity does not have a known USACE file number, you may state N/A.

Block 12. Name of Waterbody. Please provide the name (if it has a name) of any stream, lake, marsh, or other waterway to be directly impacted by the GP activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 13. Proposed Activity Coordinates. Please enter the latitude and longitude of where the proposed GP activity is located. Indicate whether the project location provided is the center of the project or whether the project location is provided as the latitude and longitude for each of the "corners" of the project area. If there are multiple sites, please list the latitude and longitude of each site (center or corners) on a separate sheet of paper and mark as Block 13.

Block 14. Proposed Activity Street Address. If the proposed activity is located at a site having a street address (not a box number), enter it in Block 14.

Block 15. General Permit Activity Type. Please select all GP activity types that apply to the proposed activity. A list of GP activity types can be found in Section III of the GP.

Block 16. Summary of Project Impacts. Please provide ALL proposed impacts, both temporary and permanent in duration, that are located in Waters of the United States. The area of impact shall be provided in square feet (SF). When applicable, impacts that result in conversion of stream bank or shoreline must also be identified in linear feet (LF). Dredging or the discharge of dredged or fill material shall also include the volume, cubic yards (CY), of material removed from or placed into Waters of the U.S. If more entries are required, please attach a table matching the desired format in Block 16.

Block 17. Project Plans. Please verify that items a-g are included in the project plans. Three types of illustrations are necessary to properly depict the proposed work. These illustrations or drawings are identified as a Vicinity Map, a Plan View (Aerial view) and a Cross Section Map. For linear projects (e.g. roads, subsurface utility lines, etc.) gradient drawings (longitudinal profile) should also be included. Plans must accurately depict the existing conditions and all aspects of the proposed activity located in waters of the U.S. Please submit one copy of all drawings formatted to print on 8½ x 11 inch or 11 x 17 inch plain white paper. Use the fewest number of sheets necessary for your drawings or illustrations. Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross section). While illustrations need not be certified engineering sheets; they should be clear, accurate, contain all necessary information, and depict all proposed work. Each submission must also include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current wetland delineation manual and regional supplement published by USACE.

Block 18. Avoidance & Minimization. Please verify that items a-d have been implemented for the proposed activity.

Block 19. Due Diligence. Please complete all the fields and submit documentation to USACE to demonstrate compliance with the above requirements. This Documentation may include emails, letters, meeting notes, phone call log, project narrative, project plans, a species list from the NOAA Section 7 Mapper, a completed copy of the IPAC determination keys, etc. Documentation should be limited to what is necessary to demonstrate how the proposed activity meets each requirement. Refer to the MA GP, Appendix A, for specific guidance on the identification of previously identified historic properties and previously unidentified historic properties. Endangered Species: *The applicant must be designated as the non-federal representative for the purposes of Section 7 consultation to select the Rangewide D-Key options. Otherwise, the applicant shall select the following option when IPAC indicates the NLEB is present: "The activity IS located within the NLEB Species Range (PCN Required)."

Block 20. Aquaculture Activities. Please verify that items a-d have been obtained or completed prior to commencing work in waters of the U.S.

Block 21. Additional Information/Attachments. Please verify that items a-d have been completed prior to commencing work in waters of the U.S.

Block 22. Lead Federal Agency. Please identify if there is another lead federal agency involved with the proposed activity. Enter the lead federal agency name (e.g., the Federal Emergency Management Agency, FEMA) and the agency's designated person of contact for the activity.

Block 23. Statement of Authorization. The applicant shall sign this section for all activities. If an agent is to be employed, the agent shall sign this section.

Block 24. Signatures. The SVN must be signed by the person proposing to undertake the GP activity, and if applicable, the authorized party (agent) that prepared the SVN. The signature of the person proposing to undertake the GP activity shall be an affirmation that the party submitting the SVN possesses the requisite property rights to undertake the GP activity.

US Army Corps of Engineers®
New England District

APPENDIX D: PCN APPLICATION CHECKLIST

The following information shall be submitted for all PCNs for USACE to properly evaluate your application. Some applications may require more information and this checklist is offered as a tool to assist applicants with submitting a complete application.

SECTION 1: GENERAL APPLICATION INFORMATION

1. ☐ Complete the Pre-Construction Notification document (Appendix B).
2. ☐ Specify which local/state/federal authorizations are required for the project and if any have been obtained or applied for at the time of USACE application submittal.
3. ☐ Identify all funding sources the project will receive or has received to date. Provide any relevant information in the application submission.
4. ☐ Is this part of a larger project that is being implemented in phases? If so, describe the project schedule and how each phase will be implemented.
5. ☐ Describe the existing conditions on the site and the general land use in the vicinity of the project at the time application submittal.
6. ☐ Provide any historic information available that you may have of project area, e.g., existing USACE permit numbers, the names under which the permits were obtained if the permit numbers are unknown, construction dates and proof of prior existence (aerials, photos, town hall records, affidavits, state or local permits, etc.) to verify that the project predates regulation and is "vested".[19]
7. ☐ The anticipated start and end dates for construction.

SECTION 2: WETLAND DELINEATION

8. ☐ Data used to support aquatic resource boundary determinations (delineation forms, delineation map(s) that show the locations of each aquatic resource in the project area, aerial and ground photographs, LIDAR imagery, national wetland inventory maps, soil maps, national hydrography dataset maps, floodplain maps, historical imagery, etc.).
9. ☐ Photographs of the wetland(s) and/or waterway(s) where impacts are proposed. Photos at low tide are preferred for work in tidal waters.
10. ☐ Indicate the relationship of the project area to waters of the U.S., i.e., adjacent wetlands, tidal influence or hydraulic connectivity through culverts, or other conveyances, etc.
11. ☐ At minimum the delineation map/figure should include the following:
    a. Contour lines showing topography.
    b. North arrow.
    c. Bar and text scale.
    d. Legend.
    e. Drawn project boundary.
    f. High tide line, mean high water, mean low water, ordinary high water mark, and/or wetland boundaries.
    g. Captions with a unique name for each aquatic resource and the area or length of the aquatic resource within the project area.

[19] Vested is exempt (someone or something) from a new law or regulation.

h. Appropriate landmarks and features (e.g., culverts, special aquatic sites, etc.).
i. Points showing the paired upland and wetland delineation locations for tidal and non-tidal wetlands only.

SECTION 3: AVOIDANCE & MINIMIZATION

12. ☐ Describe specific measures taken to avoid impacts to aquatic resources or describe why aquatic resources could not be avoided while achieving the project purpose and need.
13. ☐ For impacts to aquatic resources that could not be avoided, describe specific considerations/ measures taken to minimize the area of proposed impacts to aquatic resources in designing the project.
14. ☐ Describe specific measures taken to avoid and minimize the proposed direct, indirect, and secondary impacts to aquatic resources and their functions through construction techniques and timing.
15. ☐ If applicable, provide a restoration plan that describes how all temporary fills and structures will be removed and the area restored to pre-impact conditions (see GC 22).
16. ☐ If applicable, provide an Invasive Species Control Plan (see GC 29). For sample control plans, see www.nae.usace.army.mil/missions/regulatory/invasive-species.
17. ☐ If applicable, describe how the proposed wetland/waterbody crossing is compliant with GC 31, Stream Work and Crossings, and Wetland Crossings.

SECTION 4A: PROJECT IMPACTS

18. ☐ Describe the overall project and the activities located in Waters of the U.S. (WOTUS) that you are seeking authorization for.
19. ☐ Identify the following for project impacts in WOTUS:
    a. ☐ Direct, indirect, secondary impacts[20] within WOTUS.
    b. ☐ The size of each impact (square feet or acres, or linear feet).
    c. ☐ For discharges of fill material (§404), specify the volume of fill material to be discharged (cubic yards).
    d. ☐ The impact duration from each activity, permanent or temporary (X days).

SECTION 4B: PROJECT PLANS

20. ☐ Submit project plans that depict all impacts in WOTUS. On the project plans, applicants shall provide:

General Information

    a. ☐ Plan view and typical cross-section view sheets that show the existing and proposed conditions. These illustrations should each be identified with a figure number, date of the map, the project title, the name of the applicant and the type of illustration (vicinity map, plan view, or cross section).
    b. ☐ Drawings, sketches, or plans that are legible, reproducible (color is encouraged, but features must be distinguishable in black and white), drawn to scale, and no larger than 11”x17” and 10 MB when submitted in digital format. Numeric and graphic/bar scales must agree, and plan details must be measurable using a standard engineer’s scale on printed plans. Reduced plans are not acceptable.
    c. ☐ The north arrow and remove miscellaneous non-wetland or water project related features such as conduits, utility poles, guardrails, etc.

[20] See definitions section for the definitions of direct, indirect, secondary impacts.

d. ☐ Clearly draw the overall limits of work, staging areas, disposal sites, access routes, and any permittee responsible mitigation sites. These areas may include both aquatic resources and upland areas.
e. ☐ Names or numbers of all roads in the site's vicinity and ownership and numbers of abutting parcels.
f. ☐ Datum in plan and elevation views. The horizontal datum shall be in the NAD 83 Massachusetts State Plane Coordinate System (INSERT) in U.S. survey feet. The vertical data in coastal projects shall be referenced to either MLLW or the North American Vertical Datum of 1988 (NAVD 88). Both the distance and depth units shall be U.S. survey feet and specified on the project plans.

Aquatic Resources & Project Impacts

g. ☐ Delineation of all aquatic resource types on site including salt marsh; other special aquatic sites (vegetated shallows, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges); other waters, such as lakes, ponds, vernal pools, natural rocky habitat (tidal only), and perennial, intermittent, and ephemeral streams.
h. ☐ Identify the substrate type (cobble/gravel, organic detritus, sand/shell, silt, mud) and the approximate percentage of each substrate type on site. Grain sizes shall be based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders. Sediment samples with a content of 10% or more of pebble-gravel-cobble and/or boulder in the top layer (6-12 inches) should be delineated and material with epifauna/macroalgae should be differentiated from bare pebble-gravel-cobble and boulder.
i. ☐ The direction of ebb and flood in tidal waters and direction of flow in non-tidal waters.
j. ☐ In tidal waters, the project boundary distance from special aquatic sites identified in 20g above if within 25 feet from that resource.
k. ☐ USACE jurisdictional boundaries including ordinary high-water mark (OHWM), high tide line (HTL), mean high water (MHW). Other boundaries include mean low water (MLW), mean lower low water (MLLW), as applicable.
   - Non-tidal: OHWM and/or wetland boundaries.
   - Tidal (structures/work only): MHW, MLW.
   - Tidal (Fill and Structures/work): HTL, MHW, MLW.
   - Tidal (Dredging/Beach Nourishment): HTL, MHW, MLW, MLLW.
l. ☐ Identification of each aquatic resource with a unique name (ex. Wetland 1, Wetland 2, Tributary 1, Beaver Brook, Atlantic Ocean) and the size of each aquatic resource within the project area (square feet or acres).
m. ☐ Impacts to each aquatic resource with captions denoting the size of each impact (square feet, acres, or linear feet) and the duration of the impact (ex. Permanent, Temporary (X days).

SECTION 4C: PROJECT PLANS - SPECIFIC PROJECT INFORMATION

21. ☐ For projects involving Navigation, Structures, Dredging, and/or Beach Nourishment, the applicant shall also address the following:

Navigation

a. ☐ Identify the locations of adjacent Federal navigation project (FNP) and/or state/local navigation projects on the project plans.
b. ☐ Specify the distance between the FNP and proposed project boundary, the authorized depths of the FNP, and state plane coordinates of seaward end(s) of project structures near an FNP.

Structures

a. ☐ Identification of the piling type (steel, timber, concrete) and diameter to be removed and/or installed.
b. ☐ Specify the minimal height of the structures' frame over saltmarsh. To meet the SV threshold, piers must be ≤4 feet in width and this minimal height must achieve a 1.5:1 ratio (i.e., a 4-foot-wide pier is 6 feet above a saltmarsh).
c. ☐ For floats, the methods of securing them (piles, bottom anchors) and for keeping them off substrate (skids, stops) at low water. To meet the SV threshold, a minimum depth of 18-inches of water should be maintained below a floating dock/structure at lower tide levels.

Dredging

a. ☐ The area (SF, acre) and volume (CY) of material to be dredged waterward of MHW for each dredge location.
b. ☐ Dredge boundaries.
c. ☐ Bathymetry for existing, proposed, and historical (include dates and USACE permits) dredge depths.
d. ☐ The likely final angle of repose of the side cuts based on the physical characterization of the material to be dredged and based upon the high/ medium/low, wave or current energy of the location.
e. ☐ Label area whether the dredging is new, maintenance, improvement, or a combination.
f. ☐ Location of the disposal site (include location sheet). NOTE: For projects proposing open water, nearshore disposal, or beach nourishment, contact USACE as early as possible for sampling and testing protocols. Sediment testing, including physical (e.g., grain-size analysis), chemical and biological testing may be required. Sampling/testing of sediments without such contact should not occur and if done, will be at the applicant's risk.
g. ☐ The methods and areas used to retain or prevent dredged material from running back into the wetland or waterway. Provide the capacity of the storage area and points of runback, including the overflow route, into the aquatic system.
h. ☐ For open-water disposal, explain why inland or beneficial reuse sites are not practicable.
i. ☐ Show the finished top elevation of the disposal site.

Beach Nourishment

a. ☐ For beach nourishment, identify the disposal footprint, existing and proposed nourishment profiles (multiple profiles are appropriate if the site is more than 150 feet long or non-contiguous), total fill area (SF) and volume (CY), fill area and volume waterward of the HTL, and delineation of dunes, banks, existing beach vegetation, and contours.
b. ☐ For beach nourishment identify the substrate type (fine sand, sand, cobble, boulder) and/or grain-size of existing material.

SECTION 5: STRUCTURES

22. ☐ For projects with the removal of existing pilings identify the number, type (steel, timber, concrete) and diameter of pilings to be removed and the methodology for removal (cut off at mud line, pulling, vibratory, etc.).
23. ☐ For projects with the installation of new pilings identify the number, type (steel, timber, concrete) and diameter of pilings to be installed and the methodology for installation (vibratory hammer, impact hammer etc.).
24. ☐ Identify any existing structures and moorings in waters adjacent to the proposed activity, their dimensions, and the distance to the limits and coordinates of any proposed mooring field or reconfiguration zone. For reconfiguration zone and mooring fields, provide the coordinates for all

corners based on the Massachusetts State Plane Coordinate System. Specify the maximum number of slips and/or moorings within proposed reconfiguration zones or anchorage areas.

25. ☐ The dimensions of the structure or work and extent of encroachment waterward of MHW and from affixed point on the shoreline or upland.
26. ☐ Shoreline of adjacent properties and property boundary offset for structures. In narrow waterbodies, the distance to opposite shoreline, waterway width, and structures across from proposed work.
27. ☐ For new commercial boating facilities, anchorage areas or reconfiguration zones, provide a description of the type of vessels that would use the facility, and any plans for sewage pump-out facilities, fueling facilities and contingency plans for oil spills.
28. ☐ See Sections 4A-C above.

SECTION 6: AQUACULTURE

29. ☐ Identify the coordinates for lease area corners and gear configuration area on the project plans.
30. ☐ Identify the proposed aquaculture gear type (buoys, floats, racks, trays, nets, lines, tubes, cages, containers, and other structures). Provide the impacts for each aquaculture gear type (see Section 4A 19a-d).
31. ☐ For a GP 18 to be valid, applicants must have (a) their MA DMF Aquaculture Certification letter for licensed shellfish aquaculture sites, (b) documentation that the applicant has coordinated with the U.S. Coast Guard regarding USCG Private Aids to Navigation standards, (c) their MEPA Certificate (if required), and (d) documentation that the applicant has contacted their local authorities (ex. harbormaster, select board, shellfish constable) for authorization of their facility.
32. Provide information on site the operation, maintenance, and access. Will the site be accessed via boat, kayak, etc.? Will cages be removed in the winter? How often will gear be checked on? Is there an operations plan for the proposed aquaculture area?
33. ☐ See Sections 4A-C above.

SECTION 7: DREDGING

34. ☐ Sampling plan requests for new, improvement or maintenance dredging must submit completed **Dredged Material Evaluation checklist found at Dredged Material Evaluation Checklist, Sampling and Analysis Plan Requirements from Applicant (army.mil)** and identify the method of handling/transporting the dredged material.
35. ☐ Identify grain-size of material to be dredged (e.g., silty sand) and provide any existing sediment grain size and bulk sediment chemistry data from the proposed project or nearby projects. Include information on any recent spills of oil and/or other hazardous materials and/or nearby outfalls. Document the information source, e.g., EPA database, the harbormaster or fire chief. If there are none, state “none”.
36. ☐ See Section 4A, 4B and 4C, Dredging 21(a-i) above.

SECTION 8: WETLAND/WATERBODY CROSSINGS

37. ☐ For the stream crossing, identify the crossing methodology on the project plan (e.g., dam and pump, dry, wet, etc.). Submit a waterway crossing sequencing plan with the application.
38. ☐ If the project includes a permanent crossing of a tidal waterway, your project design should be modified to match the velocity, depth, cross-sectional area, and substrate of the existing waterbody adjacent to the crossing and provide documentation (hydraulic analysis including low lying property analysis) that the size of the crossing will not restrict tidal flow over the full natural tide range and will not adversely affect abutting infrastructure.

39. ☐ If the work includes a permanent crossing of a non-tidal stream, your project design should be modified to match the culvert gradient of the existing stream channel profile, provide clearance for ≥1.2 times bank full width and conveyance should be embedded ≥1-2 feet for box culverts and pipe arches or ≥1-2 feet and at least 25 percent for rounded pipes/culverts in accordance with the Massachusetts Stream Crossing Standards. Provide the basis for any variation to this requirement.
40. ☐ If the work includes a permanent crossing of a non-tidal stream, the structure should be designed to include a natural bottom substrate within the conveyance that matches the characteristics of the substrate in the natural stream channel and the character of the banks (mobility, slope, stability, confinement, grain and rock size). The conveyance should be designed with a minimum openness ratio ≥0.82-feet (0.25-meters). For how to calculate openness ratio and stream simulation ecological approach for road and stream crossings, see https://www.nae.usace.army.mil/Missions/Regulatory/Stream-and-River-Continuity/.

SECTION 9: COMPENSATORY MITIGATION

41. ☐ Does the project require Compensatory Mitigation[21] for impacts to Waters of the U.S.? (See Section V in the 2023 Massachusetts General Permit)
42. ☐ If the project requires mitigation, does the selected compensatory mitigation option (i.e., In-Lieu Fee, permittee-responsible mitigation) deviate from the order of the options presented in §332.3(b)(2)-(6)? If so, please explain why. https://www.ecfr.gov/current/title-33/chapter-II/part-332/section-332.3
43. ☐ For any compensatory mitigation that involves preservation, the applicant must use a site protection instrument to preserve the parcel in perpetuity. (Conservation Easement, Deed Restriction, etc.) https://www.mass.gov/service-details/conservation-restriction-review-program.

SECTION 10: HISTORIC PROPERTIES & NOTIFICATIONS TO SHPO, THPOs, BUAR

44. ☐ Notify the SHPO, Massachusetts Historical Commission, of the Project via Certified Mail and include proof of delivery or receipt in the application package (See Appendix A).
45. ☐ As applicable, notify the THPOs, Narragansett Indian Tribe, Wampanoag Tribe of Gay Head (Aquinnah), and Mashpee Wampanoag Tribe, of the Project via email OR mail and include proof of delivery or receipt in the application package (See Appendix A).
46. ☐ As applicable, notify the BUAR via email (*strongly preferred*) OR mail and include proof of delivery or receipt in the application package (See Appendix A).
47. ☐ Include responses to this notification in the permit application.
48. ☐ As applicable, information on historic properties (Tribal and Archaeological) within the project area should be provided in the permit application.

SECTION 11: ENDANGERED SPECIES & ESSENTIAL FISH HABITAT

49. ☐ Provide a USFWS Information for Planning and Consultation (IPaC) Official Species List from https://ecos.fws.gov/ipac and the email of the individual who generated the list (see GC 10 of the 2023 Massachusetts General Permit for more information).
50. ☐ Provide a species list from the NMFS Section 7 Endangered Species Act mapper at https://noaa.maps.arcgis.com/apps/webappviewer/index.html.
51. ☐ Provide a species list from the NMFS Essential Fish Habitat Mapper at https://www.habitat.noaa.gov/apps/efhmapper/?page=page_3.

[21] Your mitigation proposal must be consistent with the December 29, 2020 Compensatory Mitigation Standard Operating Procedures at https://www.nae.usace.army.mil/Portals/74/docs/regulatory/Mitigation/Compensatory-Mitigation-SOP-2020.pdf and 2008 Mitigation Rule.

52. ☐ If the project will generate turbidity, describe the extent of turbidity and if erosion controls will be used to contain turbidity. If turbidity controls are not operationally feasible, explain the basis for your conclusion and identify any other measures that you will implement to minimize resuspension of sediment.
53. ☐ Identify the substrate type and any aquatic resources that will be affected by the proposed action. (SAV, salt marsh, sand, silt/clay, rocky/hard bottom)
54. ☐ For projects which will include the installation of pilings/sheet-piles, identify the substrate at the project site (sand, cobble, silt/mud/clay), the installation method (vibratory hammer, impact hammer, combination) and indicate whether the following “soft start” procedures at beginning of the workday and after a 30-minute period of rest will be deployed:
    a. ☐ Vibratory Pile Installation: pile driving will be initiated for 15 seconds at reduced energy followed by a one-minute waiting period. This sequence of 15 seconds of reduced energy driving, one-minute waiting period will be repeated two additional times, followed immediately by pile-driving at full rate and energy.
    b. ☐ Impact Pile Installation: pile driving will commence with an initial set of three strikes by the hammer at 40% energy, followed by a one-minute wait period, then two subsequent 3-strike sets at 40% energy, with one-minute waiting periods, before initiating continuous impact driving.
55. ☐ If the project involves dredging, describe any dredge history, number of dredge events to be covered by the permit, erosion/sediment controls, dredge type, intake structures (mesh screen size), dredged material disposal site.
56. ☐ For project activities associated with structures, identify the number, type (drill barge, work boat, tugboat, etc.), and size of any temporary vessels that will be used. Specify measures that will be implemented to ensure vessels are not berthed in shallow water or will “ground out” at low tide.
57. ☐ For aquaculture projects identify whether any component of the gear is seasonal (will be removed annually) or will be in place year-round. If gear will be present year-round and will be variably managed (e.g., floating in summer, bottom in winter) identify month/date for such configurations.
58. ☐ For aquaculture projects identify whether the project will involve use of an existing vessel or new vessel. Identify the length for all work vessels and identify the distance round trip from vessel berthing location and aquaculture area.
59. ☐ For project activities associated with docking structures (either commercial, industrial, or recreational) identify the number, type (motorized/non-motorized, jet-ski, sailboat, kayak, canoe, other that will be berthed there and the sizes of each.
60. ☐ Information required for Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act:
    a. Results of an eelgrass survey completed per the INSERT.
    b. Essential Fish Habitat Assessment to determine project-related impacts to essential fish habitat, using guidance developed by the National Marine Fisheries Service.
61. ☐ A document containing the following information (requirements of 50 CFR §600.920(e)(3)):
    a. Description of proposed action.
    b. Analysis of potential adverse effects on essential fish habitat.
    c. Conclusions regarding the effects of the action on essential fish habitat.
    d. If applicable, proposed mitigation.
    e. Analysis of alternatives to the proposed action.
    f. Other:

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00840

MASSACHUSETTS
Department of Environmental Protection

Water Quality Certificate Application

THIS PAGE IS INTENTIONALLY LEFT BLANK

ANALYTICAL REPORT

Lab Number:	L2423658
Client:	TG&B Marine Services PO Box 773 Monument Beach, MA 02553
ATTN:	Mark Avakian
Phone:	(508) 326-3686
Project Name:	PEABODY BIKEWAY
Project Number:	Not Specified
Report Date:	05/31/24

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0825), DoD (L2474), FL (E87814), IL (200081), IN (C-MA-04), KY (KY98046), LA (85084), ME (MA00030), MD (350), MI (9110), MN (025-999-495), NJ (MA015), NY (11627), NC (685), OR (MA-0262), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #525-23-107-88708A1), USFWS (Permit #A24920).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2423658-01	SS-3	SEDIMENT	PEABODY, MA	04/30/24 10:22	04/30/24
L2423658-02	SS-2	SEDIMENT	PEABODY, MA	04/30/24 11:05	04/30/24
L2423658-03	SS-1	SEDIMENT	PEABODY, MA	04/30/24 11:35	04/30/24

Proposal No. 609211-132091

A00840 - 4

CORE LOG VesPos Software

PROJECT: Peabody Bikeway Ext Project DATE: 04-30-2024
LOCATION: Peabody, MA WATER BODY NAME: Local Creek
SAMPLED BY: TG&B Marine Services, Inc.
CLIENT: Green International Affiliates, Inc.
PERSONNEL: BA,JH.CT VESSEL: Hand Carried
POSITIONING METHOD: Visual
SAMPLING METHOD: Vibracore
SAMPLER TYPE: polycarbonate liner

SAMPLE ID: SS-2
TIME: 11:05
WATER DEPTH: 2.2’
AS-BUILT PENETRATION: 4’
RECOVERY: 3.9’
NO. OF ATTEMPTS: 1
COLLECTION COMMENTS: Weather Calm, partially cloudy
Location per drawing Culvert#2 346+20. PID-no detect.

0-2'soft black muck to sand. 2' to 2.3'dark black organic material. 2.3' to fine gray sand to medium sand

CORE LOG VesPos Software

PROJECT: Peabody Bikeway Ext Project DATE: 04-30-2024

LOCATION: Peabody, MA WATER BODY NAME: Local Creek
SAMPLED BY: TG&B Marine Services, Inc.
CLIENT: Green International Affiliates, Inc.
PERSONNEL: BA,JH,CT VESSEL: Hand Carried
POSITIONING METHOD: Visual
SAMPLING METHOD: Vibracore
SAMPLER TYPE: polycarbonate liner

SAMPLE ID: SS-1
TIME: 11:35
WATER DEPTH: 1.9’
AS-BUILT PENETRATION:3.2’
RECOVERY: 2.4 FT
NO. OF ATTEMPTS: 3
COLLECTION COMMENTS: Weather Calm, partially cloudy
LOCATION: per drawing, Culvert #1 329+85 PID-no detect

0-1.4' coarse to medium sand, 1.4'- 2.4' medium gray to fine sand

CORE LOG VesPos Software

PROJECT: Peabody Bikeway Ext Project DATE: 4-30-2024
LOCATION: Peabody, MA WATER BODY NAME: Local Creek
SAMPLED BY: TG&B Marine Services, Inc.
CLIENT: Green International Affiliates, Inc.
PERSONNEL: BA,JH,CT VESSEL: Hand Carried
POSITIONING METHOD: Visual
SAMPLING METHOD: Vibracore
SAMPLER TYPE: polycarbonate liner

SAMPLE ID: SS-3
TIME: 10:22
WATER DEPTH: 2.2’
AS-BUILT PENETRATION: 4.0’
RECOVERY: 3.9’
NO. OF ATTEMPTS: 1
COLLECTION COMMENTS: Weather Calm, partially cloudy
Location: per drawing, Boardwalk crossing 538+51 PID-no detect.

0-1.4'soft muck to sand. 1.4' to 3.9' stones/cobble and sand

Project Name:	PEABODY BIKEWAY	**Lab Number:**	L2423658
Project Number:	Not Specified	**Report Date:**	05/31/24

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: PEABODY BIKEWAY **Lab Number:** L2423658
Project Number: Not Specified **Report Date:** 05/31/24

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Sample Receipt

L2423658-01,-02 and -03: The sample was frozen upon receipt in order to arrest the holding time.

PAHs/PCB Congeners

L2423658-01: The surrogate recovery is outside the individual acceptance criteria for dbob (43%), but within the overall method allowances.

Total Metals

The WG1926511-3 MS recovery for lead (189%), performed on L2423658-01, does not apply because the sample concentration is greater than four times the spike amount added.

The WG1926511-4 Laboratory Duplicate RPD for lead (32%), performed on L2423658-01, is outside the acceptance criteria. The elevated RPD has been attributed to the non-homogeneous nature of the native sample.

Total Organic Carbon

The WG1922112-1 Method Blank, associated with L2423658-01 through -03, has a concentration above the reporting limit for Total Organic Carbon. Since the associated sample concentrations are greater than 10x the blank concentration for this analyte, no corrective action is required.

Grain Size Analysis

The WG1921942-1 Laboratory Duplicate RPD for % gravel (22%), performed on L2423658-02, is outside the acceptance criteria. The elevated RPD has been attributed to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Kim L. Bailey Kim L. Bailey

Title: Technical Director/Representative Date: 05/31/24

ORGANICS

VOLATILES

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 1,8260D
Analytical Date: 05/10/24 14:01
Analyst: JIC
Percent Solids: 78%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.7	1.7	1
1,1-Dichloroethane	ND		ug/kg	0.74	0.11	1
Chloroform	ND		ug/kg	1.1	0.10	1
Carbon tetrachloride	ND		ug/kg	0.74	0.17	1
1,2-Dichloropropane	ND		ug/kg	0.74	0.09	1
Dibromochloromethane	ND		ug/kg	0.74	0.10	1
1,1,2-Trichloroethane	ND		ug/kg	0.74	0.20	1
Tetrachloroethene	ND		ug/kg	0.37	0.14	1
Chlorobenzene	ND		ug/kg	0.37	0.09	1
Trichlorofluoromethane	ND		ug/kg	3.0	0.52	1
1,2-Dichloroethane	ND		ug/kg	0.74	0.19	1
1,1,1-Trichloroethane	ND		ug/kg	0.37	0.12	1
Bromodichloromethane	ND		ug/kg	0.37	0.08	1
trans-1,3-Dichloropropene	ND		ug/kg	0.74	0.20	1
cis-1,3-Dichloropropene	ND		ug/kg	0.37	0.12	1
1,3-Dichloropropene, Total	ND		ug/kg	0.37	0.12	1
1,1-Dichloropropene	ND		ug/kg	0.37	0.12	1
Bromoform	ND		ug/kg	3.0	0.18	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.37	0.12	1
Benzene	ND		ug/kg	0.37	0.12	1
Toluene	ND		ug/kg	0.74	0.40	1
Ethylbenzene	ND		ug/kg	0.74	0.10	1
Chloromethane	ND		ug/kg	3.0	0.69	1
Bromomethane	ND		ug/kg	1.5	0.43	1
Vinyl chloride	ND		ug/kg	0.74	0.25	1
Chloroethane	ND		ug/kg	1.5	0.34	1
1,1-Dichloroethene	ND		ug/kg	0.74	0.18	1
trans-1,2-Dichloroethene	ND		ug/kg	1.1	0.10	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.37	0.10	1
1,2-Dichlorobenzene	ND		ug/kg	1.5	0.11	1
1,3-Dichlorobenzene	ND		ug/kg	1.5	0.11	1
1,4-Dichlorobenzene	ND		ug/kg	1.5	0.13	1
Methyl tert butyl ether	ND		ug/kg	1.5	0.15	1
p/m-Xylene	ND		ug/kg	1.5	0.42	1
o-Xylene	ND		ug/kg	0.74	0.22	1
Xylenes, Total	ND		ug/kg	0.74	0.22	1
cis-1,2-Dichloroethene	ND		ug/kg	0.74	0.13	1
1,2-Dichloroethene, Total	ND		ug/kg	0.74	0.10	1
Dibromomethane	ND		ug/kg	1.5	0.18	1
1,4-Dichlorobutane	ND		ug/kg	7.4	0.17	1
1,2,3-Trichloropropane	ND		ug/kg	1.5	0.09	1
Styrene	ND		ug/kg	0.74	0.14	1
Dichlorodifluoromethane	ND		ug/kg	7.4	0.68	1
Acetone	46		ug/kg	18	7.4	1
Carbon disulfide	ND		ug/kg	7.4	3.4	1
2-Butanone	10		ug/kg	7.4	1.6	1
Vinyl acetate	ND		ug/kg	7.4	1.6	1
4-Methyl-2-pentanone	ND		ug/kg	7.4	0.95	1
2-Hexanone	ND		ug/kg	7.4	0.88	1
Ethyl methacrylate	ND		ug/kg	7.4	1.2	1
Acrylonitrile	ND		ug/kg	3.0	0.85	1
Bromochloromethane	ND		ug/kg	1.5	0.15	1
Tetrahydrofuran	ND		ug/kg	3.0	1.2	1
2,2-Dichloropropane	ND		ug/kg	1.5	0.15	1
1,2-Dibromoethane	ND		ug/kg	0.74	0.21	1
1,3-Dichloropropane	ND		ug/kg	1.5	0.12	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.37	0.10	1
Bromobenzene	ND		ug/kg	1.5	0.11	1
n-Butylbenzene	ND		ug/kg	0.74	0.12	1
sec-Butylbenzene	ND		ug/kg	0.74	0.11	1
tert-Butylbenzene	ND		ug/kg	1.5	0.09	1
o-Chlorotoluene	ND		ug/kg	1.5	0.14	1
p-Chlorotoluene	ND		ug/kg	1.5	0.08	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.2	0.74	1
Hexachlorobutadiene	ND		ug/kg	3.0	0.12	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Isopropylbenzene	ND		ug/kg	0.74	0.08	1
p-Isopropyltoluene	ND		ug/kg	0.74	0.08	1
Naphthalene	ND		ug/kg	3.0	0.48	1
n-Propylbenzene	ND		ug/kg	0.74	0.13	1
1,2,3-Trichlorobenzene	ND		ug/kg	1.5	0.24	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.5	0.20	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.5	0.14	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.5	0.25	1
trans-1,4-Dichloro-2-butene	ND		ug/kg	3.7	1.0	1
Ethyl ether	ND		ug/kg	1.5	0.25	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	100		70-130
Toluene-d8	102		70-130
4-Bromofluorobenzene	108		70-130
Dibromofluoromethane	103		70-130

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 1,8260D
Analytical Date: 05/10/24 14:40
Analyst: AJK
Percent Solids: 69%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.9	1.8	1
1,1-Dichloroethane	ND		ug/kg	0.78	0.11	1
Chloroform	ND		ug/kg	1.2	0.11	1
Carbon tetrachloride	ND		ug/kg	0.78	0.18	1
1,2-Dichloropropane	ND		ug/kg	0.78	0.10	1
Dibromochloromethane	ND		ug/kg	0.78	0.11	1
1,1,2-Trichloroethane	ND		ug/kg	0.78	0.21	1
Tetrachloroethene	ND		ug/kg	0.39	0.15	1
Chlorobenzene	ND		ug/kg	0.39	0.10	1
Trichlorofluoromethane	ND		ug/kg	3.1	0.54	1
1,2-Dichloroethane	ND		ug/kg	0.78	0.20	1
1,1,1-Trichloroethane	ND		ug/kg	0.39	0.13	1
Bromodichloromethane	ND		ug/kg	0.39	0.09	1
trans-1,3-Dichloropropene	ND		ug/kg	0.78	0.21	1
cis-1,3-Dichloropropene	ND		ug/kg	0.39	0.12	1
1,3-Dichloropropene, Total	ND		ug/kg	0.39	0.12	1
1,1-Dichloropropene	ND		ug/kg	0.39	0.12	1
Bromoform	ND		ug/kg	3.1	0.19	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.39	0.13	1
Benzene	ND		ug/kg	0.39	0.13	1
Toluene	ND		ug/kg	0.78	0.42	1
Ethylbenzene	ND		ug/kg	0.78	0.11	1
Chloromethane	ND		ug/kg	3.1	0.72	1
Bromomethane	ND		ug/kg	1.6	0.45	1
Vinyl chloride	ND		ug/kg	0.78	0.26	1
Chloroethane	ND		ug/kg	1.6	0.35	1
1,1-Dichloroethene	ND		ug/kg	0.78	0.18	1
trans-1,2-Dichloroethene	ND		ug/kg	1.2	0.11	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.39	0.11	1
1,2-Dichlorobenzene	ND		ug/kg	1.6	0.11	1
1,3-Dichlorobenzene	ND		ug/kg	1.6	0.12	1
1,4-Dichlorobenzene	ND		ug/kg	1.6	0.13	1
Methyl tert butyl ether	ND		ug/kg	1.6	0.16	1
p/m-Xylene	ND		ug/kg	1.6	0.44	1
o-Xylene	ND		ug/kg	0.78	0.23	1
Xylenes, Total	ND		ug/kg	0.78	0.23	1
cis-1,2-Dichloroethene	ND		ug/kg	0.78	0.14	1
1,2-Dichloroethene, Total	ND		ug/kg	0.78	0.11	1
Dibromomethane	ND		ug/kg	1.6	0.18	1
1,4-Dichlorobutane	ND		ug/kg	7.8	0.18	1
1,2,3-Trichloropropane	ND		ug/kg	1.6	0.10	1
Styrene	ND		ug/kg	0.78	0.15	1
Dichlorodifluoromethane	ND		ug/kg	7.8	0.71	1
Acetone	74		ug/kg	19	7.8	1
Carbon disulfide	ND		ug/kg	7.8	3.5	1
2-Butanone	18		ug/kg	7.8	1.7	1
Vinyl acetate	ND		ug/kg	7.8	1.7	1
4-Methyl-2-pentanone	ND		ug/kg	7.8	1.0	1
2-Hexanone	ND		ug/kg	7.8	0.92	1
Ethyl methacrylate	ND		ug/kg	7.8	1.2	1
Acrylonitrile	ND		ug/kg	3.1	0.89	1
Bromochloromethane	ND		ug/kg	1.6	0.16	1
Tetrahydrofuran	ND		ug/kg	3.1	1.2	1
2,2-Dichloropropane	ND		ug/kg	1.6	0.16	1
1,2-Dibromoethane	ND		ug/kg	0.78	0.22	1
1,3-Dichloropropane	ND		ug/kg	1.6	0.13	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.39	0.10	1
Bromobenzene	ND		ug/kg	1.6	0.11	1
n-Butylbenzene	ND		ug/kg	0.78	0.13	1
sec-Butylbenzene	ND		ug/kg	0.78	0.11	1
tert-Butylbenzene	ND		ug/kg	1.6	0.09	1
o-Chlorotoluene	ND		ug/kg	1.6	0.15	1
p-Chlorotoluene	ND		ug/kg	1.6	0.08	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.3	0.78	1
Hexachlorobutadiene	ND		ug/kg	3.1	0.13	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Isopropylbenzene	ND		ug/kg	0.78	0.09	1
p-Isopropyltoluene	ND		ug/kg	0.78	0.09	1
Naphthalene	ND		ug/kg	3.1	0.50	1
n-Propylbenzene	ND		ug/kg	0.78	0.13	1
1,2,3-Trichlorobenzene	ND		ug/kg	1.6	0.25	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.6	0.21	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.6	0.15	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.6	0.26	1
trans-1,4-Dichloro-2-butene	ND		ug/kg	3.9	1.1	1
Ethyl ether	ND		ug/kg	1.6	0.26	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	104		70-130
Toluene-d8	107		70-130
4-Bromofluorobenzene	116		70-130
Dibromofluoromethane	105		70-130

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 1,8260D
Analytical Date: 05/10/24 15:19
Analyst: AJK
Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	3.9	1.8	1
1,1-Dichloroethane	ND		ug/kg	0.78	0.11	1
Chloroform	ND		ug/kg	1.2	0.11	1
Carbon tetrachloride	ND		ug/kg	0.78	0.18	1
1,2-Dichloropropane	ND		ug/kg	0.78	0.10	1
Dibromochloromethane	ND		ug/kg	0.78	0.11	1
1,1,2-Trichloroethane	ND		ug/kg	0.78	0.21	1
Tetrachloroethene	ND		ug/kg	0.39	0.15	1
Chlorobenzene	ND		ug/kg	0.39	0.10	1
Trichlorofluoromethane	ND		ug/kg	3.1	0.54	1
1,2-Dichloroethane	ND		ug/kg	0.78	0.20	1
1,1,1-Trichloroethane	ND		ug/kg	0.39	0.13	1
Bromodichloromethane	ND		ug/kg	0.39	0.09	1
trans-1,3-Dichloropropene	ND		ug/kg	0.78	0.21	1
cis-1,3-Dichloropropene	ND		ug/kg	0.39	0.12	1
1,3-Dichloropropene, Total	ND		ug/kg	0.39	0.12	1
1,1-Dichloropropene	ND		ug/kg	0.39	0.12	1
Bromoform	ND		ug/kg	3.1	0.19	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.39	0.13	1
Benzene	ND		ug/kg	0.39	0.13	1
Toluene	ND		ug/kg	0.78	0.42	1
Ethylbenzene	ND		ug/kg	0.78	0.11	1
Chloromethane	ND		ug/kg	3.1	0.73	1
Bromomethane	ND		ug/kg	1.6	0.45	1
Vinyl chloride	ND		ug/kg	0.78	0.26	1
Chloroethane	ND		ug/kg	1.6	0.35	1
1,1-Dichloroethene	ND		ug/kg	0.78	0.18	1
trans-1,2-Dichloroethene	ND		ug/kg	1.2	0.11	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.39	0.11	1
1,2-Dichlorobenzene	ND		ug/kg	1.6	0.11	1
1,3-Dichlorobenzene	ND		ug/kg	1.6	0.12	1
1,4-Dichlorobenzene	ND		ug/kg	1.6	0.13	1
Methyl tert butyl ether	ND		ug/kg	1.6	0.16	1
p/m-Xylene	ND		ug/kg	1.6	0.44	1
o-Xylene	ND		ug/kg	0.78	0.23	1
Xylenes, Total	ND		ug/kg	0.78	0.23	1
cis-1,2-Dichloroethene	ND		ug/kg	0.78	0.14	1
1,2-Dichloroethene, Total	ND		ug/kg	0.78	0.11	1
Dibromomethane	ND		ug/kg	1.6	0.18	1
1,4-Dichlorobutane	ND		ug/kg	7.8	0.18	1
1,2,3-Trichloropropane	ND		ug/kg	1.6	0.10	1
Styrene	ND		ug/kg	0.78	0.15	1
Dichlorodifluoromethane	ND		ug/kg	7.8	0.71	1
Acetone	44		ug/kg	20	7.8	1
Carbon disulfide	ND		ug/kg	7.8	3.6	1
2-Butanone	10		ug/kg	7.8	1.7	1
Vinyl acetate	ND		ug/kg	7.8	1.7	1
4-Methyl-2-pentanone	ND		ug/kg	7.8	1.0	1
2-Hexanone	ND		ug/kg	7.8	0.92	1
Ethyl methacrylate	ND		ug/kg	7.8	1.2	1
Acrylonitrile	ND		ug/kg	3.1	0.90	1
Bromochloromethane	ND		ug/kg	1.6	0.16	1
Tetrahydrofuran	ND		ug/kg	3.1	1.2	1
2,2-Dichloropropane	ND		ug/kg	1.6	0.16	1
1,2-Dibromoethane	ND		ug/kg	0.78	0.22	1
1,3-Dichloropropane	ND		ug/kg	1.6	0.13	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.39	0.10	1
Bromobenzene	ND		ug/kg	1.6	0.11	1
n-Butylbenzene	ND		ug/kg	0.78	0.13	1
sec-Butylbenzene	ND		ug/kg	0.78	0.11	1
tert-Butylbenzene	ND		ug/kg	1.6	0.09	1
o-Chlorotoluene	ND		ug/kg	1.6	0.15	1
p-Chlorotoluene	ND		ug/kg	1.6	0.08	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	2.3	0.78	1
Hexachlorobutadiene	ND		ug/kg	3.1	0.13	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by EPA 5035 Low - Westborough Lab						
Isopropylbenzene	ND		ug/kg	0.78	0.09	1
p-Isopropyltoluene	ND		ug/kg	0.78	0.09	1
Naphthalene	ND		ug/kg	3.1	0.51	1
n-Propylbenzene	ND		ug/kg	0.78	0.13	1
1,2,3-Trichlorobenzene	ND		ug/kg	1.6	0.25	1
1,2,4-Trichlorobenzene	ND		ug/kg	1.6	0.21	1
1,3,5-Trimethylbenzene	ND		ug/kg	1.6	0.15	1
1,2,4-Trimethylbenzene	ND		ug/kg	1.6	0.26	1
trans-1,4-Dichloro-2-butene	ND		ug/kg	3.9	1.1	1
Ethyl ether	ND		ug/kg	1.6	0.27	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	104		70-130
Toluene-d8	103		70-130
4-Bromofluorobenzene	109		70-130
Dibromofluoromethane	105		70-130

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 1,8260D
Analytical Date: 05/10/24 10:07
Analyst: LAC

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 01-03 Batch: WG1920321-5					
Methylene chloride	ND		ug/kg	5.0	2.3
1,1-Dichloroethane	ND		ug/kg	1.0	0.14
Chloroform	0.29	J	ug/kg	1.5	0.14
Carbon tetrachloride	ND		ug/kg	1.0	0.23
1,2-Dichloropropane	ND		ug/kg	1.0	0.12
Dibromochloromethane	ND		ug/kg	1.0	0.14
1,1,2-Trichloroethane	ND		ug/kg	1.0	0.27
Tetrachloroethene	ND		ug/kg	0.50	0.20
Chlorobenzene	ND		ug/kg	0.50	0.13
Trichlorofluoromethane	ND		ug/kg	4.0	0.70
1,2-Dichloroethane	ND		ug/kg	1.0	0.26
1,1,1-Trichloroethane	ND		ug/kg	0.50	0.17
Bromodichloromethane	ND		ug/kg	0.50	0.11
trans-1,3-Dichloropropene	ND		ug/kg	1.0	0.27
cis-1,3-Dichloropropene	ND		ug/kg	0.50	0.16
1,3-Dichloropropene, Total	ND		ug/kg	0.50	0.16
1,1-Dichloropropene	ND		ug/kg	0.50	0.16
Bromoform	ND		ug/kg	4.0	0.25
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	0.17
Benzene	ND		ug/kg	0.50	0.17
Toluene	ND		ug/kg	1.0	0.54
Ethylbenzene	ND		ug/kg	1.0	0.14
Chloromethane	ND		ug/kg	4.0	0.93
Bromomethane	ND		ug/kg	2.0	0.58
Vinyl chloride	ND		ug/kg	1.0	0.34
Chloroethane	ND		ug/kg	2.0	0.45
1,1-Dichloroethene	ND		ug/kg	1.0	0.24
trans-1,2-Dichloroethene	ND		ug/kg	1.5	0.14
Trichloroethene	ND		ug/kg	0.50	0.14

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 1,8260D
Analytical Date: 05/10/24 10:07
Analyst: LAC

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 01-03 Batch: WG1920321-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	0.14
1,3-Dichlorobenzene	ND		ug/kg	2.0	0.15
1,4-Dichlorobenzene	ND		ug/kg	2.0	0.17
Methyl tert butyl ether	ND		ug/kg	2.0	0.20
p/m-Xylene	ND		ug/kg	2.0	0.56
o-Xylene	ND		ug/kg	1.0	0.29
Xylenes, Total	ND		ug/kg	1.0	0.29
cis-1,2-Dichloroethene	ND		ug/kg	1.0	0.18
1,2-Dichloroethene, Total	ND		ug/kg	1.0	0.14
Dibromomethane	ND		ug/kg	2.0	0.24
1,4-Dichlorobutane	ND		ug/kg	10	0.23
1,2,3-Trichloropropane	ND		ug/kg	2.0	0.13
Styrene	ND		ug/kg	1.0	0.20
Dichlorodifluoromethane	ND		ug/kg	10	0.92
Acetone	ND		ug/kg	25	10.
Carbon disulfide	ND		ug/kg	10	4.6
2-Butanone	ND		ug/kg	10	2.2
Vinyl acetate	ND		ug/kg	10	2.2
4-Methyl-2-pentanone	ND		ug/kg	10	1.3
2-Hexanone	ND		ug/kg	10	1.2
Ethyl methacrylate	ND		ug/kg	10	1.6
Acrylonitrile	ND		ug/kg	4.0	1.2
Bromochloromethane	ND		ug/kg	2.0	0.20
Tetrahydrofuran	ND		ug/kg	4.0	1.6
2,2-Dichloropropane	ND		ug/kg	2.0	0.20
1,2-Dibromoethane	ND		ug/kg	1.0	0.28
1,3-Dichloropropane	ND		ug/kg	2.0	0.17
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	0.13
Bromobenzene	ND		ug/kg	2.0	0.14

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 1,8260D
Analytical Date: 05/10/24 10:07
Analyst: LAC

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 01-03 Batch: WG1920321-5					
n-Butylbenzene	ND		ug/kg	1.0	0.17
sec-Butylbenzene	ND		ug/kg	1.0	0.15
tert-Butylbenzene	ND		ug/kg	2.0	0.12
o-Chlorotoluene	ND		ug/kg	2.0	0.19
p-Chlorotoluene	ND		ug/kg	2.0	0.11
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	1.0
Hexachlorobutadiene	ND		ug/kg	4.0	0.17
Isopropylbenzene	ND		ug/kg	1.0	0.11
p-Isopropyltoluene	ND		ug/kg	1.0	0.11
Naphthalene	ND		ug/kg	4.0	0.65
n-Propylbenzene	ND		ug/kg	1.0	0.17
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	0.32
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	0.27
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	0.19
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	0.33
trans-1,4-Dichloro-2-butene	ND		ug/kg	5.0	1.4
Ethyl ether	ND		ug/kg	2.0	0.34

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	100		70-130
Toluene-d8	103		70-130
4-Bromofluorobenzene	106		70-130
Dibromofluoromethane	100		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 01-03 Batch: WG1920321-3 WG1920321-4								
Methylene chloride	86		83		70-130	4		30
1,1-Dichloroethane	95		93		70-130	2		30
Chloroform	93		91		70-130	2		30
Carbon tetrachloride	83		82		70-130	1		30
1,2-Dichloropropane	96		96		70-130	0		30
Dibromochloromethane	90		92		70-130	2		30
1,1,2-Trichloroethane	94		94		70-130	0		30
Tetrachloroethene	87		85		70-130	2		30
Chlorobenzene	94		93		70-130	1		30
Trichlorofluoromethane	80		77		70-139	4		30
1,2-Dichloroethane	95		95		70-130	0		30
1,1,1-Trichloroethane	89		87		70-130	2		30
Bromodichloromethane	93		94		70-130	1		30
trans-1,3-Dichloropropene	94		94		70-130	0		30
cis-1,3-Dichloropropene	96		95		70-130	1		30
1,1-Dichloropropene	88		86		70-130	2		30
Bromoform	86		89		70-130	3		30
1,1,2,2-Tetrachloroethane	96		95		70-130	1		30
Benzene	92		91		70-130	1		30
Toluene	93		92		70-130	1		30
Ethylbenzene	95		94		70-130	1		30
Chloromethane	95		88		52-130	8		30
Bromomethane	83		80		57-147	4		30

Proposal No. 609211-132091

A00840 - 25

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 01-03 Batch: WG1920321-3 WG1920321-4								
Vinyl chloride	88		83		67-130	6		30
Chloroethane	92		86		50-151	7		30
1,1-Dichloroethene	86		82		65-135	5		30
trans-1,2-Dichloroethene	91		88		70-130	3		30
Trichloroethene	93		92		70-130	1		30
1,2-Dichlorobenzene	93		93		70-130	0		30
1,3-Dichlorobenzene	93		93		70-130	0		30
1,4-Dichlorobenzene	94		93		70-130	1		30
Methyl tert butyl ether	93		92		66-130	1		30
p/m-Xylene	95		93		70-130	2		30
o-Xylene	95		94		70-130	1		30
cis-1,2-Dichloroethene	92		90		70-130	2		30
Dibromomethane	92		91		70-130	1		30
1,4-Dichlorobutane	104		104		70-130	0		30
1,2,3-Trichloropropane	93		95		68-130	2		30
Styrene	99		98		70-130	1		30
Dichlorodifluoromethane	71		66		30-146	7		30
Acetone	108		98		54-140	10		30
Carbon disulfide	75		72		59-130	4		30
2-Butanone	104		105		70-130	1		30
Vinyl acetate	96		91		70-130	5		30
4-Methyl-2-pentanone	102		102		70-130	0		30
2-Hexanone	108		110		70-130	2		30

Proposal No. 609211-132091

A00840 - 26

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 01-03 Batch: WG1920321-3 WG1920321-4								
Ethyl methacrylate	92		94		70-130	2		30
Acrylonitrile	101		102		70-130	1		30
Bromochloromethane	92		90		70-130	2		30
Tetrahydrofuran	100		103		66-130	3		30
2,2-Dichloropropane	91		89		70-130	2		30
1,2-Dibromoethane	95		96		70-130	1		30
1,3-Dichloropropane	94		94		69-130	0		30
1,1,1,2-Tetrachloroethane	93		93		70-130	0		30
Bromobenzene	92		92		70-130	0		30
n-Butylbenzene	91		89		70-130	2		30
sec-Butylbenzene	90		89		70-130	1		30
tert-Butylbenzene	90		89		70-130	1		30
o-Chlorotoluene	94		93		70-130	1		30
p-Chlorotoluene	95		94		70-130	1		30
1,2-Dibromo-3-chloropropane	92		93		68-130	1		30
Hexachlorobutadiene	90		90		67-130	0		30
Isopropylbenzene	93		92		70-130	1		30
p-Isopropyltoluene	92		90		70-130	2		30
Naphthalene	96		98		70-130	2		30
n-Propylbenzene	93		91		70-130	2		30
1,2,3-Trichlorobenzene	105		107		70-130	2		30
1,2,4-Trichlorobenzene	98		98		70-130	0		30
1,3,5-Trimethylbenzene	94		92		70-130	2		30

Proposal No. 609211-132091

A00840 - 27

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 01-03 Batch: WG1920321-3 WG1920321-4								
1,2,4-Trimethylbenzene	95		94		70-130	1		30
trans-1,4-Dichloro-2-butene	106		107		70-130	1		30
Ethyl ether	95		91		67-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	99		97		70-130
Toluene-d8	103		103		70-130
4-Bromofluorobenzene	104		104		70-130
Dibromofluoromethane	103		101		70-130

Proposal No. 609211-132091

A00840 - 28

SEMIVOLATILES

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA

Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 105,8270E-SIM/680(M)
Analytical Date: 05/27/24 16:30
Analyst: DB
Percent Solids: 78%

Extraction Method: EPA 3570
Extraction Date: 05/15/24 22:00
Cleanup Method: EPA 3630
Cleanup Date: 05/16/24

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Naphthalene	ND		ug/kg	4.95	2.48	1
2-Methylnaphthalene	ND		ug/kg	4.95	2.48	1
Acenaphthylene	3.24	J	ug/kg	4.95	2.48	1
Acenaphthene	ND		ug/kg	4.95	2.48	1
Fluorene	ND		ug/kg	4.95	2.48	1
Phenanthrene	12.4		ug/kg	4.95	2.48	1
Anthracene	5.56		ug/kg	4.95	2.48	1
Fluoranthene	35.9		ug/kg	4.95	2.48	1
Pyrene	37.8		ug/kg	4.95	2.48	1
Benz(a)anthracene	23.2		ug/kg	4.95	2.48	1
Chrysene	26.0		ug/kg	4.95	2.48	1
Benzo(b)fluoranthene	31.4		ug/kg	4.95	2.48	1
Benzo(k)fluoranthene	20.3		ug/kg	4.95	2.48	1
Benzo(a)pyrene	23.8		ug/kg	4.95	2.48	1
Indeno(1,2,3-cd)Pyrene	19.7		ug/kg	4.95	2.48	1
Dibenz(a,h)anthracene	4.97		ug/kg	4.95	2.48	1
Benzo(ghi)perylene	20.8		ug/kg	4.95	2.48	1
Cl2-BZ#8	ND		ug/kg	0.495	0.248	1
Cl3-BZ#18	ND		ug/kg	0.495	0.248	1
Cl3-BZ#28	ND		ug/kg	0.495	0.248	1
Cl4-BZ#44	ND		ug/kg	0.495	0.248	1
Cl4-BZ#49	ND		ug/kg	0.495	0.248	1
Cl4-BZ#52	ND		ug/kg	0.495	0.248	1
Cl4-BZ#66	ND		ug/kg	0.495	0.248	1
Cl5-BZ#87	ND		ug/kg	0.495	0.248	1
Cl5-BZ#101	ND		ug/kg	0.495	0.248	1
Cl5-BZ#105	ND		ug/kg	0.495	0.248	1
Cl5-BZ#118	ND		ug/kg	0.495	0.248	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Cl6-BZ#128	ND		ug/kg	0.495	0.248	1
Cl6-BZ#138	ND		ug/kg	0.495	0.248	1
Cl6-BZ#153	ND		ug/kg	0.495	0.248	1
Cl7-BZ#170	ND		ug/kg	0.495	0.248	1
Cl7-BZ#180	ND		ug/kg	0.495	0.248	1
Cl7-BZ#183	ND		ug/kg	0.495	0.248	1
Cl7-BZ#184	ND		ug/kg	0.495	0.248	1
Cl7-BZ#187	ND		ug/kg	0.495	0.248	1
Cl8-BZ#195	ND		ug/kg	0.495	0.248	1
Cl9-BZ#206	ND		ug/kg	0.495	0.248	1
Cl10-BZ#209	ND		ug/kg	0.495	0.248	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Methylnaphthalene-d10	41.5		30-150
Pyrene-d10	48.5		30-150
Benzo(b)fluoranthene-d12	44.5		30-150
DBOB	**43**	Q	50-125
BZ 198	51		50-125

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA

Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 105,8270E-SIM/680(M)
Analytical Date: 05/27/24 16:57
Analyst: DB
Percent Solids: 69%

Extraction Method: EPA 3570
Extraction Date: 05/15/24 22:00
Cleanup Method: EPA 3630
Cleanup Date: 05/16/24

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Naphthalene	10.0		ug/kg	5.43	2.72	1
2-Methylnaphthalene	7.47		ug/kg	5.43	2.72	1
Acenaphthylene	10.6		ug/kg	5.43	2.72	1
Acenaphthene	ND		ug/kg	5.43	2.72	1
Fluorene	4.80	J	ug/kg	5.43	2.72	1
Phenanthrene	51.8		ug/kg	5.43	2.72	1
Anthracene	13.1		ug/kg	5.43	2.72	1
Fluoranthene	141		ug/kg	5.43	2.72	1
Pyrene	125		ug/kg	5.43	2.72	1
Benz(a)anthracene	68.7		ug/kg	5.43	2.72	1
Chrysene	93.7		ug/kg	5.43	2.72	1
Benzo(b)fluoranthene	93.5		ug/kg	5.43	2.72	1
Benzo(k)fluoranthene	57.5		ug/kg	5.43	2.72	1
Benzo(a)pyrene	79.9		ug/kg	5.43	2.72	1
Indeno(1,2,3-cd)Pyrene	58.8		ug/kg	5.43	2.72	1
Dibenz(a,h)anthracene	14.8		ug/kg	5.43	2.72	1
Benzo(ghi)perylene	67.9		ug/kg	5.43	2.72	1
Cl2-BZ#8	ND		ug/kg	0.543	0.272	1
Cl3-BZ#18	ND		ug/kg	0.543	0.272	1
Cl3-BZ#28	ND		ug/kg	0.543	0.272	1
Cl4-BZ#44	ND		ug/kg	0.543	0.272	1
Cl4-BZ#49	ND		ug/kg	0.543	0.272	1
Cl4-BZ#52	ND		ug/kg	0.543	0.272	1
Cl4-BZ#66	ND		ug/kg	0.543	0.272	1
Cl5-BZ#87	ND		ug/kg	0.543	0.272	1
Cl5-BZ#101	ND		ug/kg	0.543	0.272	1
Cl5-BZ#105	ND		ug/kg	0.543	0.272	1
Cl5-BZ#118	ND		ug/kg	0.543	0.272	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Cl6-BZ#128	ND		ug/kg	0.543	0.272	1
Cl6-BZ#138	0.890		ug/kg	0.543	0.272	1
Cl6-BZ#153	0.794		ug/kg	0.543	0.272	1
Cl7-BZ#170	ND		ug/kg	0.543	0.272	1
Cl7-BZ#180	1.22		ug/kg	0.543	0.272	1
Cl7-BZ#183	ND		ug/kg	0.543	0.272	1
Cl7-BZ#184	ND		ug/kg	0.543	0.272	1
Cl7-BZ#187	0.483	J	ug/kg	0.543	0.272	1
Cl8-BZ#195	ND		ug/kg	0.543	0.272	1
Cl9-BZ#206	0.569		ug/kg	0.543	0.272	1
Cl10-BZ#209	ND		ug/kg	0.543	0.272	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Methylnaphthalene-d10	66.5		30-150
Pyrene-d10	79.5		30-150
Benzo(b)fluoranthene-d12	70		30-150
DBOB	66		50-125
BZ 198	76		50-125

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA

Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Analytical Method: 105,8270E-SIM/680(M)
Analytical Date: 05/27/24 17:24
Analyst: DB
Percent Solids: 81%

Extraction Method: EPA 3570
Extraction Date: 05/15/24 22:00
Cleanup Method: EPA 3630
Cleanup Date: 05/16/24

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Naphthalene	5.62		ug/kg	4.58	2.29	1
2-Methylnaphthalene	3.56	J	ug/kg	4.58	2.29	1
Acenaphthylene	3.71	J	ug/kg	4.58	2.29	1
Acenaphthene	ND		ug/kg	4.58	2.29	1
Fluorene	2.37	J	ug/kg	4.58	2.29	1
Phenanthrene	11.0		ug/kg	4.58	2.29	1
Anthracene	3.85	J	ug/kg	4.58	2.29	1
Fluoranthene	23.2		ug/kg	4.58	2.29	1
Pyrene	24.1		ug/kg	4.58	2.29	1
Benz(a)anthracene	12.5		ug/kg	4.58	2.29	1
Chrysene	17.9		ug/kg	4.58	2.29	1
Benzo(b)fluoranthene	19.8		ug/kg	4.58	2.29	1
Benzo(k)fluoranthene	12.5		ug/kg	4.58	2.29	1
Benzo(a)pyrene	13.3		ug/kg	4.58	2.29	1
Indeno(1,2,3-cd)Pyrene	11.9		ug/kg	4.58	2.29	1
Dibenz(a,h)anthracene	3.08	J	ug/kg	4.58	2.29	1
Benzo(ghi)perylene	14.6		ug/kg	4.58	2.29	1
Cl2-BZ#8	ND		ug/kg	0.458	0.229	1
Cl3-BZ#18	ND		ug/kg	0.458	0.229	1
Cl3-BZ#28	ND		ug/kg	0.458	0.229	1
Cl4-BZ#44	ND		ug/kg	0.458	0.229	1
Cl4-BZ#49	ND		ug/kg	0.458	0.229	1
Cl4-BZ#52	0.426	J	ug/kg	0.458	0.229	1
Cl4-BZ#66	ND		ug/kg	0.458	0.229	1
Cl5-BZ#87	ND		ug/kg	0.458	0.229	1
Cl5-BZ#101	0.239	J	ug/kg	0.458	0.229	1
Cl5-BZ#105	ND		ug/kg	0.458	0.229	1
Cl5-BZ#118	ND		ug/kg	0.458	0.229	1

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs/PCB Congeners by GC/MS - Mansfield Lab						
Cl6-BZ#128	ND		ug/kg	0.458	0.229	1
Cl6-BZ#138	0.323	J	ug/kg	0.458	0.229	1
Cl6-BZ#153	ND		ug/kg	0.458	0.229	1
Cl7-BZ#170	ND		ug/kg	0.458	0.229	1
Cl7-BZ#180	ND		ug/kg	0.458	0.229	1
Cl7-BZ#183	ND		ug/kg	0.458	0.229	1
Cl7-BZ#184	ND		ug/kg	0.458	0.229	1
Cl7-BZ#187	ND		ug/kg	0.458	0.229	1
Cl8-BZ#195	ND		ug/kg	0.458	0.229	1
Cl9-BZ#206	ND		ug/kg	0.458	0.229	1
Cl10-BZ#209	ND		ug/kg	0.458	0.229	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Methylnaphthalene-d10	53		30-150
Pyrene-d10	65		30-150
Benzo(b)fluoranthene-d12	58.5		30-150
DBOB	55		50-125
BZ 198	61		50-125

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 105,8270E-SIM/680(M)
Analytical Date: 05/27/24 13:49
Analyst: DB

Extraction Method: EPA 3570
Extraction Date: 05/15/24 22:00
Cleanup Method: EPA 3630
Cleanup Date: 05/16/24

Parameter	Result	Qualifier	Units	RL	MDL
PAHs/PCB Congeners by GC/MS - Mansfield Lab for sample(s): 01-03 Batch: WG1921641-1					
Naphthalene	ND		ug/kg	4.00	2.00
2-Methylnaphthalene	ND		ug/kg	4.00	2.00
Acenaphthylene	ND		ug/kg	4.00	2.00
Acenaphthene	ND		ug/kg	4.00	2.00
Fluorene	ND		ug/kg	4.00	2.00
Phenanthrene	ND		ug/kg	4.00	2.00
Anthracene	ND		ug/kg	4.00	2.00
Fluoranthene	ND		ug/kg	4.00	2.00
Pyrene	ND		ug/kg	4.00	2.00
Benz(a)anthracene	ND		ug/kg	4.00	2.00
Chrysene	ND		ug/kg	4.00	2.00
Benzo(b)fluoranthene	ND		ug/kg	4.00	2.00
Benzo(k)fluoranthene	ND		ug/kg	4.00	2.00
Benzo(a)pyrene	ND		ug/kg	4.00	2.00
Indeno(1,2,3-cd)Pyrene	ND		ug/kg	4.00	2.00
Dibenz(a,h)anthracene	ND		ug/kg	4.00	2.00
Benzo(ghi)perylene	ND		ug/kg	4.00	2.00
Cl2-BZ#8	ND		ug/kg	0.400	0.200
Cl3-BZ#18	ND		ug/kg	0.400	0.200
Cl3-BZ#28	ND		ug/kg	0.400	0.200
Cl4-BZ#44	ND		ug/kg	0.400	0.200
Cl4-BZ#49	ND		ug/kg	0.400	0.200
Cl4-BZ#52	ND		ug/kg	0.400	0.200
Cl4-BZ#66	ND		ug/kg	0.400	0.200
Cl5-BZ#87	ND		ug/kg	0.400	0.200
Cl5-BZ#101	ND		ug/kg	0.400	0.200
Cl5-BZ#105	ND		ug/kg	0.400	0.200
Cl5-BZ#118	ND		ug/kg	0.400	0.200
Cl6-BZ#128	ND		ug/kg	0.400	0.200

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 105,8270E-SIM/680(M)
Analytical Date: 05/27/24 13:49
Analyst: DB

Extraction Method: EPA 3570
Extraction Date: 05/15/24 22:00
Cleanup Method: EPA 3630
Cleanup Date: 05/16/24

Parameter	Result	Qualifier	Units	RL	MDL
PAHs/PCB Congeners by GC/MS - Mansfield Lab for sample(s): 01-03 Batch: WG1921641-1					
Cl6-BZ#138	ND		ug/kg	0.400	0.200
Cl6-BZ#153	ND		ug/kg	0.400	0.200
Cl7-BZ#170	ND		ug/kg	0.400	0.200
Cl7-BZ#180	ND		ug/kg	0.400	0.200
Cl7-BZ#183	ND		ug/kg	0.400	0.200
Cl7-BZ#184	ND		ug/kg	0.400	0.200
Cl7-BZ#187	ND		ug/kg	0.400	0.200
Cl8-BZ#195	ND		ug/kg	0.400	0.200
Cl9-BZ#206	ND		ug/kg	0.400	0.200
Cl10-BZ#209	ND		ug/kg	0.400	0.200

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2-Methylnaphthalene-d10	71		30-150
Pyrene-d10	86		30-150
Benzo(b)fluoranthene-d12	85		30-150
DBOB	75		50-125
BZ 198	85		50-125

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
PAHs/PCB Congeners by GC/MS - Mansfield Lab Associated sample(s): 01-03 Batch: WG1921641-2 WG1921641-3								
Naphthalene	60		62		40-140	3		30
Acenaphthylene	63		66		40-140	5		30
Acenaphthene	58		61		40-140	5		30
Fluorene	62		62		40-140	0		30
Phenanthrene	59		61		40-140	3		30
Anthracene	70		71		40-140	1		30
Fluoranthene	60		60		40-140	0		30
Pyrene	68		68		40-140	0		30
Benz(a)anthracene	73		74		40-140	1		30
Chrysene	71		69		40-140	3		30
Benzo(b)fluoranthene	80		70		40-140	13		30
Benzo(k)fluoranthene	73		75		40-140	3		30
Benzo(a)pyrene	71		69		40-140	3		30
Indeno(1,2,3-cd)Pyrene	69		68		40-140	1		30
Dibenz(a,h)anthracene	74		71		40-140	4		30
Benzo(ghi)perylene	79		76		40-140	4		30
Cl2-BZ#8	122		103		40-140	17		50
Cl3-BZ#18	105		88		40-140	18		50
Cl3-BZ#28	106		92		40-140	14		50
Cl4-BZ#44	103		88		40-140	16		50
Cl4-BZ#49	98		83		40-140	17		50
Cl4-BZ#52	102		88		40-140	15		50
Cl4-BZ#66	106		91		40-140	15		50

Proposal No. 609211-132091

A00840 - 38

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
PAHs/PCB Congeners by GC/MS - Mansfield Lab Associated sample(s): 01-03 Batch: WG1921641-2 WG1921641-3								
Cl5-BZ#87	96		83		40-140	15		50
Cl5-BZ#101	93		79		40-140	16		50
Cl5-BZ#105	103		85		40-140	19		50
Cl5-BZ#118	96		82		40-140	16		50
Cl6-BZ#128	95		80		40-140	17		50
Cl6-BZ#138	95		80		40-140	17		50
Cl6-BZ#153	97		82		40-140	17		50
Cl7-BZ#170	94		80		40-140	16		50
Cl7-BZ#180	86		73		40-140	16		50
Cl7-BZ#183	94		80		40-140	16		50
Cl7-BZ#184	94		80		40-140	16		50
Cl7-BZ#187	94		80		40-140	16		50
Cl8-BZ#195	99		85		40-140	15		50
Cl9-BZ#206	93		79		40-140	16		50
Cl10-BZ#209	100		86		40-140	15		50

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2-Methylnaphthalene-d10	64.5		66		30-150
Pyrene-d10	77		75		30-150
Benzo(b)fluoranthene-d12	77		73		30-150
DBOB	88		75		50-125
BZ 198	101		85		50-125

Proposal No. 609211-132091

A00840 - 39

PETROLEUM HYDROCARBONS

Project Name: PEABODY BIKEWAY
Lab Number: L2423658
Project Number: Not Specified
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID:	L2423658-01	Date Collected:	04/30/24 10:22
Client ID:	SS-3	Date Received:	04/30/24
Sample Location:	PEABODY, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Sediment	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	05/11/24 11:21
Analytical Date:	05/15/24 08:44	Cleanup Method1:	EPH-19-2.1
Analyst:	SBC	Cleanup Date1:	05/14/24
Percent Solids:	78%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	9.34		mg/kg	8.19	8.19	1
C19-C36 Aliphatics	36.6		mg/kg	8.19	8.19	1
C11-C22 Aromatics	10.0		mg/kg	8.19	8.19	1
C11-C22 Aromatics, Adjusted	10.0		mg/kg	8.19	8.19	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	73		40-140
o-Terphenyl	78		40-140
2-Fluorobiphenyl	80		40-140
2-Bromonaphthalene	82		40-140

Project Name: PEABODY BIKEWAY
Lab Number: L2423658
Project Number: Not Specified
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID:	L2423658-02	Date Collected:	04/30/24 11:05
Client ID:	SS-2	Date Received:	04/30/24
Sample Location:	PEABODY, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Sediment	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	05/11/24 11:21
Analytical Date:	05/15/24 09:18	Cleanup Method1:	EPH-19-2.1
Analyst:	SBC	Cleanup Date1:	05/14/24
Percent Solids:	69%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Extractable Petroleum Hydrocarbons - Westborough Lab

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
C9-C18 Aliphatics	62.9		mg/kg	9.40	9.40	1
C19-C36 Aliphatics	341		mg/kg	9.40	9.40	1
C11-C22 Aromatics	172		mg/kg	9.40	9.40	1
C11-C22 Aromatics, Adjusted	172		mg/kg	9.40	9.40	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	73		40-140
o-Terphenyl	73		40-140
2-Fluorobiphenyl	78		40-140
2-Bromonaphthalene	82		40-140

Project Name: PEABODY BIKEWAY
Lab Number: L2423658
Project Number: Not Specified
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID:	L2423658-03	Date Collected:	04/30/24 11:35
Client ID:	SS-1	Date Received:	04/30/24
Sample Location:	PEABODY, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Sediment	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	05/11/24 11:21
Analytical Date:	05/15/24 09:53	Cleanup Method1:	EPH-19-2.1
Analyst:	SBC	Cleanup Date1:	05/14/24
Percent Solids:	81%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.80	7.80	1
C19-C36 Aliphatics	ND		mg/kg	7.80	7.80	1
C11-C22 Aromatics	ND		mg/kg	7.80	7.80	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.80	7.80	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	72		40-140
o-Terphenyl	73		40-140
2-Fluorobiphenyl	79		40-140
2-Bromonaphthalene	81		40-140

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 05/11/24 13:17
Analyst: MTC

Extraction Method: EPA 3546
Extraction Date: 05/10/24 12:02
Cleanup Method: EPH-19-2.1
Cleanup Date: 05/10/24

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-03 Batch: WG1919581-1					
C9-C18 Aliphatics	ND		mg/kg	6.49	6.49
C19-C36 Aliphatics	ND		mg/kg	6.49	6.49
C11-C22 Aromatics	ND		mg/kg	6.49	6.49
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.49	6.49

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	73		40-140
2-Fluorobiphenyl	79		40-140
2-Bromonaphthalene	81		40-140

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-03 Batch: WG1919581-2 WG1919581-3								
C9-C18 Aliphatics	65		69		40-140	6		25
C19-C36 Aliphatics	81		81		40-140	0		25
C11-C22 Aromatics	70		76		40-140	8		25
Naphthalene	62		70		40-140	12		25
2-Methylnaphthalene	63		71		40-140	12		25
Acenaphthylene	62		70		40-140	12		25
Acenaphthene	65		73		40-140	12		25
Fluorene	66		74		40-140	11		25
Phenanthrene	66		74		40-140	11		25
Anthracene	77		86		40-140	11		25
Fluoranthene	69		77		40-140	11		25
Pyrene	65		72		40-140	10		25
Benzo(a)anthracene	70		78		40-140	11		25
Chrysene	53		58		40-140	9		25
Benzo(b)fluoranthene	68		76		40-140	11		25
Benzo(k)fluoranthene	62		69		40-140	11		25
Benzo(a)pyrene	80		90		40-140	12		25
Indeno(1,2,3-cd)Pyrene	68		77		40-140	12		25
Dibenzo(a,h)anthracene	52		58		40-140	11		25
Benzo(ghi)perylene	46		52		40-140	12		25

Proposal No. 609211-132091

A00840 - 45

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-03 Batch: WG1919581-2 WG1919581-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	64		66		40-140
o-Terphenyl	66		74		40-140
2-Fluorobiphenyl	73		81		40-140
2-Bromonaphthalene	76		83		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Proposal No. 609211-132091

A00840 - 46

METALS

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Sample Depth:
Matrix: Sediment
Percent Solids: 78%

Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Arsenic, Total	2.65		mg/kg	0.631	0.083	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Cadmium, Total	0.118	J	mg/kg	0.252	0.033	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Chromium, Total	45.6		mg/kg	2.52	0.590	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Copper, Total	7.70		mg/kg	2.52	0.245	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Lead, Total	484		mg/kg	0.757	0.184	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Mercury, Total	0.004	J	mg/kg	0.019	0.002	5	05/23/24 04:23	05/23/24 11:01	EPA 7474	1,7474	RJP
Nickel, Total	10.7		mg/kg	1.26	0.337	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP
Zinc, Total	49.2		mg/kg	12.6	3.28	10	05/29/24 11:13	05/29/24 16:04	EPA 3050B	1,6020B	WKP

Project Name: PEABODY BIKEWAY
Lab Number: L2423658
Project Number: Not Specified
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Sample Depth:
Matrix: Sediment
Percent Solids: 69%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Arsenic, Total	3.33		mg/kg	0.693	0.092	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Cadmium, Total	0.142	J	mg/kg	0.277	0.037	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Chromium, Total	40.8		mg/kg	2.77	0.649	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Copper, Total	17.2		mg/kg	2.77	0.269	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Lead, Total	24.2		mg/kg	0.832	0.202	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Mercury, Total	0.015	J	mg/kg	0.020	0.003	5	05/23/24 04:23	05/23/24 11:04	EPA 7474	1,7474	RJP
Nickel, Total	11.4		mg/kg	1.39	0.370	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP
Zinc, Total	38.3		mg/kg	13.9	3.60	10	05/29/24 11:13	05/29/24 16:26	EPA 3050B	1,6020B	WKP

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Sample Depth:
Matrix: Sediment
Percent Solids: 81%

Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Arsenic, Total	1.36		mg/kg	0.592	0.078	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Cadmium, Total	0.10	J	mg/kg	0.237	0.031	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Chromium, Total	20.7		mg/kg	2.37	0.554	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Copper, Total	5.86		mg/kg	2.37	0.230	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Lead, Total	10.9		mg/kg	0.711	0.173	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Mercury, Total	0.005	J	mg/kg	0.018	0.002	5	05/23/24 04:23	05/23/24 11:07	EPA 7474	1,7474	RJP
Nickel, Total	12.7		mg/kg	1.18	0.316	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP
Zinc, Total	30.8		mg/kg	11.8	3.08	10	05/29/24 11:13	05/29/24 16:31	EPA 3050B	1,6020B	WKP

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1923408-1										
Mercury, Total	ND		mg/kg	0.013	0.002	5	05/23/24 04:23	05/23/24 10:44	1,7474	RJP

Prep Information

Digestion Method: EPA 7474

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1926511-1										
Arsenic, Total	ND		mg/kg	0.478	0.063	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Cadmium, Total	ND		mg/kg	0.191	0.025	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Chromium, Total	ND		mg/kg	1.91	0.448	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Copper, Total	ND		mg/kg	1.91	0.186	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Lead, Total	ND		mg/kg	0.574	0.140	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Nickel, Total	ND		mg/kg	0.957	0.256	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP
Zinc, Total	ND		mg/kg	9.57	2.49	10	05/29/24 11:13	05/29/24 16:35	1,6020B	WKP

Prep Information

Digestion Method: EPA 3050B

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1923408-2 SRM Lot Number: D123-540								
Mercury, Total	106		-		67-132	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1926511-2								
Arsenic, Total	93		-		80-120	-		20
Cadmium, Total	95		-		80-120	-		20
Chromium, Total	92		-		80-120	-		20
Copper, Total	94		-		80-120	-		20
Lead, Total	91		-		80-120	-		20
Nickel, Total	95		-		80-120	-		20
Zinc, Total	93		-		80-120	-		20

Proposal No. 609211-132091

A00840 - 52

Matrix Spike Analysis
Batch Quality Control

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1923408-3 QC Sample: L2423366-01 Client ID: MS Sample												
Mercury, Total	0.115	3.9	3.08	**76**	Q	-	-		80-120	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1926511-3 QC Sample: L2423658-01 Client ID: SS-3												
Arsenic, Total	2.65	11.9	12.9	86		-	-		75-125	-		20
Cadmium, Total	0.118J	5.24	4.94	94		-	-		75-125	-		20
Chromium, Total	45.6	19.8	65.2	99		-	-		75-125	-		20
Copper, Total	7.70	24.7	30.6	93		-	-		75-125	-		20
Lead, Total	484	52.4	583	**189**	Q	-	-		75-125	-		20
Nickel, Total	10.7	49.4	55.4	90		-	-		75-125	-		20
Zinc, Total	49.2	49.4	92.8	88		-	-		75-125	-		20

Proposal No. 609211-132091

A00840 - 53

Lab Duplicate Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1923408-4 QC Sample: L2423366-01 Client ID: DUP Sample						
Mercury, Total	0.115	0.116	mg/kg	1		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1926511-4 QC Sample: L2423658-01 Client ID: SS-3						
Arsenic, Total	2.65	2.24	mg/kg	17		20
Cadmium, Total	0.118J	0.101J	mg/kg	NC		20
Chromium, Total	45.6	42.4	mg/kg	7		20
Copper, Total	7.70	8.21	mg/kg	6		20
Lead, Total	484	668	mg/kg	**32**	Q	20
Nickel, Total	10.7	9.34	mg/kg	14		20
Zinc, Total	49.2	44.9	mg/kg	9		20

Proposal No. 609211-132091

A00840 - 54

INORGANICS
&
MISCELLANEOUS

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-01
Client ID: SS-3
Sample Location: PEABODY, MA
Sample Depth:
Matrix: Sediment

Date Collected: 04/30/24 10:22
Date Received: 04/30/24
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab										
Total Organic Carbon (Rep1)	1.69		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Rep2)	1.31		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Average)	1.50		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Grain Size Analysis - Mansfield Lab										
% Total Gravel	28.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Coarse Sand	17.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Medium Sand	29.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Fine Sand	20.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Total Fines	6.00		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
General Chemistry - Mansfield Lab										
Solids, Total	78.2		%	0.100	0.100	1	-	05/02/24 12:22	121,2540G	MRP

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-02
Client ID: SS-2
Sample Location: PEABODY, MA
Sample Depth:
Matrix: Sediment

Date Collected: 04/30/24 11:05
Date Received: 04/30/24
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab										
Total Organic Carbon (Rep1)	2.49		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Rep2)	2.54		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Average)	2.51		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Grain Size Analysis - Mansfield Lab										
% Total Gravel	20.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Coarse Sand	11.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Medium Sand	26.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Fine Sand	33.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Total Fines	10.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
General Chemistry - Mansfield Lab										
Solids, Total	68.5		%	0.100	0.100	1	-	05/02/24 12:22	121,2540G	MRP

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

SAMPLE RESULTS

Lab ID: L2423658-03
Client ID: SS-1
Sample Location: PEABODY, MA
Sample Depth:
Matrix: Sediment

Date Collected: 04/30/24 11:35
Date Received: 04/30/24
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab										
Total Organic Carbon (Rep1)	0.975		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Rep2)	0.742		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Average)	0.858		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Grain Size Analysis - Mansfield Lab										
% Total Gravel	9.00		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Coarse Sand	7.00		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Medium Sand	25.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Fine Sand	51.0		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
% Total Fines	8.00		%	0.100	NA	1	-	05/16/24 10:38	12,D6913/D7928	SJK
General Chemistry - Mansfield Lab										
Solids, Total	80.5		%	0.100	0.100	1	-	05/02/24 12:22	121,2540G	MRP

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab for sample(s): 01-03 Batch: WG1922112-1										
Total Organic Carbon (Rep1)	0.021		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Rep2)	0.028		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP
Total Organic Carbon (Average)	0.025		%	0.010	0.010	1	-	05/15/24 11:19	1,9060A	SPP

Lab Control Sample Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY

Project Number: Not Specified

Lab Number: L2423658

Report Date: 05/31/24

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Organic Carbon - Mansfield Lab Associated sample(s): 01-03 Batch: WG1922112-2								
Total Organic Carbon (Rep1)	87		-		75-125	-		25
Total Organic Carbon (Rep2)	97		-		75-125	-		25
Total Organic Carbon (Average)	92		-		75-125	-		25

Proposal No. 609211-132091

A00840 - 60

Lab Duplicate Analysis

Batch Quality Control

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1916278-1 QC Sample: L2422926-01 Client ID: DUP Sample						
Solids, Total	39.2	38.8	%	1		10
Grain Size Analysis - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1921942-1 QC Sample: L2423658-02 Client ID: SS-2						
% Total Gravel	20.0	16.0	%	**22**	Q	20
% Coarse Sand	11.0	11.0	%	0		20
% Medium Sand	26.0	27.0	%	4		20
% Fine Sand	33.0	37.0	%	11		20
% Total Fines	10.0	9.00	%	11		20

Proposal No. 609211-132091

A00840 - 61

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2423658-01A	Vial MeOH preserved	A	NA		20.4	Y	Absent		8260HLW(14)
L2423658-01B	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-01C	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-01D	Plastic 2oz unpreserved for TS	A	NA		20.4	Y	Absent		A2-TS(7)
L2423658-01E	Plastic 60ml unpreserved	A	NA		20.4	Y	Absent		A2-PAH/PCBCONG(14)
L2423658-01F	Plastic 8oz unpreserved for Grain Size	A	NA		20.4	Y	Absent		A2-HYDRO-TFINE(),A2-HYDRO-FSAND(),A2-HYDRO-MSAND(),A2-HYDRO-TGRAVEL(),A2-HYDRO-CSAND()
L2423658-01G	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		A2-PB-6020T(180),A2-ZN-6020T(180),A2-NI-6020T(180),A2-HG-7474T(28),A2-CR-6020T(180),A2-AS-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-TOC-9060-2REPS(28),A2-PREP-3050:2T(180),A2-CU-6020T(180)
L2423658-01H	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		EPH-20(14)
L2423658-02A	Vial MeOH preserved	A	NA		20.4	Y	Absent		8260HLW(14)
L2423658-02B	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-02C	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-02D	Plastic 2oz unpreserved for TS	A	NA		20.4	Y	Absent		A2-TS(7)
L2423658-02E	Plastic 60ml unpreserved	A	NA		20.4	Y	Absent		A2-PAH/PCBCONG(14)
L2423658-02F	Plastic 8oz unpreserved for Grain Size	A	NA		20.4	Y	Absent		A2-HYDRO-TFINE(),A2-HYDRO-FSAND(),A2-HYDRO-MSAND(),A2-HYDRO-TGRAVEL(),A2-HYDRO-CSAND()
L2423658-02G	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		A2-PB-6020T(180),A2-ZN-6020T(180),A2-NI-6020T(180),A2-HG-7474T(28),A2-CR-6020T(180),A2-AS-6020T(180),A2-HGPREP-AF(28),A2-CD-6020T(180),A2-TOC-9060-2REPS(28),A2-PREP-3050:2T(180),A2-CU-6020T(180)
L2423658-02H	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		EPH-20(14)

Proposal No. 609211-132091

A00840 - 62

*Values in parentheses indicate holding time in days

Project Name: PEABODY BIKEWAY
Project Number: Not Specified

Lab Number: L2423658
Report Date: 05/31/24

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2423658-03A	Vial MeOH preserved	A	NA		20.4	Y	Absent		8260HLW(14)
L2423658-03B	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-03C	Vial water preserved	A	NA		20.4	Y	Absent	30-APR-24 17:15	8260HLW(14)
L2423658-03D	Plastic 2oz unpreserved for TS	A	NA		20.4	Y	Absent		A2-TS(7)
L2423658-03E	Plastic 60ml unpreserved	A	NA		20.4	Y	Absent		A2-PAH/PCBCONG(14)
L2423658-03F	Plastic 8oz unpreserved for Grain Size	A	NA		20.4	Y	Absent		A2-HYDRO-TFINE(),A2-HYDRO-FSAND(),A2-HYDRO-MSAND(),A2-HYDRO-TGRAVEL(),A2-HYDRO-CSAND()
L2423658-03G	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		A2-PB-6020T(180),A2-NI-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-CR-6020T(180),A2-AS-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-PREP-3050:2T(180),A2-TOC-9060-2REPS(28),A2-CU-6020T(180)
L2423658-03H	Glass 250ml/8oz unpreserved	A	NA		20.4	Y	Absent		EPH-20(14)

Proposal No. 609211-132091

A00840 - 63

*Values in parentheses indicate holding time in days

Project Name: PEABODY BIKEWAY **Lab Number:** L2423658

Project Number: Not Specified **Report Date:** 05/31/24

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Project Name:	PEABODY BIKEWAY	**Lab Number:**	L2423658
Project Number:	Not Specified	**Report Date:**	05/31/24

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively

Report Format: DU Report with 'J' Qualifiers

Project Name:	PEABODY BIKEWAY	**Lab Number:**	L2423658
Project Number:	Not Specified	**Report Date:**	05/31/24

Data Qualifiers

Identified Compounds (TICs). For calculated parameters, this represents that one or more values used in the calculation were estimated.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: DU Report with 'J' Qualifiers

Project Name: PEABODY BIKEWAY
Project Number: Not Specified
Lab Number: L2423658
Report Date: 05/31/24

REFERENCES

1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - VI, 2018.

12 Annual Book of ASTM Standards. (American Society for Testing and Materials) ASTM International.

105 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - IIIA, 1997 in conjunction with NOAA Technical Memorandum NMFS-NWFSC-59: Extraction, Cleanup and GC/MS Analysis of Sediments and Tissues for Organic Contaminants, March 2004 and the Determination of Pesticides and PCBs in Water and Oil/Sediment by GC/MS: Method 680, EPA 01A0005295, November 1985.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

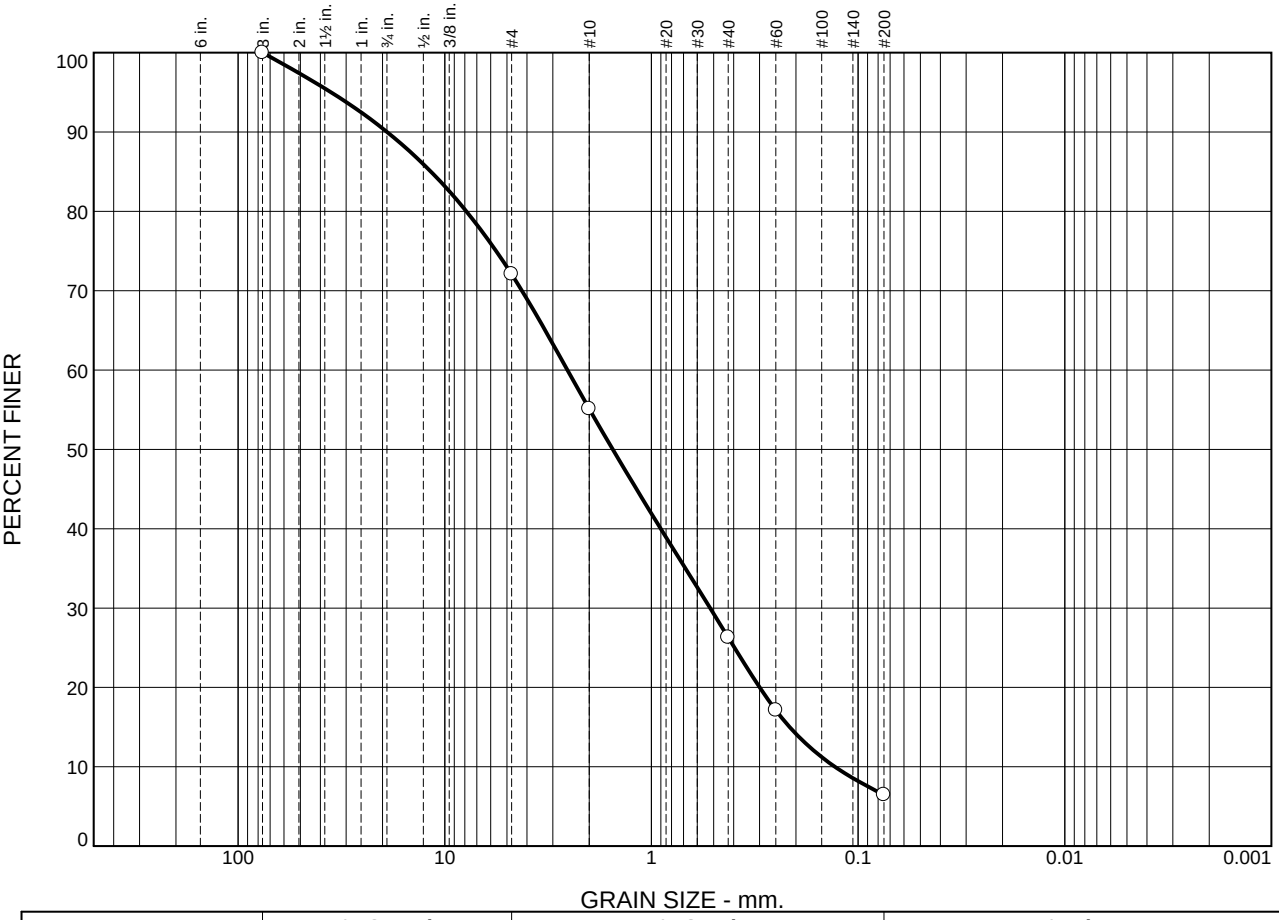
We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

ASTM D6913/D7928

GRAIN SIZE ANALYSIS

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	10	18	17	29	20	6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.6667	2.5490	1.5394	0.5202	0.2143	0.1295	0.82	19.69

Material Description	USCS	AASHTO
○		

Project No. **Client:**

Project:

○ **Source of Sample:** SS-3 **Sample Number:** L2423658-01

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

5/24/2024

Location: SS-3
Sample Number: L2423658-01

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 370.30
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
370.30	0.00	3"	0.00	0.00	100
		#4	103.40	0.00	72
		#10	62.82	0.00	55
		#40	106.70	0.00	26
		#60	34.01	0.00	17
		#200	39.47	0.00	6.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	10	18	28	17	29	20	66			6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.1295	0.2143	0.2995	0.5202	0.9013	1.5394	2.5490	7.8592	11.6667	19.0149	35.4736

Fineness Modulus	C_u	C_c
3.93	19.69	0.82

Alpha Analytical

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	8	12	11	26	33	10	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.9119	0.9902	0.5641	0.2626	0.1181	0.0782	0.89	12.67

	Material Description	USCS	AASHTO
○			

Project No. **Client:**

Project:

○ **Source of Sample:** SS-2 **Sample Number:** L2423658-02

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

5/24/2024

Location: SS-2
Sample Number: L2423658-02

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 138.63
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
138.63	0.00	3"	0.00	0.00	100
		#4	27.98	0.00	80
		#10	14.65	0.00	69
		#40	35.97	0.00	43
		#60	20.19	0.00	29
		#200	26.63	0.00	9.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	8	12	20	11	26	33	70			10

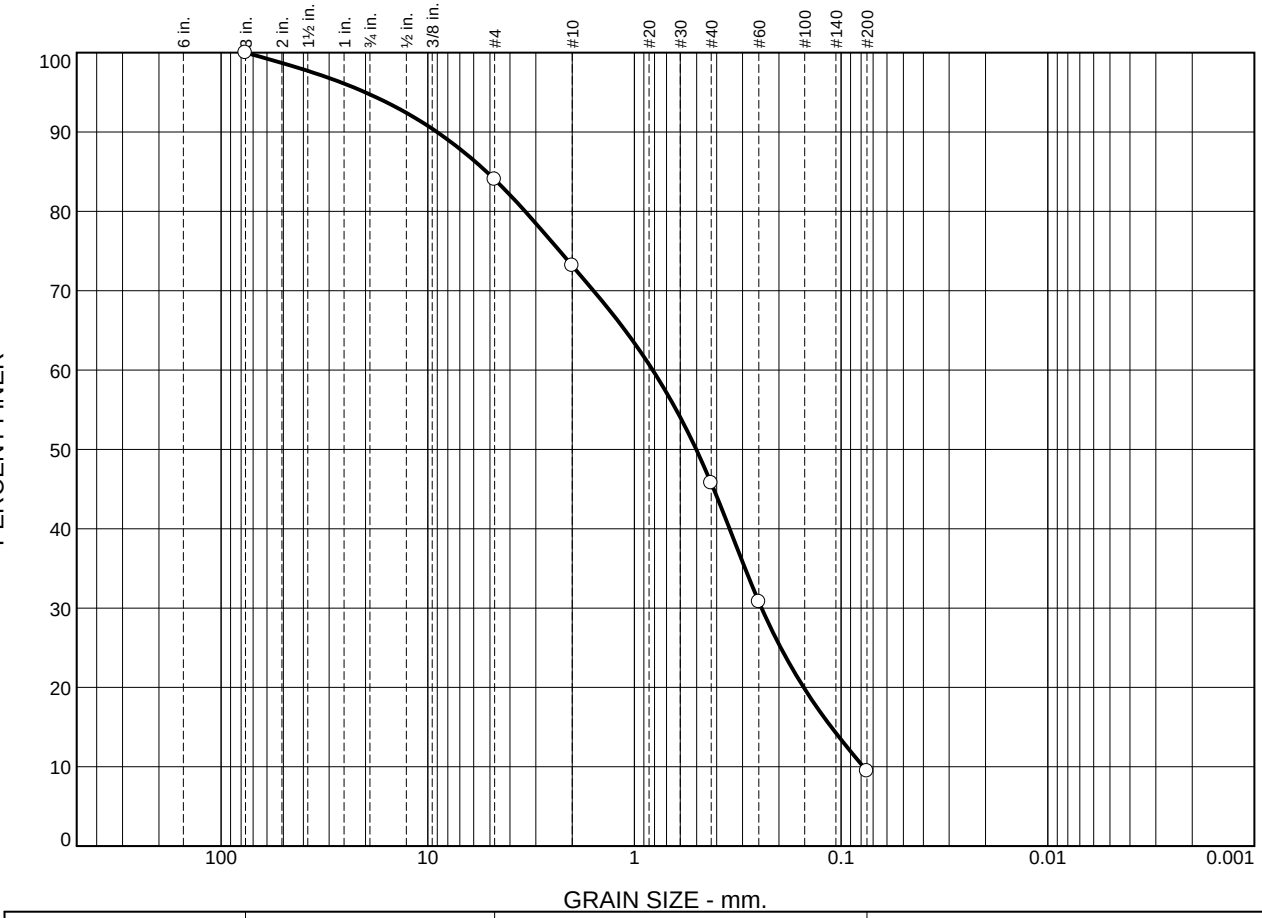
D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0782	0.1181	0.1645	0.2626	0.3762	0.5641	0.9902	4.8288	7.9119	14.4827	30.8629

Fineness Modulus	C_u	C_c
3.08	12.67	0.89

Alpha Analytical

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	5	11	11	27	37	9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			5.2023	0.8159	0.5023	0.2425	0.1115	0.0780	0.92	10.45

Material Description	USCS	AASHTO
○		

Project No. **Client:**

Project:

○ **Source of Sample:** SS-2 **Sample Number:** WG1921942-1

Remarks:

Alpha Analytical

Mansfield, MA

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

5/24/2024

Location: SS-2
Sample Number: WG1921942-1

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 138.45
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
138.45	0.00	3"	0.00	0.00	100
		#4	22.12	0.00	84
		#10	15.05	0.00	73
		#40	37.94	0.00	46
		#60	20.72	0.00	31
		#200	29.52	0.00	9.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	5	11	16	11	27	37	75			9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0780	0.1115	0.1518	0.2425	0.3466	0.5023	0.8159	3.3799	5.2023	9.0210	20.0475

Fineness Modulus	C_u	C_c
2.82	10.45	0.92

Alpha Analytical

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	3	6	7	25	51	8	

LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
		2.2313	0.4440	0.3263	0.1761	0.0999	0.0814	0.86	5.45

Material Description	USCS	AASHTO

Project No. **Client:**

Project:

Source of Sample: SS-1 **Sample Number:** L2423658-03

Alpha Analytical

Mansfield, MA

Remarks:

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

5/24/2024

Location: SS-1
Sample Number: L2423658-03

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 254.23
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
254.23	0.00	3"	0.00	0.00	100
		#4	24.03	0.00	91
		#10	16.45	0.00	84
		#40	64.53	0.00	59
		#60	45.40	0.00	41
		#200	83.47	0.00	8.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	3	6	9	7	25	51	83			8

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0814	0.0999	0.1218	0.1761	0.2438	0.3263	0.4440	1.3016	2.2313	4.3606	11.4651

Fineness Modulus	C_u	C_c
2.15	5.45	0.86

Alpha Analytical

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Nonpotable Water: EPA RSK-175 Dissolved Gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

Serial_No:05312416:46

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL LABORATORIES
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Date Rec'd in Lab: 4/30/24

ALPHA Job #: L2423658

Client Information

Client: TG&B Marine Services
Address: P.O. Box 773
Bourne, MA 02553
Phone: 508 326-3686
Email: mark tgb@aol.com

Project Information

Project Name: Peabody Bikeway
Project Location: Peabody, MA
Project #:
Project Manager: Mark Arakian
ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)

Date Due:

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA6 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
☑ See Bottle Order

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Sample Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials
23658- 01	SS-3	4/30/24	1022		MAH
02	SS-2	"	1105		↓
03	SS-1	"	1135		

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H= $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type																							
Preservative																							

Relinquished By:	Date/Time	Received By:	Date/Time
	2:12 4-30-24		4/30/24 17:12

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Proposal No. 609211-132091

A00840 - 78

Pace

Bottle Order Request

Bottle Order # 466257

APR-29-24 10:35:29

Page 1 of 1

Acctnum : TG&B
Contact Name : Mr. Mark Avakian
Projectnum :

Company : TG&B Marine Services
Client PM : Mr. Mark Avakian
Projectname : Peabody Bikeway MassDOT (609211)

Request date : 04/29/24
Order taken by : Elizabeth Boyle

Status : NEED
Linked Call :

Sample delivery date :
Projected TAT :

Completed by :
Date Completed :

Delivery method : Client pickup- 4pm

Matrix : Sediment # Samples :

Analytes : Total Solids (SM 2540 B-2011) Metals (6010D) Water Content

Client IDs : 1

0 Trip Blanks

Container	Quantity	Analyte Label
Glass 250ml/8oz unpreserved	4	Total Metals PAH/PCBCONG TOC-9060
Glass 250ml/8oz unpreserved	1	4-20
Plastic 8oz unpreserved for 2mm Size	1	2mm Size
Plastic 2oz unpreserved for	1	
5 mL Syringe for VOA	2	
Vial MeOH preserved	2	OHLW
Vial water preserved	2	OHLW

Bottle Quantity Summary:

5 mL Syringe for VOA
Glass 250ml/8oz unpreserved
Plastic 2oz unpreserved for
Plastic 8oz unpreserved for 2mm Size
Vial MeOH preserved
Vial water preserved

Trip Blanks, Field Blanks and Flow Controller

Special Shipping Requirements

Pending Shipping Date(s)
04/29/24

Cooler	Temperature	Temp	NJ Courier Pickup Label	Return Shipping Labels
A				

Client PI - [illegible] by 4pm 4/29
Please include [illegible] time

If you have questions on this Bottle Order, need to order additional bottles or schedule a Sample Pickup, please call a member of our Pace team at 508-898-9220.

PLEASE PUT SAMPLES ON ICE
EXCEPT CANISTER OR BAG SAMPLES

Serial_No:05312416:46

June 11, 2024

To:	Heidi M. Davis, MassDEP (heidi.davis@mass.gov) Ryan Hale, MassDEP (ryan.hale@mass.gov)
Cc:	Jill Provencal, MassDEP NERO (jill.provencal@mass.gov) Dan Vasconcelos, USACE (daniel.b.vasconcelos@usace.army.mil) Melissa Lenker, MassDOT (melissa.lenker@dot.state.ma.us) Erica Larner, MassDOT (erica.n.larner@dot.state.ma.us) Corinna Beckwith, MassDOT (corinna.beckwith@dot.state.ma.us) Brendan Callahan, Peabody Community Development (brendan.callahan@peabody-ma.gov) Lucia DelNegro, Peabody Conservation Agent (Lucia.DelNegro@peabody-ma.gov) Alex Strysky, MEPA (alexander.strysky@mass.gov)
From:	Oxana Fartushnaya, Green International Affiliates, Inc. Danielle Spicer, Green International Affiliates, Inc.
Date:	June 11, 2024
Project Name:	Independence Greenway Extension, Peabody, MA
Project Number:	Green No. 17118
Subject:	**Response to MassDEP Administrative Completeness and Technical Deficiency Review letter for 401 Application No: 24-WW26-0034-APP**

This memorandum provides the responses to DEP Administrative Completeness and Technical Deficiency Letter for 401 WQC Transmittal No: 24-WW26-0034-APP (Fill and Dredge).

Comments from the letter are noted below with responses to each technical review comment noted below in **Bold**.

1. Some of the helical piles proposed to support the boardwalk over Proctor Brook and its associated wetlands are located directly within the channel of Proctor Brook. MassDEP is concerned that the helical piles and associated cross bars have the potential to accumulate debris and cause an obstruction. Please provide an evaluation of alternative methods to support the boardwalk over Proctor Brook that would remove the helical piles from the channel itself.

The removal of helical piles within Proctor Brook would require a structure that spans over the channel. A structure spanning over Proctor Brook would require a much more robust beam system and support pier on the east side where the boardwalk continues through the wetlands and uplands towards Endicott Street. The beams would need to be steel or composite glulam beams that are much deeper than the current sawn timber beams. Increased beam depth would increase the height of the trail vertical profile over the brook; therefore, increasing the fill for the west approach trail into the wetlands area. The more robust pier on the east side would require either a concrete footing or drilled/driven deep piles. Both of these elements would require excavation within the wetlands and a larger footprint of the final structure. Additionally, construction would require much larger equipment. Another consideration regarding the foundation type was the existing 42" diameter City-owned sewer main just south of the boardwalk in this area. A larger pier structure

could impact the existing sewer line and require a relocation of the critical utility. Over 200' length of the sewer main could need to be relocated between the manhole structures, requiring additional excavation within Proctor Brook and the wetlands. As a result, taking steps to avoid relocation of the sewer line within this area also contributed to the decision to use the helical piles as shown on the Plans.

The proposed layout and the use of helical piles was selected to minimize impacts on the natural resources of the site. The helical piles are screwed into place using small equipment and require no excavation. All that remains in the final condition is a ~2" diameter shaft exposed above grade. The proposed spacing is based on the required loading for the boardwalk and the typical load carrying capacity of the sawn timber elements and the helical piles themselves. The longitudinal bracing piles were minimized as much as possible, and only one of these bracing piles is within the limits of Proctor Brook. Regarding the potential for debris collection, there are relatively small culverts both upstream and downstream of the proposed boardwalk crossing which would stop or limit larger debris. Therefore, debris getting caught in the helical piles is only of concern for the short stretch between these two culverts, decreasing the likelihood for significant issues with accumulation. In addition, a hydraulic study was done of this area to demonstrate there will be no rise in the Base Flood Elevation of Proctor Brook at this crossing as is include with this response letter.

We have used both helical piles and timber piles in a similar application for a previous project for the Town of Ashland. For the Sudbury Riverwalk pedestrian trail an observation platform and bridge were constructed within the limits of the Sudbury River floodway. At both locations, the pile spacing, and configuration was similar to the proposed layout for the Peabody Bikeway Extension boardwalk. This project was permitted in 2019 through the Town of Ashland Conservation Commission and built in 2020. To date there have been no issues regarding debris accumulation that Green has been made aware of by the Town.

2. MassDEP is aware that scour analyses at two of the replacement stream crossings (approximate Stations 329+75 and 346+25) determined that the placement of riprap is required for scour protection. Per 314 CMR 9.06 (1), no discharge of fill material shall be permitted if there is a practicable alternative that would have less impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Per 314 CMR 9.06(2), no discharge of fill material shall be permitted unless appropriate and practicable steps have been taken which will avoid and minimize potential adverse impacts to Bordering Vegetated Wetlands or Land Under Water (LUW). As discussed during the June 3, 2024 meeting, the amount of riprap proposed appears excessive and it has not been demonstrated that 314 CMR 9.06 (1) and (2) have been met with the current design. Potentially practicable alternatives discussed during the meeting included reshaping the riprap fill areas to follow more natural drainage patterns, removing riprap from adjacent BVWs to the extent practicable, and natural a bank stabilization measures in strategic locations. Please provide this evaluation for MassDEP review and incorporate any practicable measures to achieve less riprap fill. A reduction in BVW alteration may result in a commensurate reduction in the required BVW mitigation.

We evaluated alternative options for scour protection based on the Federal Highway Administration (FHWA) standards, specifically the Hydraulic Engineering Circular No. 23, "Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition." According to Table 2.1 of this guidance, biotechnical countermeasures are unsuitable or rarely used for contraction scour in floodplain and channel environments and for overtopping flow

at approach embankments. Alternative methods described in this table, such as those constructed from concrete, are more intrusive to the environment compared to riprap. To mitigate the environmental impact beyond what was originally proposed, the design has been revised to include proposed vegetated riprap with a layer of compost material on top. In all areas where vegetated stakes will be proposed within riprap in the BVW area, a layer of compost and seed mix will be added over the rip rap such that the compost fills the voids and is at or slightly below the surface of the stones. The addition of compost soil to the vegetated riprap will benefit vegetation re-establishment and aid in restoring the area to natural conditions. A revised detail for Compost and Seed over Vegetated Riprap is included as an attachment to this letter.

Our design follows the FHWA's Hydraulic Engineering Circular No. 14, Third Edition, "Hydraulic Design of Energy Dissipators for Culverts and Channels." The riprap aprons do not significantly dissipate energy but are crucial for spreading the flow and ensuring a smooth transition to natural drainage paths or sheet flow where applicable. Ineffectively designed or too-short aprons could increase erosion downstream, which our proposed design aims to prevent. Key design elements, including the size, length, width, and depth of the riprap apron, have been considered to address the water flow dynamics on the channel and at the embankments. These crossings occur at angles that generate turbulence, contraction flow, and increased velocity around the inlet and outlet of the culverts, necessitating our proposed approach. Signs of existing scour were present and considered for the extents of the riprap placement. These culverts have failed in the past, making scour countermeasures crucial to avoid further failures of the culverts at these locations.

We identified a location downstream of the culvert at approximately Station 329+75 where we're able to reduce the amount of riprap while still providing adequate scour protection. The limits of the initially proposed riprap limits were conservative due to the factors previously mentioned and the signs of existing scour in the area; however, given DEP's comment, this area was reviewed for any possible reduction. Considering the topography at the culvert outlet, the eastern extents of the riprap have been reduced to the local high point at the end of the existing scour hole. Up to this point, the riprap will mitigate the risk of scour downstream of the culvert. Additionally, the shape of the riprap apron was revised to provide protection in a more natural flow pattern by adding curvature to the riprap layout while still maintaining the necessary dimensions to protect against scour. Riprap impacts shown at the culvert at station 346+20 shows the minimum amount of scour protection and cannot be reduced. The reduction of rip rap at Culvert I resulted in a reduction in permanent LUW impacts from a total of 10,343 SF to 8,287 SF as well as a reduction in permanent bank impacts from 618 LF to 588 LF, as shown on the revised WQC/ACOE Impacts Plans included as an attachment to this memorandum. Even though there is a minor increase in temporary LUW impacts at Culvert I, the cumulative permanent and temporary impacts at this locations are decreased as a result of the design changes.

Although the highest velocities in the channel are along the center of the channel, significant turbulence still occurs at the edges creating erosion and scour. Due to the shape of the channel and concerns about turbulence at the toe of the embankments due to high velocities through the culverts, scour protection within the wetlands was not reduced. This is similar to the potential for abutment scour on a bridge. For this reason, the scour protection along the banks and within adjacent wetlands is necessary to protect the embankments.

3. As discussed during the June 3, 2024 meeting, placement of crushed stone filter strips should be evaluated at strategic low points along the shared use path. Although credit may not be given for Stormwater Management Standards 2, 3, or 4, they would provide some totals suspended solids

removal and groundwater recharge functions and would be considered an improvement of existing conditions as required for redevelopment projects.

The proposed shared use path consists of a 10-foot-wide paved hot mix asphalt (HMA) path with 2-foot-wide stone dust shoulders on both sides over an 8-inch subbase of gravel borrow. Per the MassDOT Project Development and Design Guide (PDDG), 10 feet is the minimum width for a two-directional shared use path and a minimum of 2-foot-wide graded shoulders must be maintained adjacent to both sides of the path. The path is impervious, but the stone dust shoulders are pervious and will provide some infiltration along the entire length of the pathway.

Stone dust was considered as an alternative to the HMA for the path but, due to the expected users, flooding concerns in the area, and regional uniformity with the other sections of the Independence Greenway, a paved HMA path is the preferred alternative. The other existing and proposed segments of the Independence Greenway, as well as the segments of the greater Border to Boston Trail, are paved, so for continuity, this segment is proposed to be paved as well. A paved path provides accessibility to the most vulnerable users of the path, such as wheelchair users and young children. Additionally, there is a history of flooding in the area and overtopping of the path during major storm events. There is a reasonable concern that future flooding in the area could wash out the stone dust path and associated erosion would contaminate the nearby wetlands and Proctor Brook.

4. Alternatives to the proposed paved waterway from Stations 289+50 to 290+00 need to be evaluated including redesigning it to be a Stormwater Control Measure per Volume 2, Chapter 2 of the Stormwater Handbook to receive credit; or at a minimum redesigning it to be a rock-lined conveyance swale to better prevent potential erosive flows.

The proposed stone filled paved waterway at Sta. 289+50 to 290+00 has been revised to a stone waterway rather than a paved waterway. See the revised Construction Plans and Profile – 1 Sheet attached to this memorandum for the revised stone waterway.

5. It appears the shading for permanent and temporary LUW impacts may be reversed on the plans in some areas. Please confirm and correct the plans if needed.

The shading for permanent and temporary LUW impacts was reversed on the Boardwalk Impacts Sheets and has been revised. See revised Boardwalk Impacts Sheets 1-3 attached to this memorandum.

6. Please note sediment chemistry results indicate concentrations of lead in Sample SS-3 that exceed the Massachusetts Contingency Plan RCS-1 criteria. As such, MassDEP intends to condition the WQC accordingly.

So noted.

Wetland Replication - Proposed new wetland replication area

Additionally, the wetland replication area has been relocated to address DEP concerns about the previously shown replication area. Included as attachments to this memorandum are a revised wetland replication plan for a new replication area located north of Gilmore Terrace as well as the wetland delineation memorandum including DEP data forms and a photo log of the area. This area

is a more natural extension of the wetland than the previously shown replication area, and we believe addresses DEP's concerns with the original location. While this area does require a small access road, it is off of a public ROW, proposes timber matting for the temporary access, and the access route was designed to avoid existing trees; thereby minimizing impacts. In addition, the buffer zone associated with this replication area does not extend into any private property.

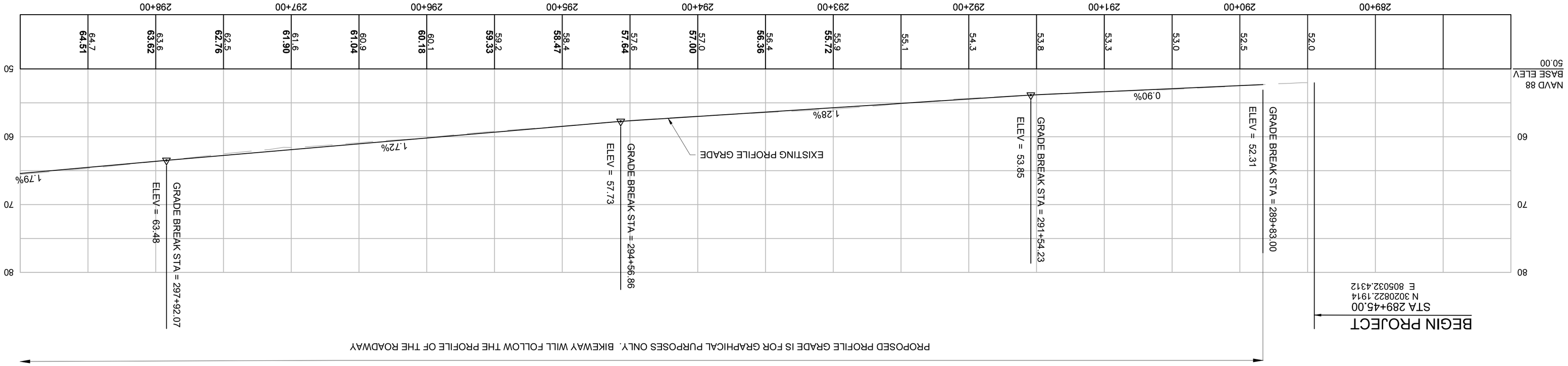
Enclosed with this letter response are the following documents:

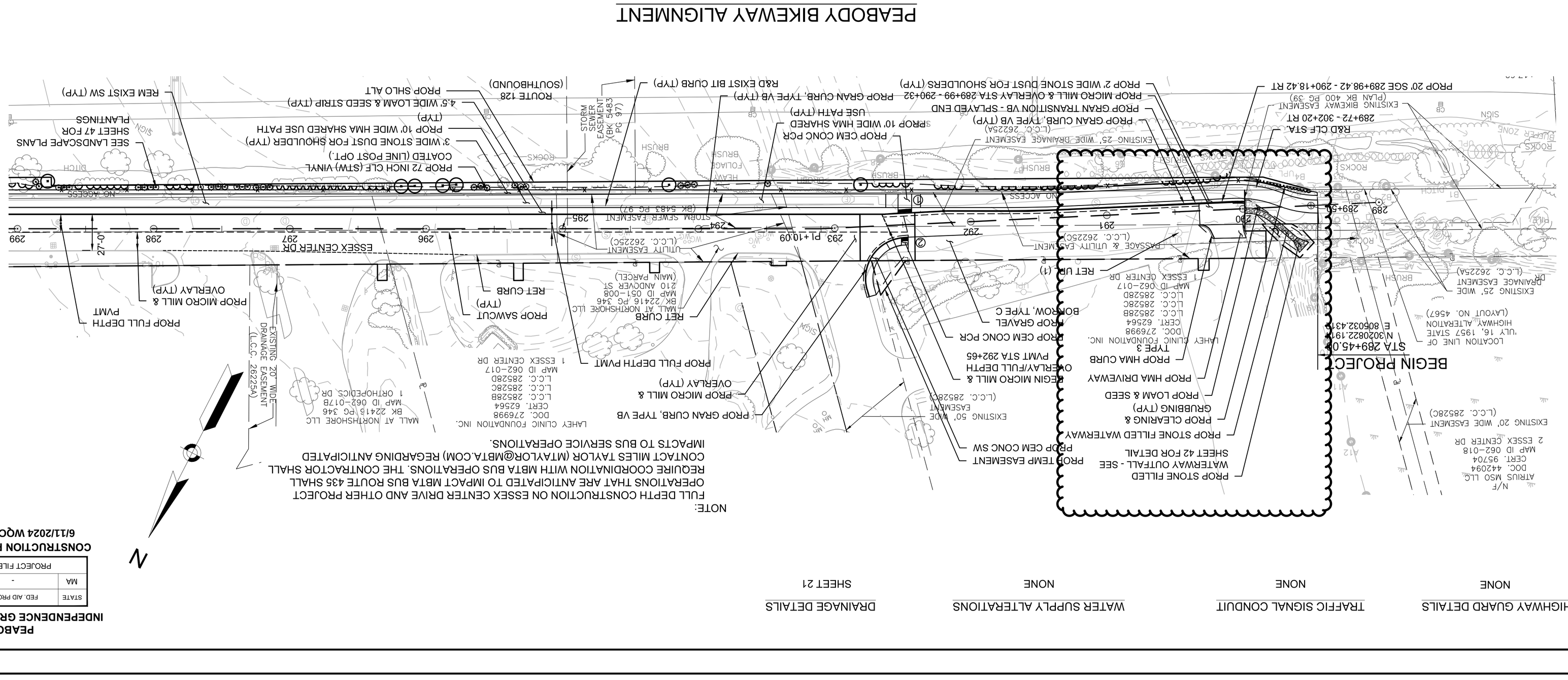
- Revised Plan Sheets
  - Construction Plan and Profile – 1 (Sheet 9)
  - Construction Plan and Profile – 4 (Sheet 12)
  - Construction Plan and Profile – 5 (Sheet 13)
  - Drainage and Utility Plans – 1-4 (Sheets 21-24)
  - Wetland Replication Plans (Sheets 33 & 34)
  - Culvert 1 – Plan and Longitudinal Section (Sheet 35)
  - Culvert 1 – Headwall Elevations (Sheet 36)
  - Culvert 2 – Plan and Longitudinal Section (Sheet 37)
  - Culvert 2 – Headwall Elevations (Sheet 38)
  - Construction Details – 2 (Sheet 42)
  - WQC/ACOE Impact Plans (Sheet 1, 4, and 5 of 8)
  - Boardwalk Impact Plans (Sheets 1-3)
- Wetland Delineation Memo for New Wetland Replication Area
- Hydraulic and Scour Reports

Y:\Shared\Engineering\Projects\2017\17118\Documents\ENV\WQC\DEP 401 WQC Admin And Tech Def Letter\Responses To Admin And Tech Def 24-WW26-0034-APP - 609211 Peabody_R-01.Docx

Revised Plan Sheets

PEABODY BIKEWAY ALIGNMENT





CONTINUED ON SHEET NO. 10

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	143
	PROJECT FILE NO. 609211		

CONSTRUCTION PLAN & PROFILE - 1
6/11/2024 WQC/NOI REVISIONS

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

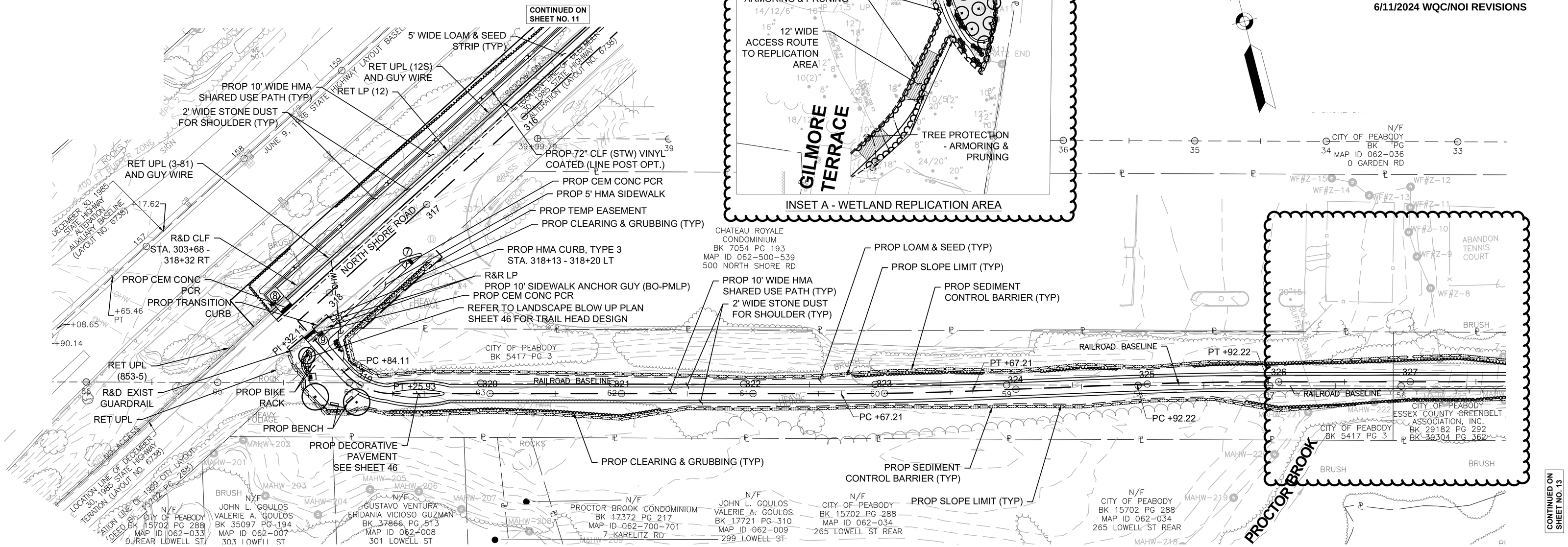
NONE

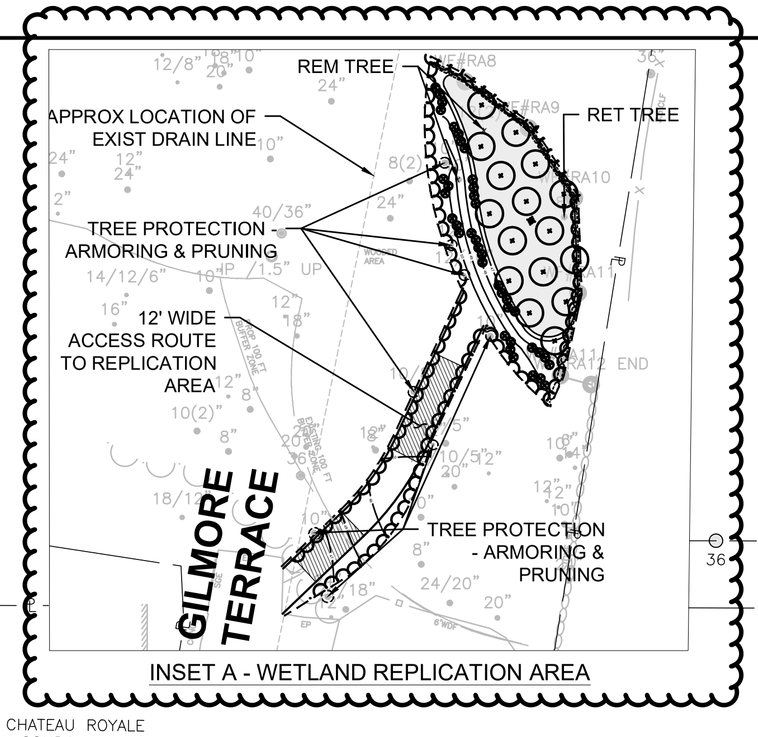
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	12	143
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 4
6/11/2024 WQC/NOI REVISIONS

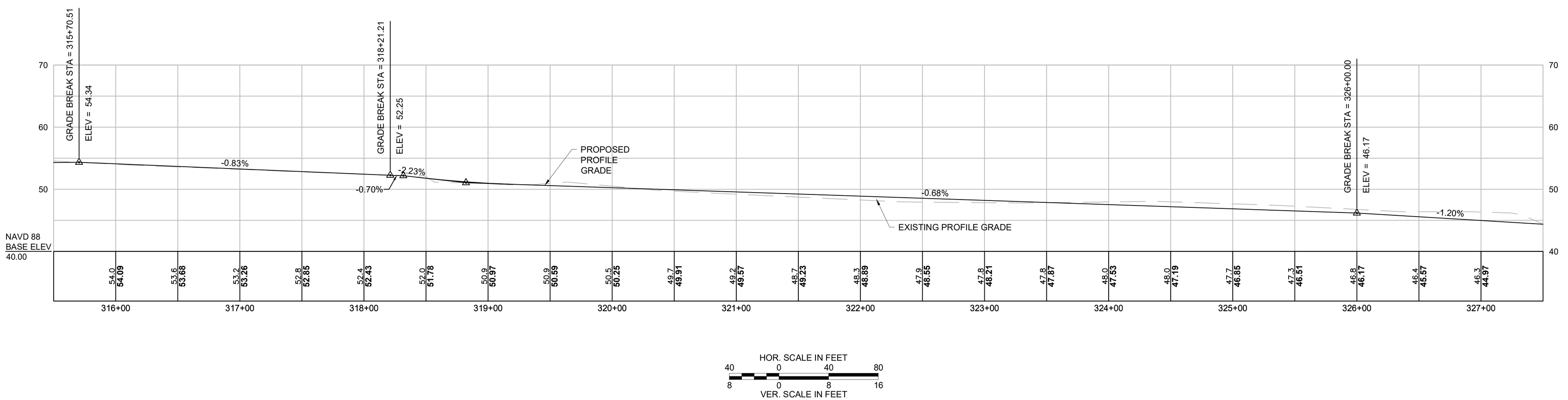
SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG Plotted on 11-Jun-2024 9:36 AM





INSET A - WETLAND REPLICATION AREA

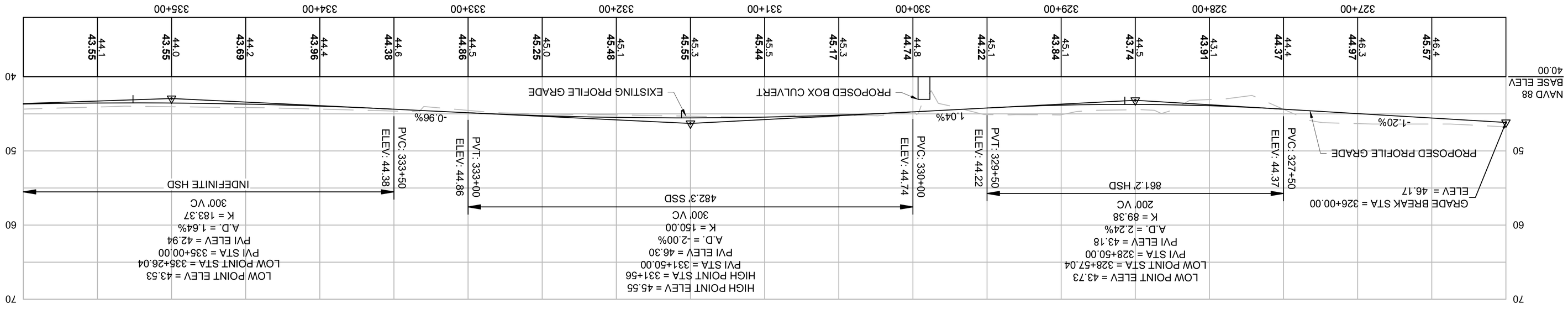
PEABODY BIKEWAY ALIGNMENT

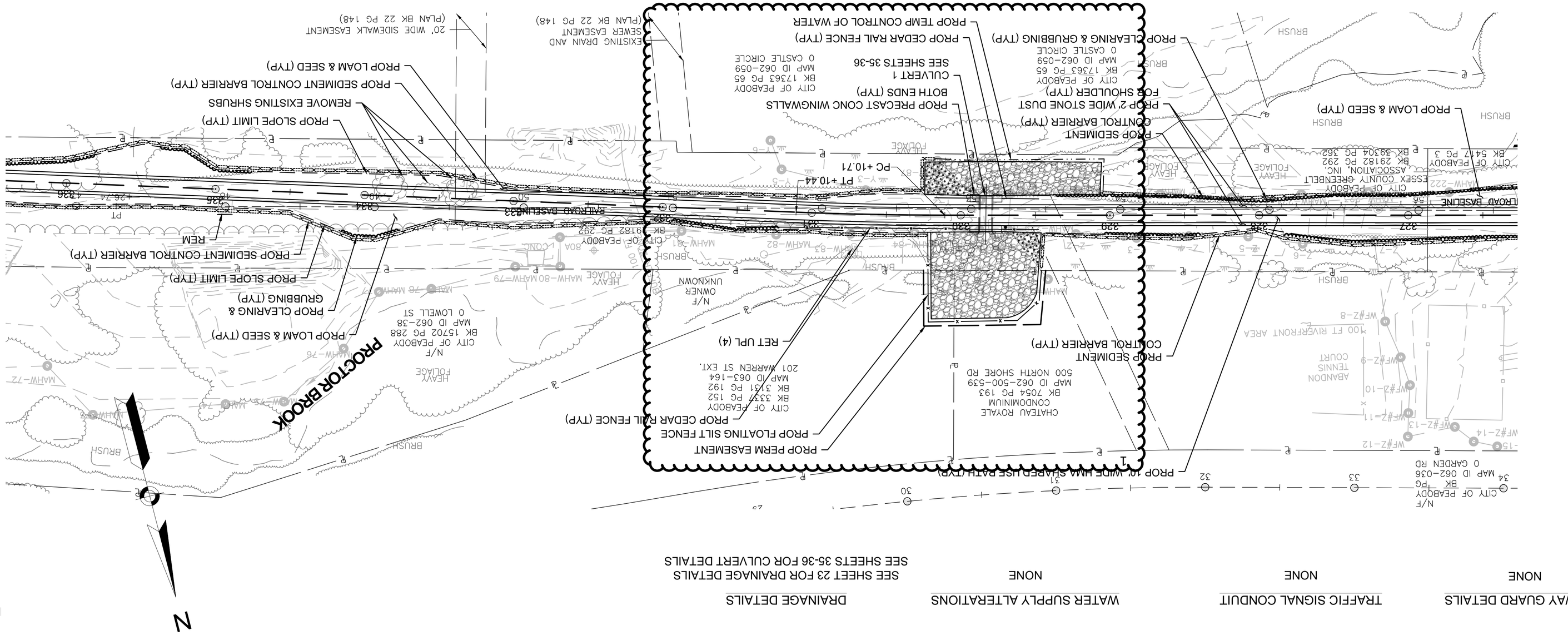


A00840 - 87

CONTINUED ON SHEET NO. 12

PEABODY BIKEWAY ALIGNMENT




CONTINUED ON SHEET NO. 14
PROCTOR BROOK
N
PROP 10' WIDE MIX SHARED USE PATH (TYP)
PROP CLEARING & GRUBBING (TYP)
PROP SEDIMENT CONTROL BARRIER (TYP)
PROP 2' WIDE STONE DUST FOR SHOULDER (TYP)
PROP PRECAST CONC WINGWALLS
BOTH ENDS (TYP)
CULVERT 1
SEE SHEETS 35-36
PROP TEMP CONTROL OF WATER
PROP CEDAR RAIL FENCE (TYP)
EXISTING DRAIN AND SEWER EASEMENT
(PLAN BK 22 PG 148)
20' WIDE SIDEWALK EASEMENT
(PLAN BK 22 PG 148)
PROP LOAM & SEED (TYP)
PROP SEDIMENT CONTROL BARRIER (TYP)
REMOVE EXISTING SHRUBS
PROP SLOPE LIMIT (TYP)
PROP LOAM & SEED (TYP)
PROP CLEARING & GRUBBING (TYP)
PROP SLOPE LIMIT (TYP)
PROP SEDIMENT CONTROL BARRIER (TYP)
REM
PROP PERM EASEMENT
PROP FLOATING SILT FENCE
PROP CEDAR RAIL FENCE (TYP)
RET UPL (4)
PC +10.71
PT +10.44
CITY OF PEABODY
BK 17363 PG 65
MAP ID 062-059
0 CASTLE CIRCLE
CHATEAU ROYALE
CONDOMINIUM
BK 7054 PG 193
MAP ID 062-500-539
500 NORTH SHORE RD
201 WARREN ST EXT.
CITY OF PEABODY
BK 33?? PG 152
BK 33?? PG 192
MAP ID 063-164
N/F
UNKNOWN OWNER
CITY OF PEABODY
BK 15702 PG 288
MAP ID 062-38
0 LOWELL ST
CITY OF PEABODY
BK 9182 PG 292
ESSEX COUNTY GREENBELT ASSOCIATION, INC.
BK 29182 PG 292
BK 33?04 PG 362
CITY OF PEABODY
BK 5417 PG 3
N/F
CITY OF PEABODY
BK ?PG
MAP ID 062-036
0 GARDEN RD
RAILROAD BASELINE
100 FT RIVERFRONT AREA
ABANDON TENNIS COURT
HEAVY FOLIAGE
BRUSH
MAHW-72
MAHW-76
MAHW-79
MAHW-80
MAHW-81
MAHW-82
MAHW-83
MAHW-84
MAHW-85
MAHW-86
MAHW-87
MAHW-88
MAHW-89
MAHW-90
MAHW-91
MAHW-92
MAHW-93
MAHW-94
MAHW-95
MAHW-96
MAHW-97
MAHW-98
MAHW-99
MAHW-100
MAHW-101
MAHW-102
MAHW-103
MAHW-104
MAHW-105
MAHW-106
MAHW-107
MAHW-108
MAHW-109
MAHW-110
MAHW-111
MAHW-112
MAHW-113
MAHW-114
MAHW-115
MAHW-116
MAHW-117
MAHW-118

TOTAL PROJECT IMPACTS TO WATERS OF THE UNITED STATES:

PERMANENT VW IMPACT AREA = 2,225 SF ±

PERMANENT LUW/WOTUS IMPACT AREA = 8,287 SF ±

TOTAL PERMANENT IMPACT AREA = 10,512 SF ±

DREDGE VOLUME = 1,491 CY

FILL VOLUME = 1,491 CY

VEGETATED WETLAND (VW)

DITCH

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

TEMPORARY VW IMPACT AREA = 4,641 SF ±

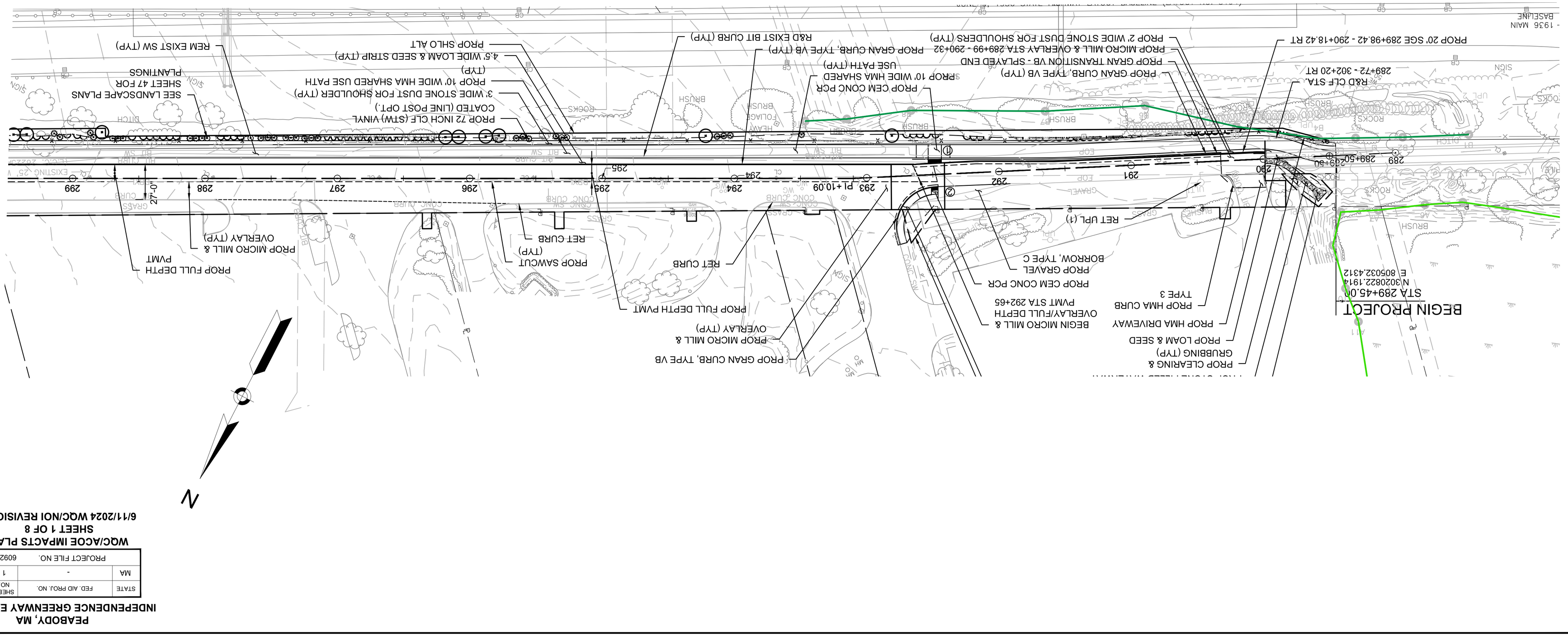
TEMPORARY LUW/WOTUS IMPACT AREA = 2,180 SF ±

TOTAL TEMPORARY IMPACT AREA = 6,821 SF ±

PERMANENT STREAM/BANK IMPACT = 588 LF ±

TEMPORARY STREAM/BANK IMPACT = 166 LF ±

SCALE IN FEET
1" = 40'
40 0 40 80



WQC/ACOE IMPACTS PLAN
SHEET 1 OF 8
6/11/2024 WQC/NOI REVISIONS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	8
PROJECT FILE NO. 609211			

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

A00840 - 89

WQC_ACOE IMPACTS.DWG Plotted on 11-Jun-2024 10:11 AM

Proposal No. 609211 132091

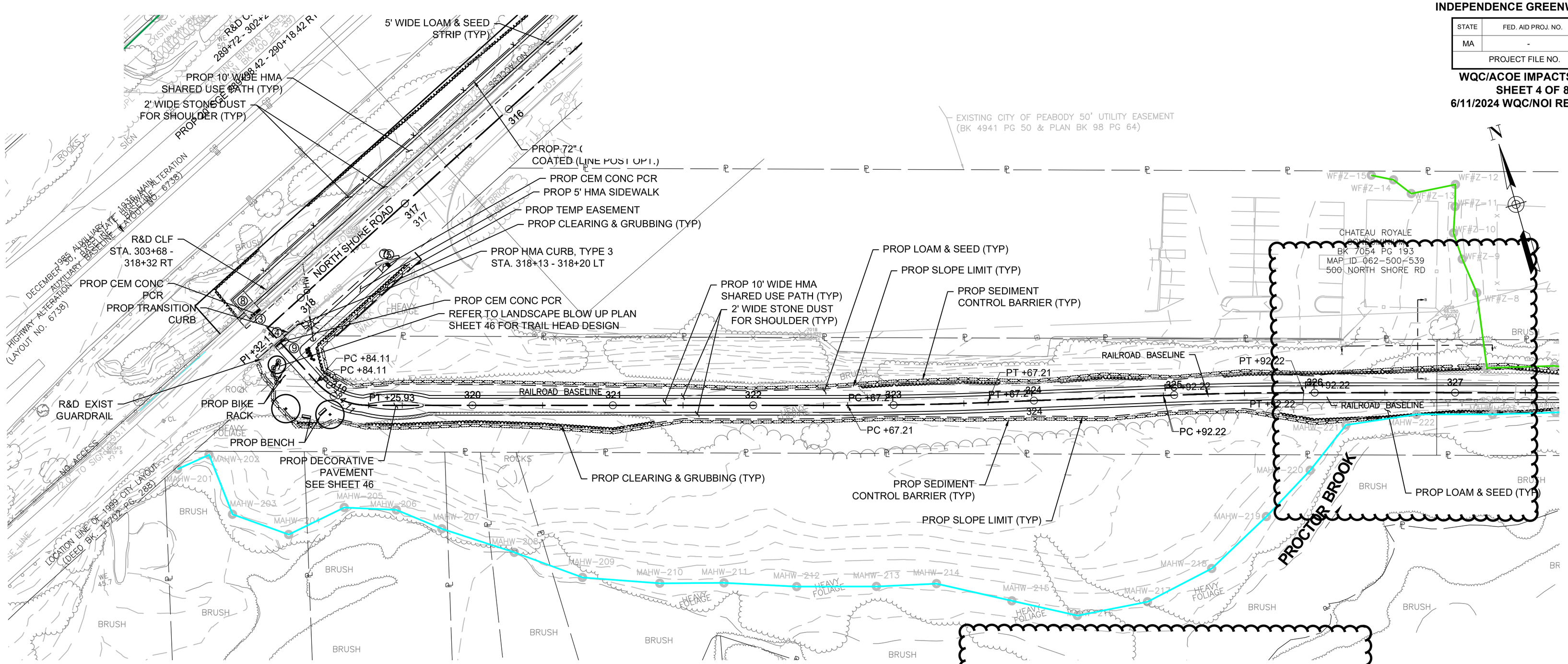
Proposal No. 609211-132091

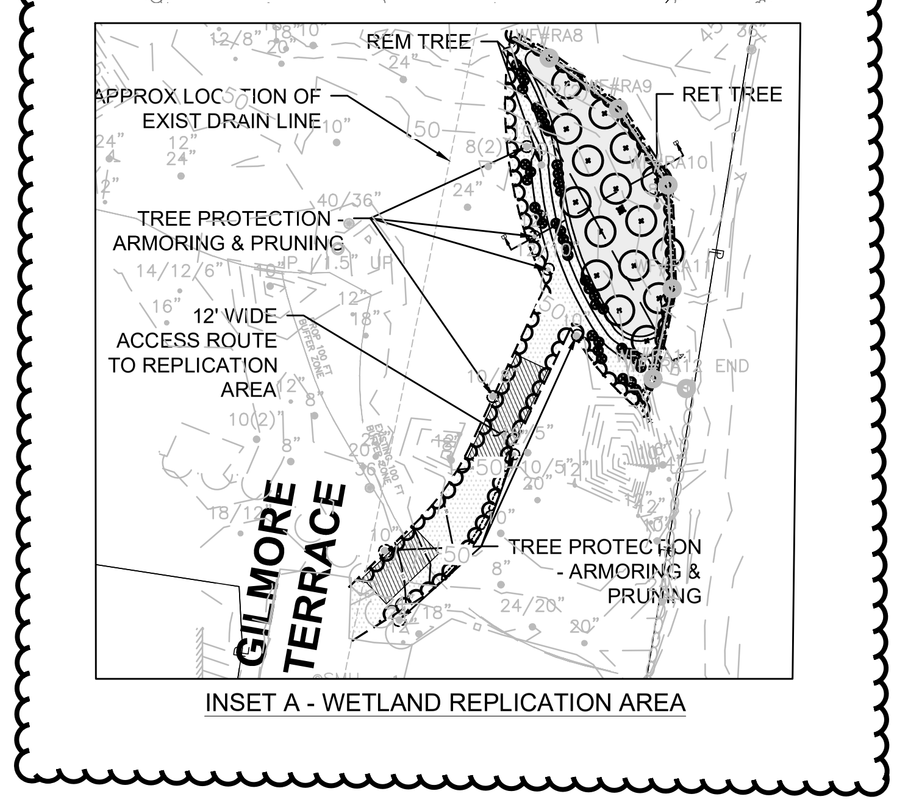
A00840 - 90

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 4 OF 8
6/11/2024 WQC/NOI REVISIONS





INSET A - WETLAND REPLICATION AREA

PERMANENT VW IMPACT AREA
TEMPORARY VW IMPACT AREA
PERMANENT LUW/WOTUS IMPACT AREA
TEMPORARY LUW/WOTUS IMPACT AREA
VEGETATED WETLAND (VW)
BANK/OHW (PERENNIAL STREAM)
BANK (INTERMITTENT STREAM)
DITCH

PERMANENT STREAM/BANK IMPACT
TEMPORARY STREAM/BANK IMPACT

40 0 40
SCALE IN FEET
1" = 40'

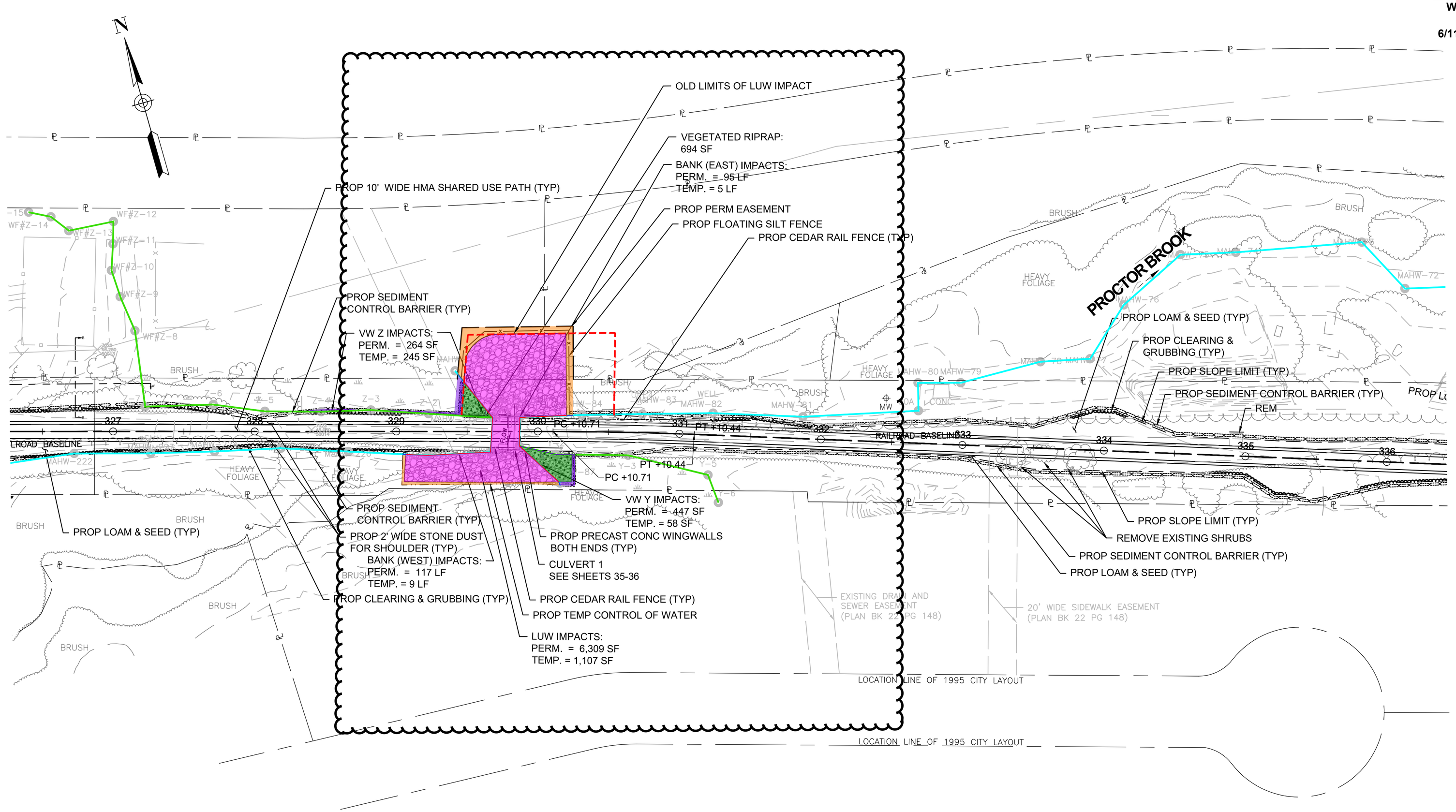
Proposal No. 609211-132091

A00840 - 91

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	8
PROJECT FILE NO.	609211		

WQC/ACOE IMPACTS PLAN
SHEET 5 OF 8
6/11/2024 WQC/NOI REVISIONS



PERMANENT VW IMPACT AREA

TEMPORARY VW IMPACT AREA

PERMANENT LUW/WOTUS IMPACT AREA

TEMPORARY LUW/WOTUS IMPACT AREA

VEGETATED WETLAND (VW)

BANK/OHW (PERENNIAL STREAM)

BANK (INTERMITTENT STREAM)

DITCH

PERMANENT STREAM/BANK IMPACT

TEMPORARY STREAM/BANK IMPACT

40 0 40
SCALE IN FEET
1" = 40'

Proposal No. 609211-132091

GENERAL PLAN (1 OF 3)

SCALE: $\frac{1}{4}$" = 1'–0"

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

BOARDWALK IMPACTS SHEET 1 OF 3

6/11/2024 WQC/NOI REVISIONS

STATION EQUATION: INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄ STA. 351+64.36 = PROCTOR BROOK ℄ STA. 88+67.46

℄ BRG. WEST ABUTMENT

W.P. #1
STA. 351+09.93

351+00

BOLLARD
(HWY. ITEM)

PT +63.04

352+00

MAHW–112

MAHW–111

MAHW–110

MAHW–78

STONE WALL

ROCKS

36"

PROP. GRS–IBS ABUTMENT

PROP. RIPRAP

LOCATION OF LOW CHORD
STA. 351+73.93

INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄

107

TIMBER POST

PROP. APPROACH SHARED–USE PATH

PROP. GRADE

PROP. GRS–IBS ABUTMENT

PROP. CEDAR RAIL FENCE (HWY. ITEM)

3'–0"

℄ PIER BENT 1 | ℄ PIER BENT 2 | ℄ PIER BENT 3 | ℄ PIER BENT 4 | ℄ PIER BENT 5 | ℄ PIER BENT 6 | ℄ PIER BENT 7 | ℄ PIER BENT 8 | ℄ PIER BENT 9 | ℄ PIER BENT 10 | ℄ PIER BENT 11 | ℄ B

PROP. TIMBER RAI

TOP OF REINFORCED SOIL FOUNDATION EL. 36.50

18" MIN. CRUSHED STONE

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

- PERMANENT BVW IMPACT AREA = 6 SF
- TEMPORARY BVW IMPACT AREA = 3,461 SF
- PERMANENT LUW IMPACT AREA = 305 SF
- TEMPORARY LUW IMPACT AREA = 432 SF – DREDGE VOLUME = 0 CY
- STREAM/BANK IMPACT (PERM.) = 37 LF
- STREAM/BANK IMPACT (TEMP.) = 4 LF
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)

TYPICAL ELEVATION (1 OF 3)

SCALE: $\frac{1}{4}$" = 1'–0"

Y:\Shared\Engineering\Projects\2017\17118\Dwg\IMPACTS.DWG Plotted on 6-Jun-2024 10:01 AM
BRIDGE IMPACTS.DWG
10-May-2024
FIFTH STRUCTURAL SUBMISSION (S5)
A00840 - 92

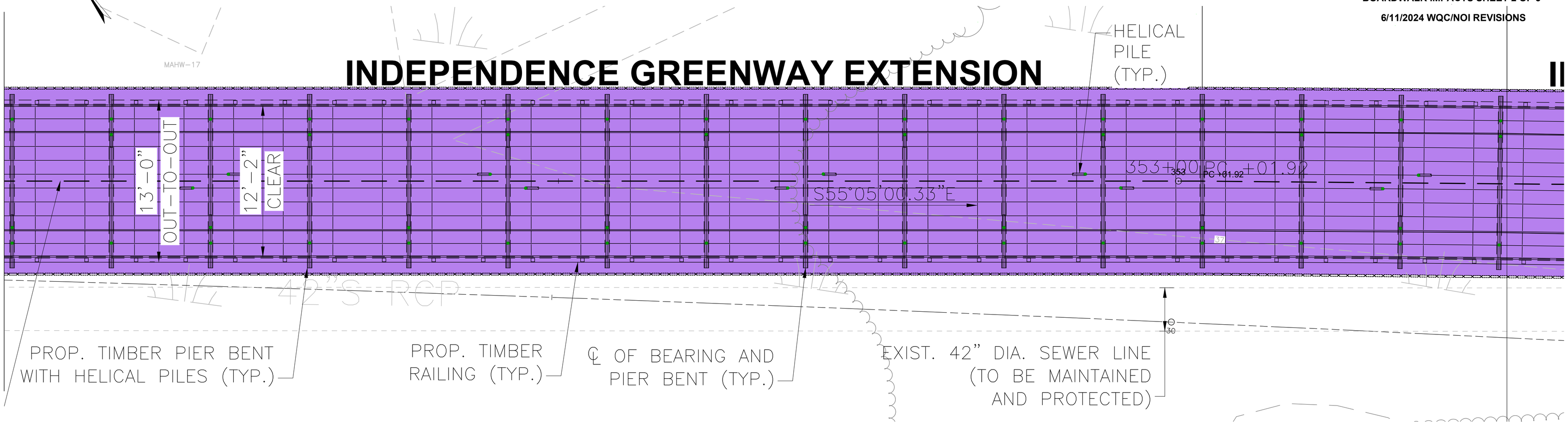
PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

BOARDWALK IMPACTS SHEET 2 OF 3

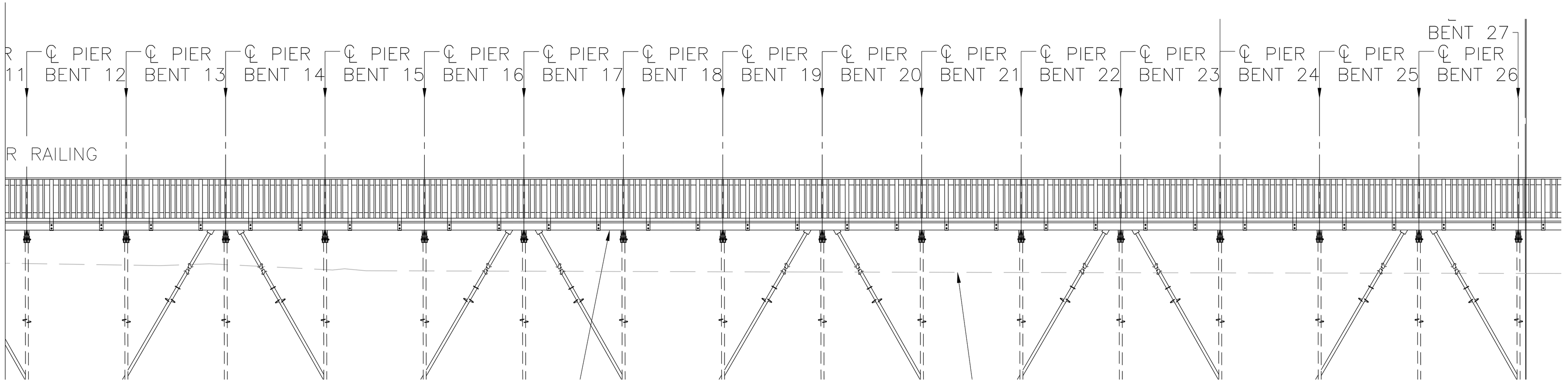
6/11/2024 WQC/NOI REVISIONS

INDEPENDENCE GREENWAY EXTENSION



GENERAL PLAN (2 OF 3)

SCALE: $\frac{1}{4}$" = 1'-0"



TYPICAL ELEVATION (2 OF 3)

SCALE: $\frac{1}{4}$" = 1'-0"

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

- PERMANENT BVW IMPACT AREA
- TEMPORARY BVW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY LUW IMPACT AREA

- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\BW

BRIDGE IMPACTS.DWG Plotted on 6-Jun-2024 10:04 AM

FIFTH STRUCTURAL SUBMISSION (SS) 10-May-2024

A00840 - 93

Proposal No. 609211-132091

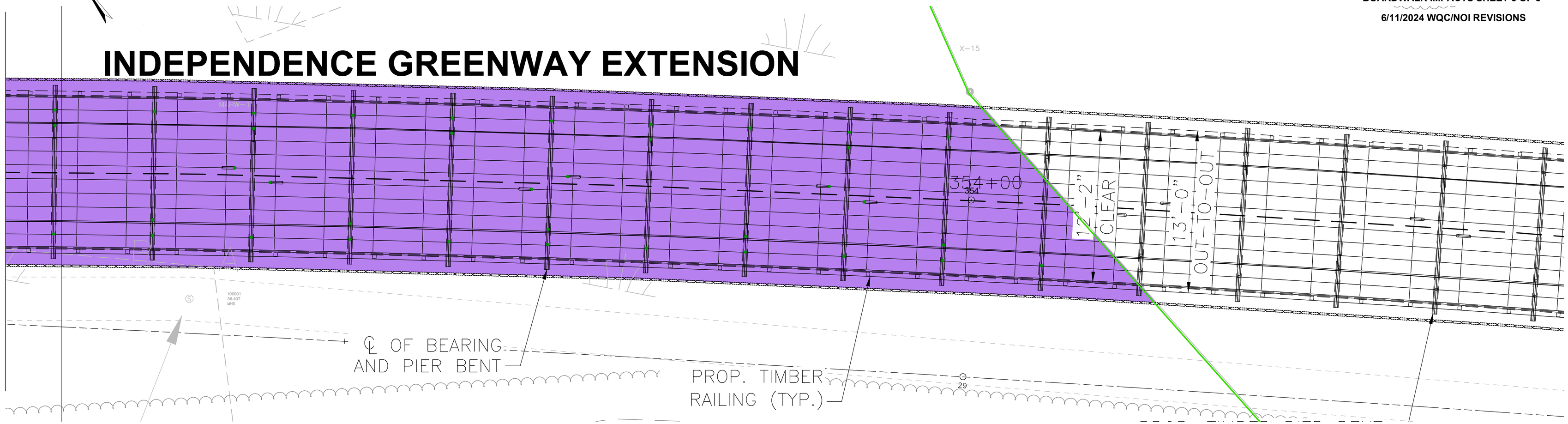
PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	142
PROJECT FILE NO.	609211		

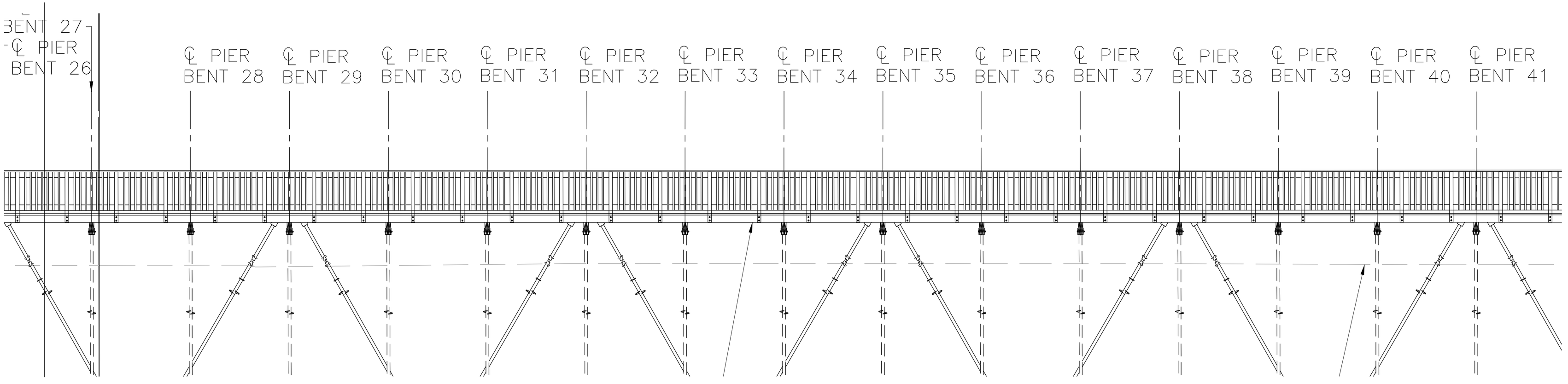
BOARDWALK IMPACTS SHEET 3 OF 3

6/11/2024 WQC/NOI REVISIONS

INDEPENDENCE GREENWAY EXTENSION



GENERAL PLAN (3 OF 3)
SCALE: ¼" = 1'-0"



TYPICAL ELEVATION (3 OF 3)
SCALE: ¼" = 1'-0"

IMPACTS FROM STA. 348+50 TO 358+50 ONLY:

- PERMANENT BVW IMPACT AREA
- TEMPORARY BVW IMPACT AREA
- PERMANENT LUW IMPACT AREA
- TEMPORARY LUW IMPACT AREA

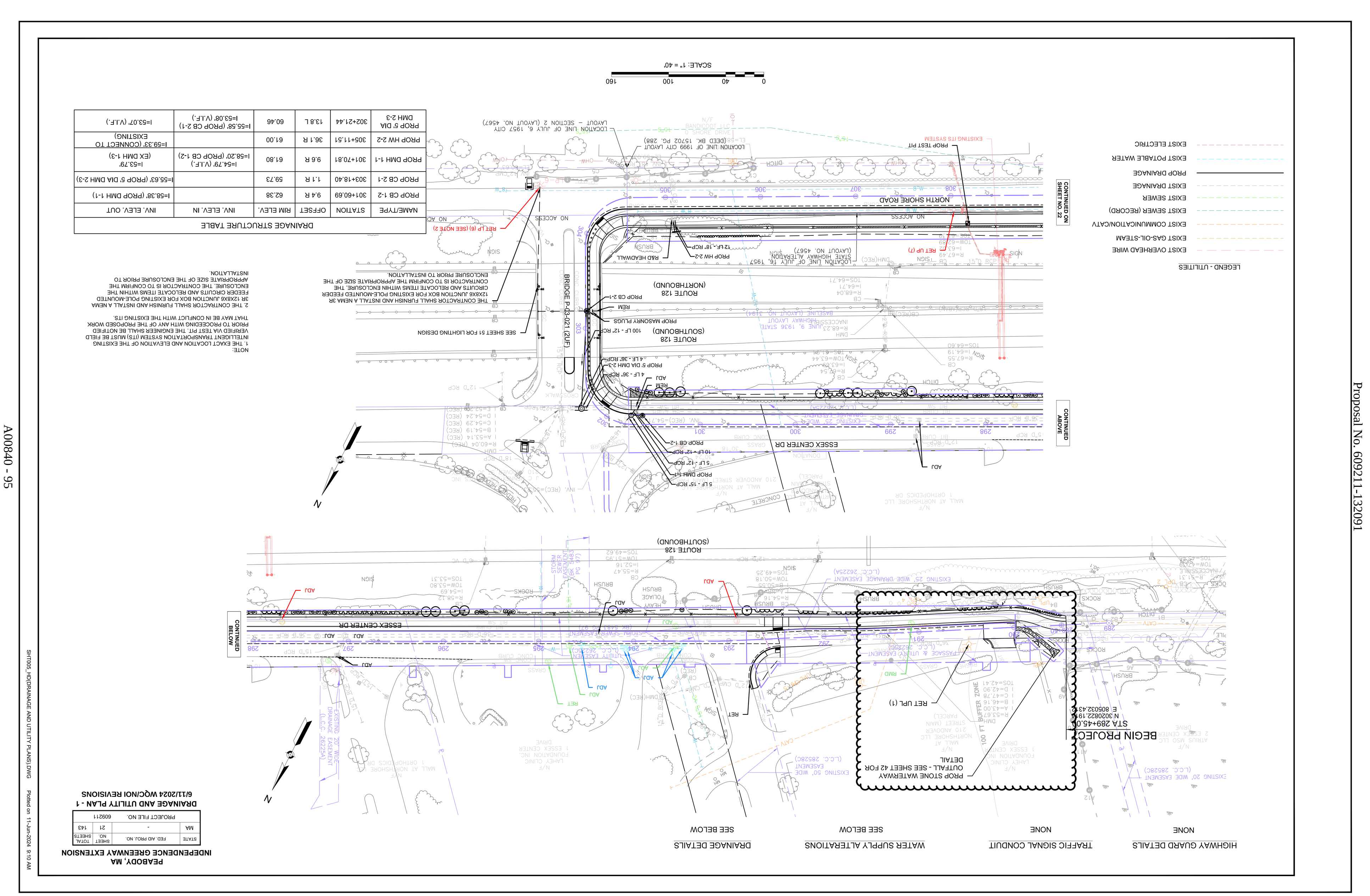
- VEGETATED WETLAND (VW)
- BANK/OHW (PERENNIAL STREAM)
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)

Y:\Shared\Engineering\Projects\2017\17118\Dwg\IMV

BRIDGE IMPACTS.DWG Plotted on 6-Jun-2024 10:05 AM

FIFTH STRUCTURAL SUBMISSION (S5) 10-May-2024

A00840 - 94



DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 1-2	301+60.69	9.4 R	62.38		I=58.38' (PROP DMH 1-1)
PROP CB 2-1	303+18.40	1.1 R	59.73		I=55.63' (PROP 5' DIA DMH 2-3)
PROP DMH 1-1	301+70.81	9.6 R	61.80	I=58.20' (PROP CB 1-2)	I=54.79' (V.I.F.) I=53.79' (EX DMH 1-3)
PROP HW 2-2	305+11.51	36.1 R	61.00		I=59.33' (CONNECT TO EXISTING)
PROP 5' DIA DMH 2-3	302+21.44	13.8 L	60.46	I=55.58' (PROP CB 2-1)	I=53.07' (V.I.F.)

NOTE:
1. THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

2. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA 3R 12X8X6 JUNCTION BOX FOR EXISTING POLE-MOUNTED FEEDER CIRCUITS AND RELOCATE ITEMS WITHIN THE ENCLOSURE. THE CONTRACTOR IS TO CONFIRM THE APPROPRIATE SIZE OF THE ENCLOSURE PRIOR TO INSTALLATION.

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	SEE BELOW	SEE BELOW

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

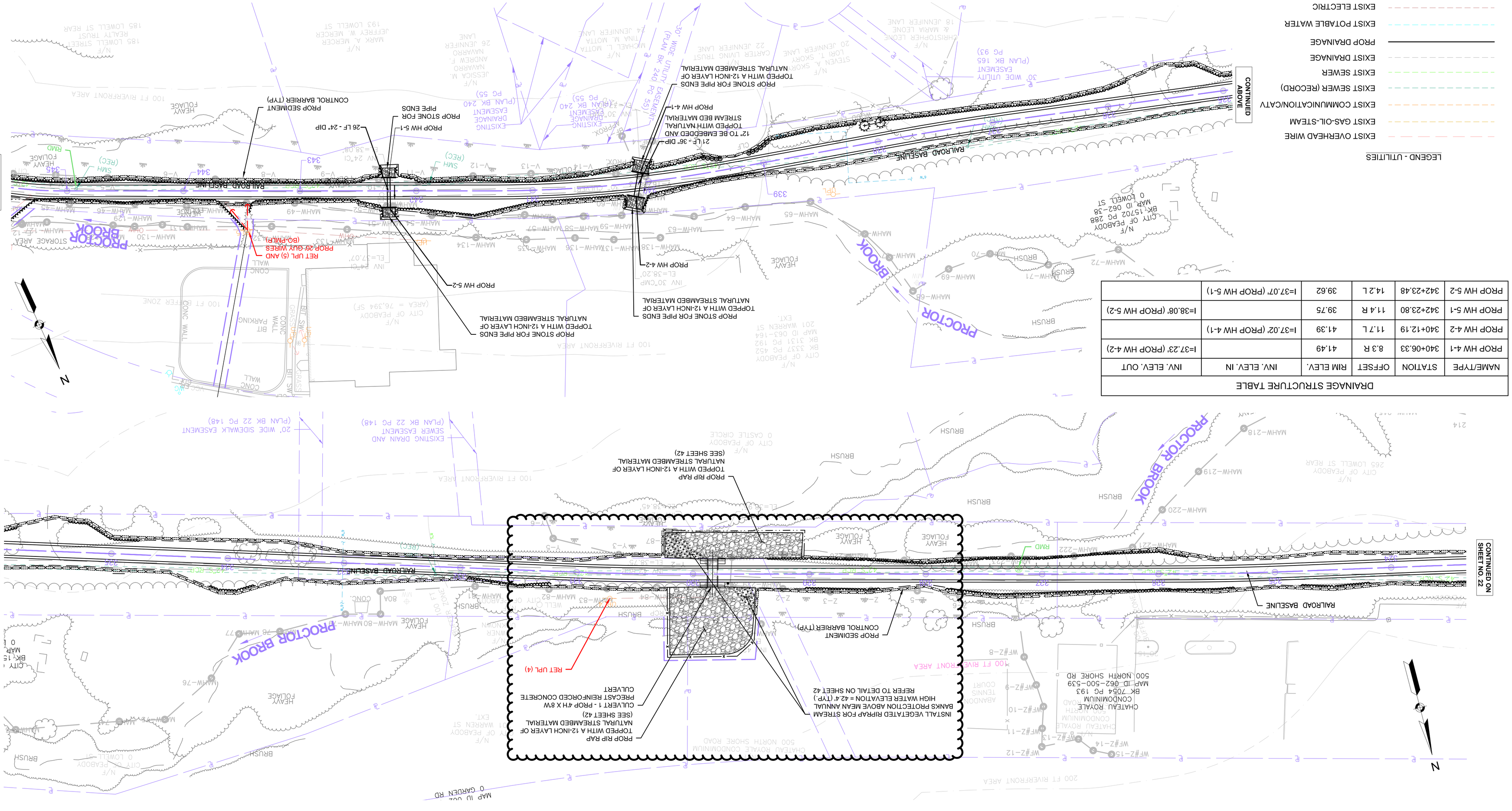
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	143
	PROJECT FILE NO.	609211	

DRAINAGE AND UTILITY PLAN - 1
6/11/2024 WQC/NOI REVISIONS

A00840 - 95

SHT005_HDRDRAINAGE AND UTILITY PLANS.DWG Plotted on 11-Jun-2024 9:10 AM

Proposal No. 609211-132091



DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 4-1	340+06.33	8.3 R	41.49		I=37.23', (PROP HW 4-2)
PROP HW 4-2	340+12.19	11.7 L	41.39		I=37.02', (PROP HW 4-1)
PROP HW 5-1	342+23.80	11.4 R	39.75		I=38.08', (PROP HW 5-2)
PROP HW 5-2	342+23.48	14.2 L	39.62	I=37.07', (PROP HW 5-1)	

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SEE BELOW

DRAINAGE AND UTILITY PLAN - 3
6/11/2024 WQC/NOI REVISIONS

PROJECT FILE NO. 609211			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	143

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

A00840 - 96

SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 11-Jun-2024 9:40 AM

Proposal No. 609211-132091

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	143
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 4
6/11/2024 WQC/NOI REVISIONS

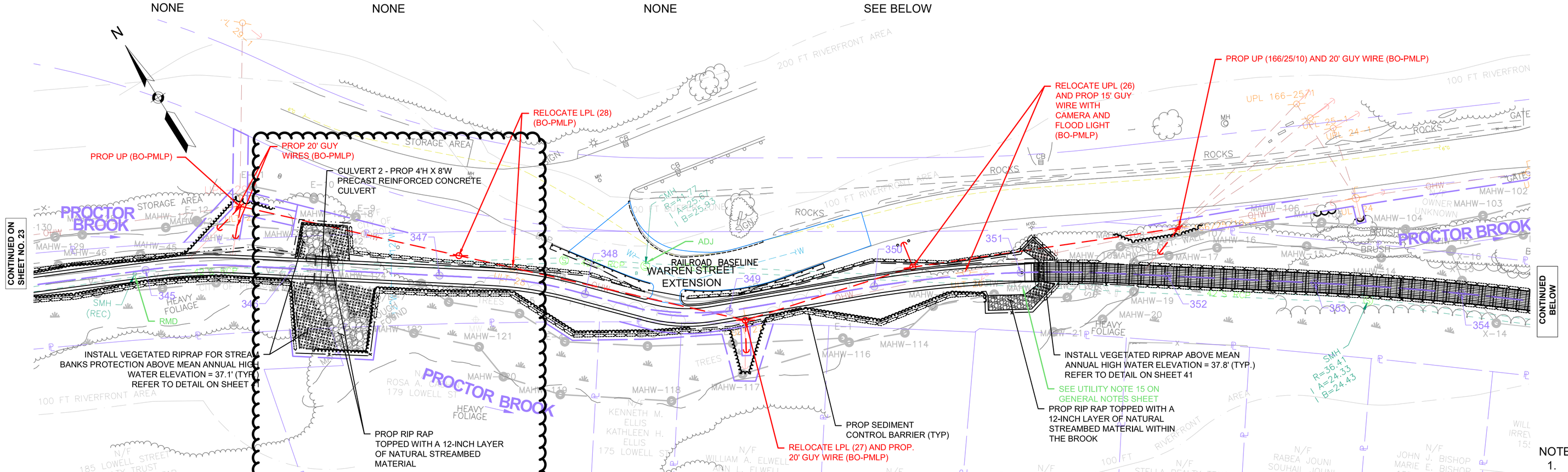
SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 11-Jun-2024 9:12 AM

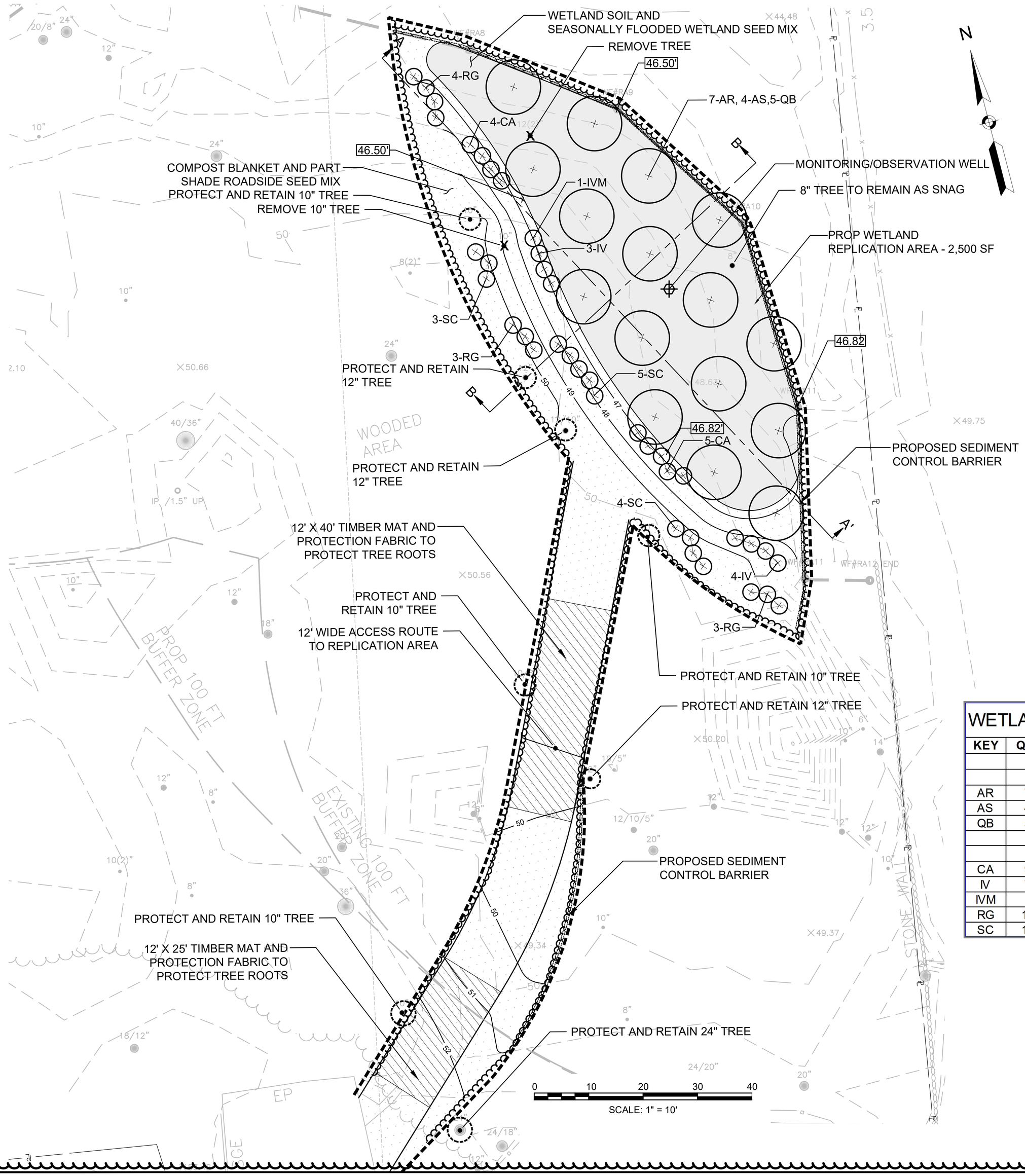
HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE BELOW


PROP UP (BO-PMLP)
PROP 20' GUY WIRES (BO-PMLP)
CULVERT 2 - PROP 4'H X 8'W PRECAST REINFORCED CONCRETE CULVERT
RELOCATE LPL (28) (BO-PMLP)
RELOCATE UPL (26) AND PROP 15' GUY WIRE WITH CAMERA AND FLOOD LIGHT (BO-PMLP)
PROP UP (166/25/10) AND 20' GUY WIRE (BO-PMLP)
CONTINUED ON SHEET NO. 23
CONTINUED BELOW
PROCTOR BROOK
RAILROAD BASELINE WARREN STREET EXTENSION
ADJ
RMD
SMH (REC)
HEAVY FOLIAGE
INSTALL VEGETATED RIPRAP FOR STREAM BANKS PROTECTION ABOVE MEAN ANNUAL HIGH WATER ELEVATION = 37.1' (TYP.) REFER TO DETAIL ON SHEET
PROP RIP RAP TOPPED WITH A 12-INCH LAYER OF NATURAL STREAMBED MATERIAL
PROP SEDIMENT CONTROL BARRIER (TYP)
RELOCATE LPL (27) AND PROP. 20' GUY WIRE (BO-PMLP)
INSTALL VEGETATED RIPRAP ABOVE MEAN ANNUAL HIGH WATER ELEVATION = 37.8' (TYP.) REFER TO DETAIL ON SHEET 41
SEE UTILITY NOTE 15 ON GENERAL NOTES SHEET
PROP RIP RAP TOPPED WITH A 12-INCH LAYER OF NATURAL STREAMBED MATERIAL WITHIN THE BROOK
100 FT RIVERFRONT AREA
200 FT RIVERFRONT AREA
100 FT BUFFER ZONE
ROCKS
GATE
STORAGE AREA
MULCH
BRUSH
TREES
POOL
DECK
PATIO
SHED
SIGN
CB
DMH
SMH
MH
OHW
UGW
WALL
FENCE
N/F CITY OF PEABODY
N/F WILLIAM A. ELWELL IRREVOCABLE TRUST 155 LOWELL ST
N/F JOHN J. BISHOP MARIE E. BISHOP 157 LOWELL ST
N/F KENNETH M. ELLIS KATHLEEN H. ELLIS 175 LOWELL ST
N/F WILLIAM A. ELWELL 173 LOWELL ST
N/F JENNIFER L. BUCHANAN 171 LOWELL ST
N/F ESCARLYN M. CRISOSTOMO 163 LOWELL ST
N/F STELLA REALTY TRUST 161 LOWELL ST
N/F RABEA JOUNI SOUHAIL JOUNI 159 LOWELL ST
N/F JOHN J. BISHOP MARIE E. BISHOP 157 LOWELL ST
N/F 185 LOWELL STREET REALTY TRUST 185 LOWELL ST REAR
N/F 179 LOWELL ST ROSA A.
N/F 175 LOWELL ST
N/F 171 LOWELL ST
N/F 163 LOWELL ST
N/F 161 LOWELL ST
N/F 159 LOWELL ST
N/F 157 LOWELL ST
N/F 155 LOWELL ST
N/F 151 LOWELL ST REAR
N/F 145 LOWELL ST
N/F 129 LOWELL ST
N/F 73 ENDICOTT ST
N/F 71 ENDICOTT ST
N/F 54 WARREN ST EXT
N/F 60 WARREN ST EXT
N/F 66 WARREN ST EXT
N/F 72 WARREN ST EXT
N/F 80 WARREN ST EXT
N/F 90 WARREN ST EXT
N/F 100 WARREN ST EXT
N/F 110 WARREN ST EXT
N/F 120 WARREN ST EXT
N/F 130 WARREN ST EXT
N/F 140 WARREN ST EXT
N/F 150 WARREN ST EXT
N/F



NOTES:

1. IMPACTS TO EXISTING TREES AND SOILS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
2. CONTACT THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION PRIOR TO THE START OF CONSTRUCTION. THE REPRESENTATIVE FOR THIS PROJECT IS MAXWELL R. MCNULTY MAXWELL.R.MCNULTY@DOT.STATE.MA.US.
3. FINAL GRADES TO BE TO MATCH ADJACENT WETLAND. MINOR ADJUSTMENTS IN FINAL GRADES SHALL BE MADE IN THE FIELD BY THE WETLAND SPECIALIST.
4. REPLICATION AREA SHALL BE EXCAVATED BELOW PROPOSED GRADES TO ALLOW FOR THE PLACEMENT OF WETLAND SOILS. THE DEPTH OF WETLAND SOILS SHALL BE 18" MAXIMUM AND SHALL MATCH THE DEPTH OF WETLAND SOIL IN THE ADJACENT WETLAND. DEPTH OF WETLAND SOIL SHALL BE DETERMINED BY THE WETLAND SPECIALIST. THE SALVAGED TOPSOIL MATERIAL AND B-HORIZON SUBSOIL MATERIAL EXCAVATED FROM THE WETLAND IMPACT AREAS SHALL BE PLACED IN SEPARATE STOCKPILES TO BE REUSED IN THE PROPOSED REPLICATION AREA IF SUITABLE.
5. REPLICATION AREA GRADES SHALL MATCH THE ELEVATIONS OF THE ABUTTING WETLAND TO MAINTAIN A HYDROLOGIC CONNECTION. WETLAND SPECIALIST SHALL INSPECT THE SUB-GRADE OF THE REPLICATION AREA TO ENSURE THAT THE PROPER HYDROLOGY HAS BEEN ESTABLISHED. MINOR MODIFICATIONS TO THIS GRADING PLAN MAY BE MADE IN THE FIELD BY THE QUALIFIED WETLAND SPECIALIST IN RESPONSE TO SUBSURFACE HYDROLOGIC CONDITIONS.
6. TREES AND SHRUBS IN THE REPLICATION AREA AND ADJACENT UPLAND AREA SHALL BE FIELD LOCATED BY THE WETLAND SPECIALIST.

PLANTING & SEEDING NOTES:

1. SEED SHALL BE MANUALLY BROADCAST. LIMITS SHOWN ARE APPROXIMATE. ACTUAL LIMITS SHALL BE AS DIRECTED BY THE WETLAND SPECIALIST.

LEGEND

- LIMIT OF WORK
- SEDIMENT BARRIER
- 100 EXISTING CONTOUR
- 44 PROPOSED CONTOUR
- PROPERTY LINE (FROM MASSGIS)
- LIMIT OF CLEARING
- 124.694 PROPOSED SPOT GRADE
- MONITORING/OBSERVATION WELL
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX
- PROPOSED SHRUB
- PROPOSED TREE
- EXISTING TREE ARMORING
- X TREE REMOVAL
- TIMBER MAT AND PROTECTION FABRIC

208 FT LENGTH OF SEDIMENT CONTROL BARRIER

3,736 SQ FT OF PART SHADE ROADSIDE SEED MIX

2,500 SQ FT WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

WETLAND REPLICATION PLANT LIST

KEY	QTY	WETLAND STAUS	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
			DECIDUOUS TREES			
AR	7	FAC	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	4	FACW	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
QB	5	FACW	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
			DECIDUOUS SHRUBS			
CA	9	FACW	CORNUS AMOMUM	SILKY DOGWOOD	2-3 FEET	#2 CONT.
IV	7	FACW	ILEX VERTICILATA	WINTERBERRY	2-3 FEET	#2 CONT.
IVM	1	FACW	ILEX VERTICILATA - MALE	MALE WINTERBERRY	2-3 FEET	#2 CONT.
RG	10	UPLAND	RHUS GLABRA	SMOOTH SUMAC	2-3 FEET	#2 CONT.
SC	12	FACW	SAMBUCUS CANADENSIS	COMMON ELDERBERRY	2-3 FEET	#2 CONT.

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	143
PROJECT FILE NO.	609211		

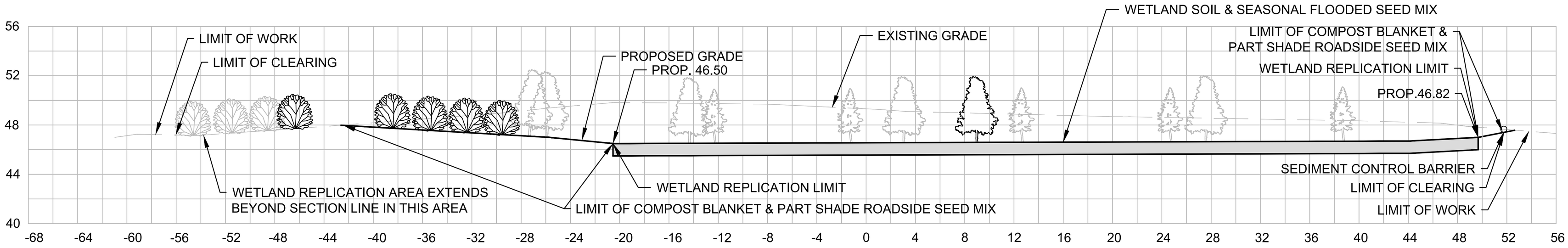
WETLAND REPLICATION PLAN
6/11/2024 WQC/NOI REVISIONS

Proposal No. 609211-132091
A00840 - 98
SHT0XX_EWTWETLAND REPLICATION PLAN).DWG Plotted on 11-Jun-2024 9:58 AM

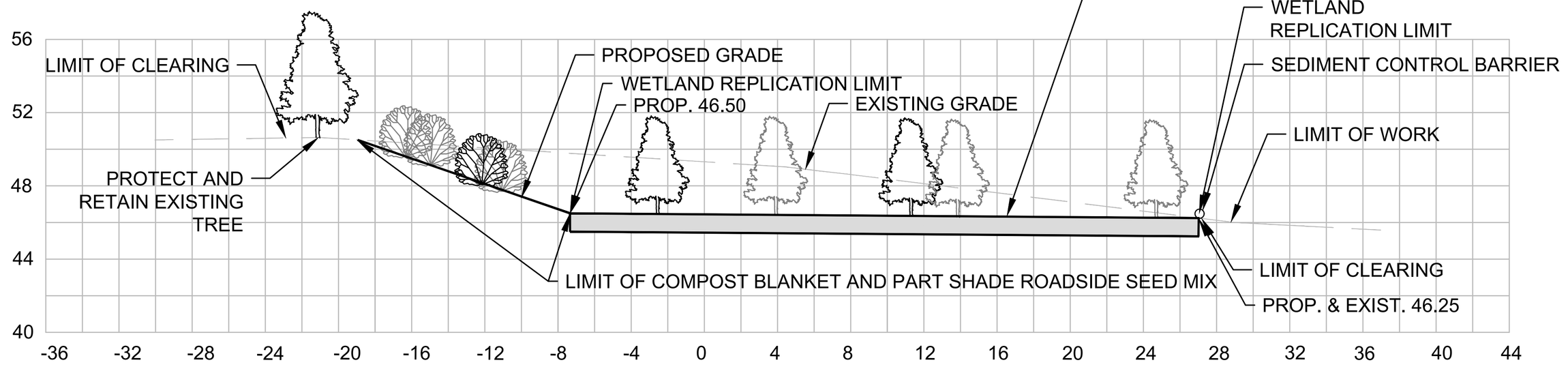
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	143
PROJECT FILE NO.	609211		

WETLAND REPLICATION SECTIONS
6/11/2024 WQC/NOI REVISIONS



SECTION (A-A')
(HOR. SCALE 1" = 4' , VERT. SCALE 1" = 4')



SECTION (B-B')
(HOR. SCALE 1" = 4' , VERT. SCALE 1" = 4')

Proposal No. 609211-132091

SHT0XX_EW(WETLAND REPLICATION PLAN).DWG Plotted on 11-Jun-2024 10:01 AM

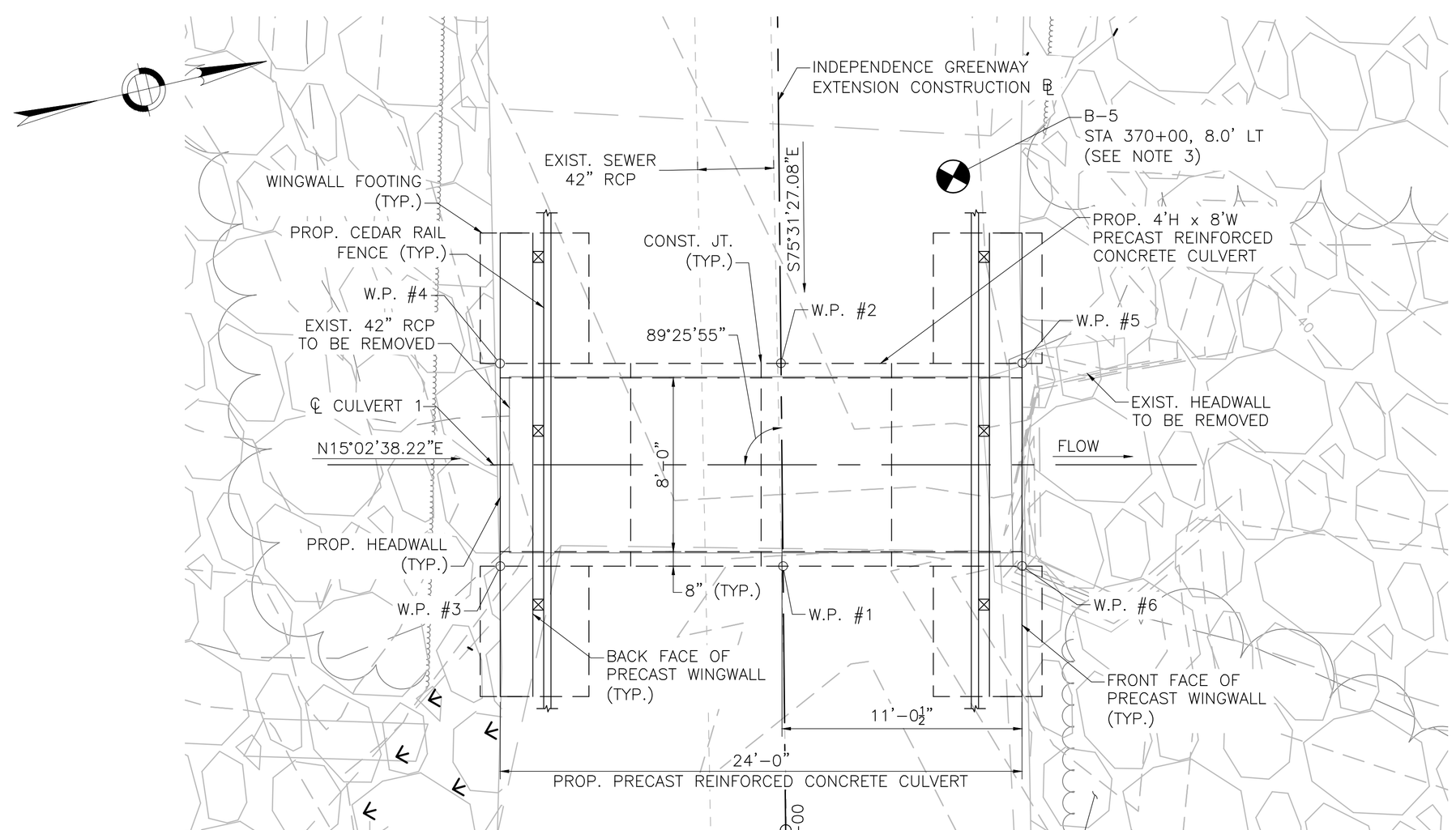
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	35	143
PROJECT FILE NO.	609211		

CULVERT 1 - PLAN AND LONGITUDINAL SECTION
6/11/2024 WQC/NOI REVISIONS

Plotted on 11-Jun-2024 8:58 AM
600211_BR01.DWG

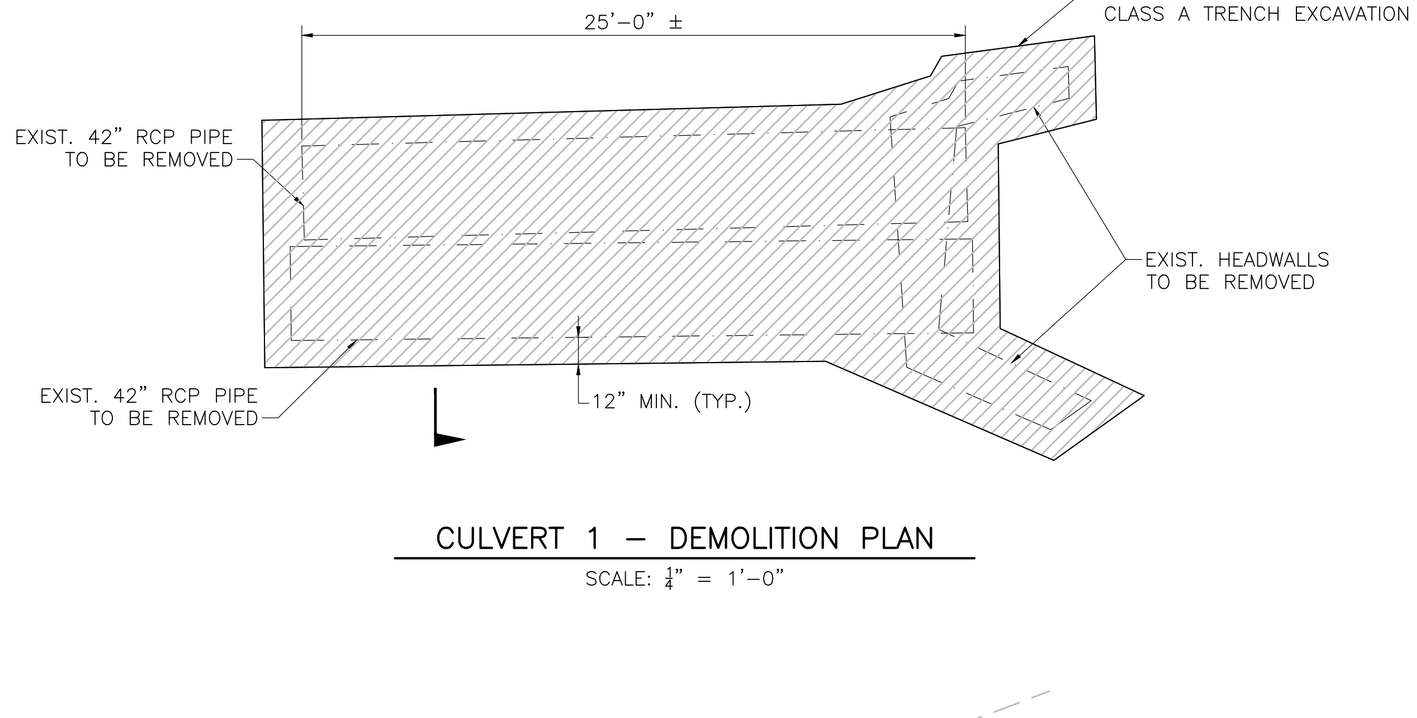
Proposal No. 609211-132091

A00840 - 100



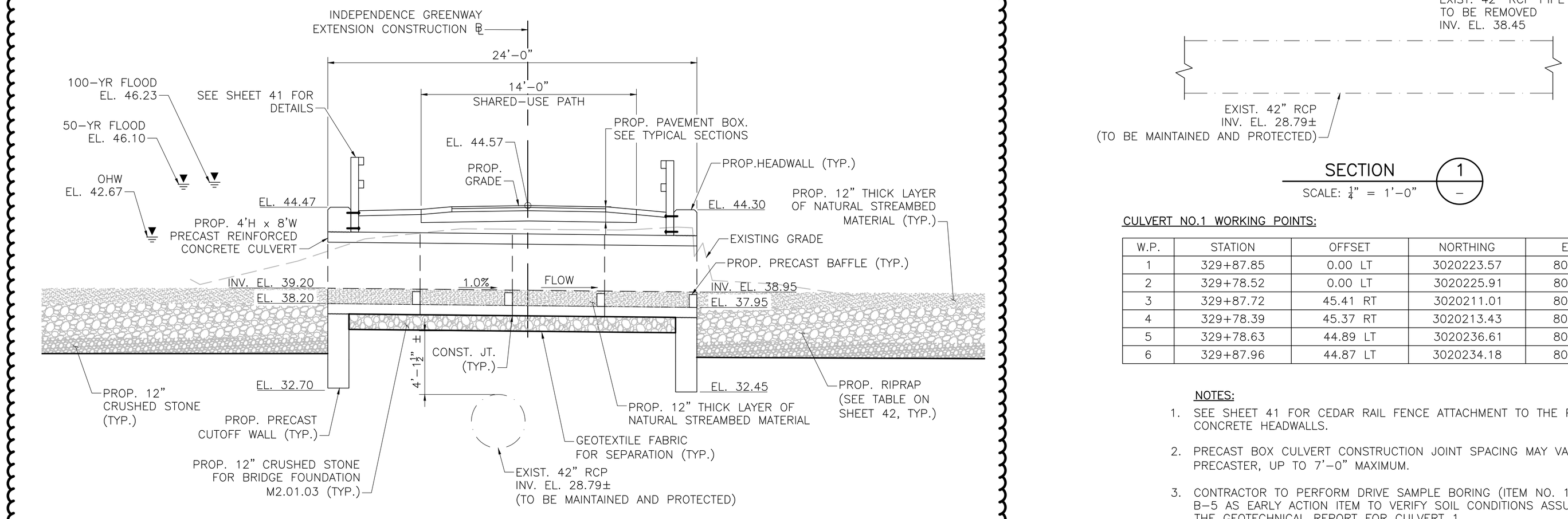
CULVERT 1 – PLAN

SCALE: ¼" = 1'–0"



CULVERT 1 – DEMOLITION PLAN

SCALE: ¼" = 1'–0"



CULVERT 1 – LONGITUDINAL SECTION

SCALE: ¼" = 1'–0"

SECTION 1 – 1

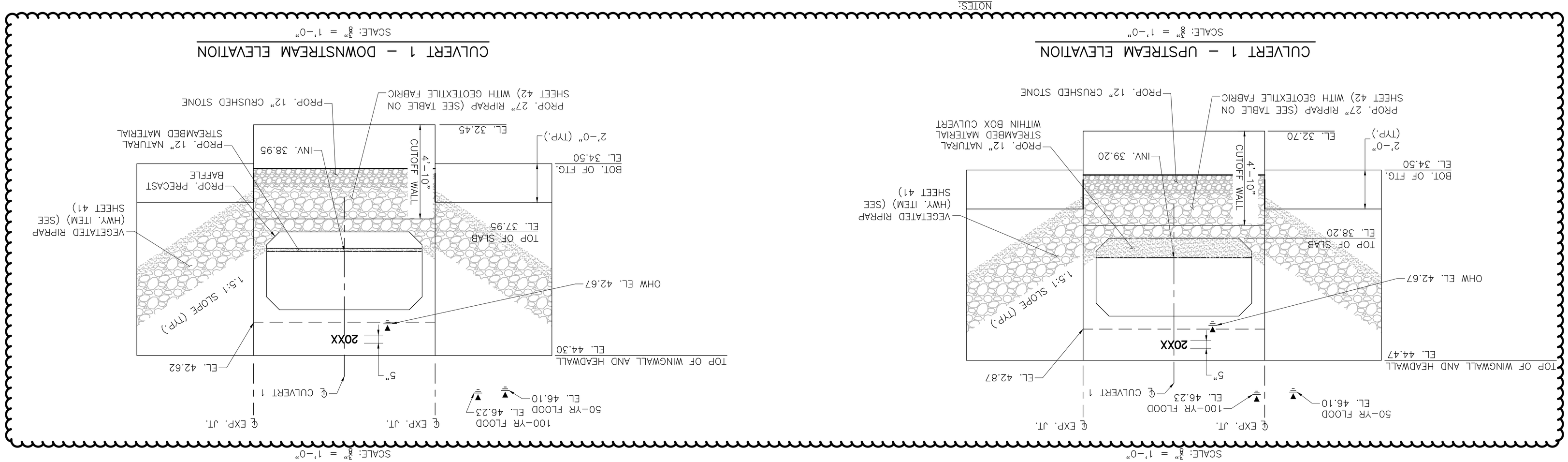
SCALE: ¼" = 1'–0"

CULVERT NO.1 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
1	329+87.85	0.00 LT	3020223.57	806099.03
2	329+78.52	0.00 LT	3020225.91	806089.99
3	329+87.72	45.41 RT	3020211.01	806095.66
4	329+78.39	45.37 RT	3020213.43	806086.64
5	329+78.63	44.89 LT	3020236.61	806092.87
6	329+87.96	44.87 LT	3020234.18	806101.88

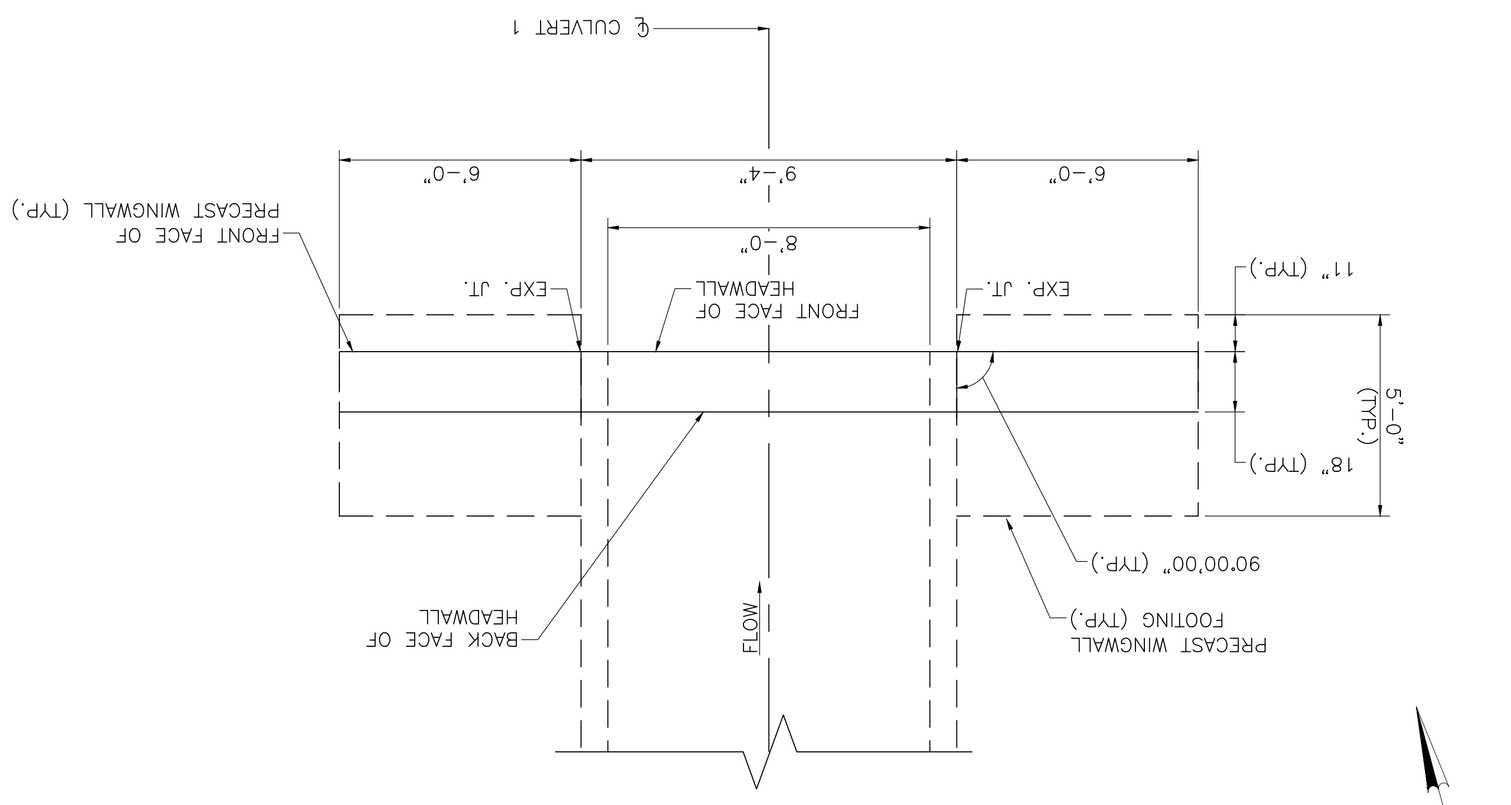
NOTES:

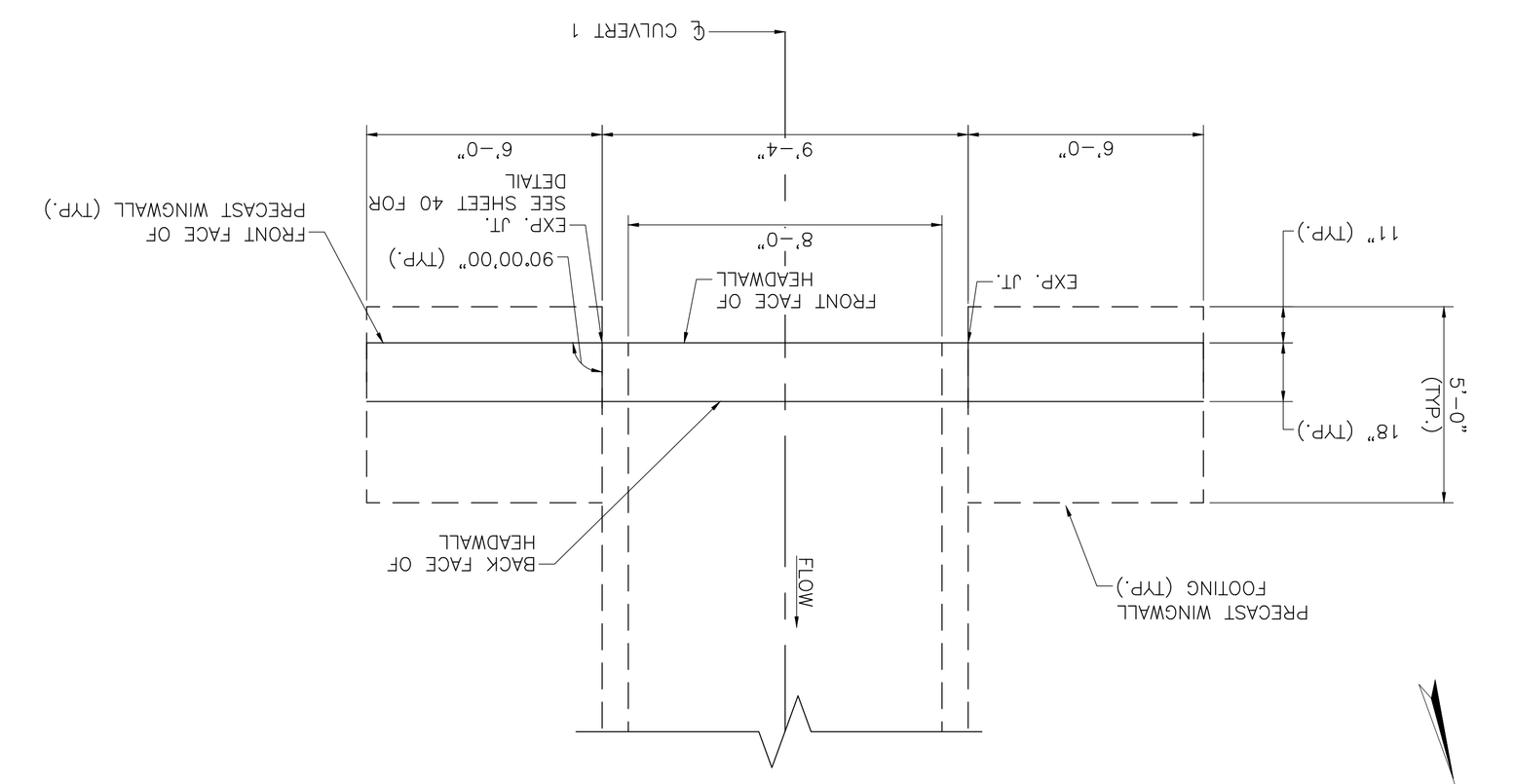
1. SEE SHEET 41 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'–0" MAXIMUM.
3. CONTRACTOR TO PERFORM DRIVE SAMPLE BORING (ITEM NO. 191.) FOR B–5 AS EARLY ACTION ITEM TO VERIFY SOIL CONDITIONS ASSUMED IN THE GEOTECHNICAL REPORT FOR CULVERT 1.
4. EXISTING 42" DIAMETER SEWER LINE TO BE MAINTAINED AND PROTECTED DURING CONSTRUCTION. PLEASE SEE SPECIAL PROVISION ITEM NO. 228. CLOSED CIRCUIT TV INSPECTION OF SEWER LINE FOR ADDITIONAL INFORMATION AND REQUIREMENTS.



NOTES:

1. SEE SHEET 34 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.





PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	36	143
PROJECT FILE NO. 609211			

CULVERT 1 - HEADWALL ELEVATIONS
6/11/2024 WQC/NOI REVISIONS

609211_BR02.DWG Plotted on 11-Jun-2024 8:59 AM

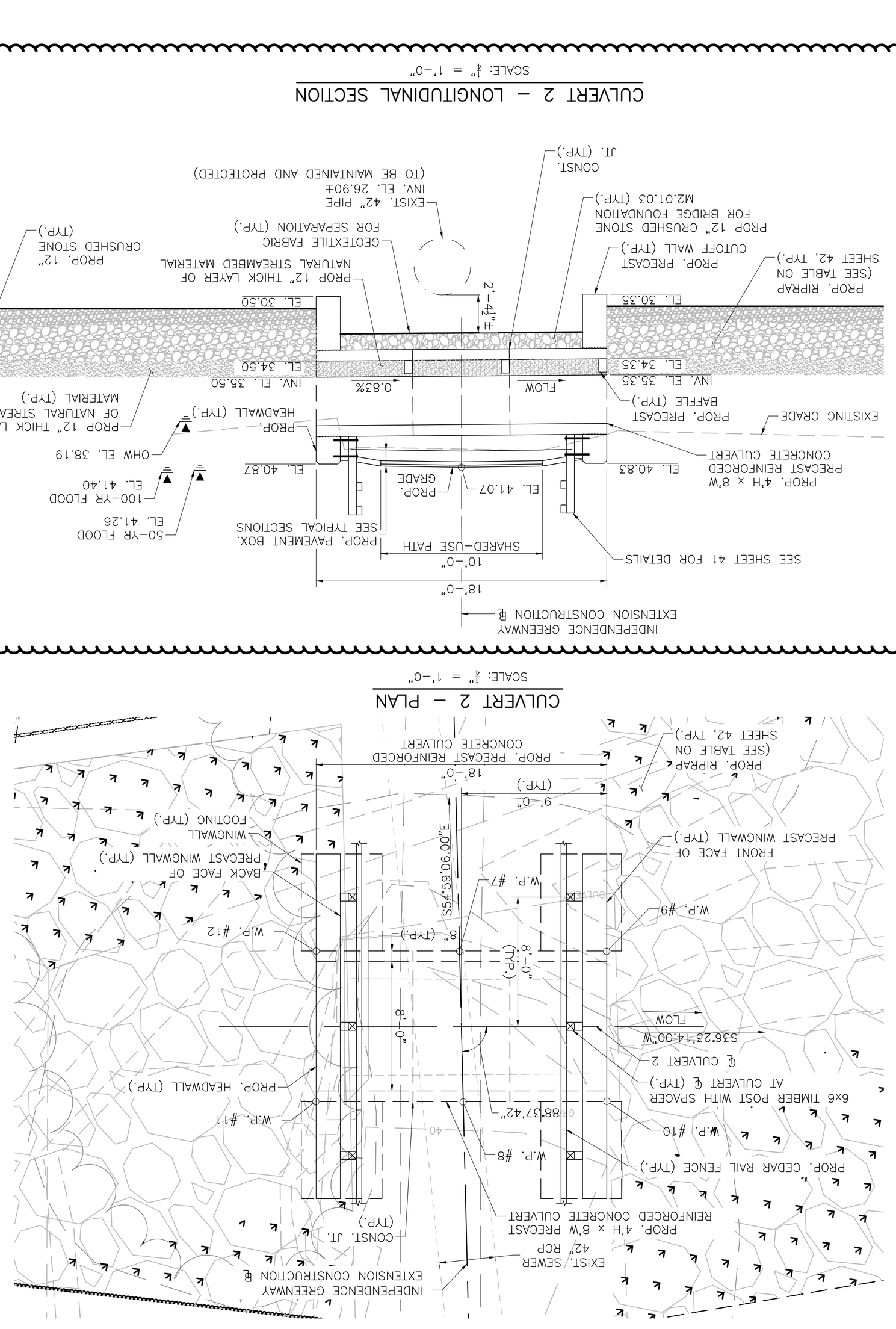
Proposal No. 609211-132091

CULVERT 2 – LONGITUDINAL SECTION

SCALE: 1" = 1'–0"

CULVERT 2 – PLAN

SCALE: 1" = 1'–0"



SECTION

SCALE: 1" = 1'–0"

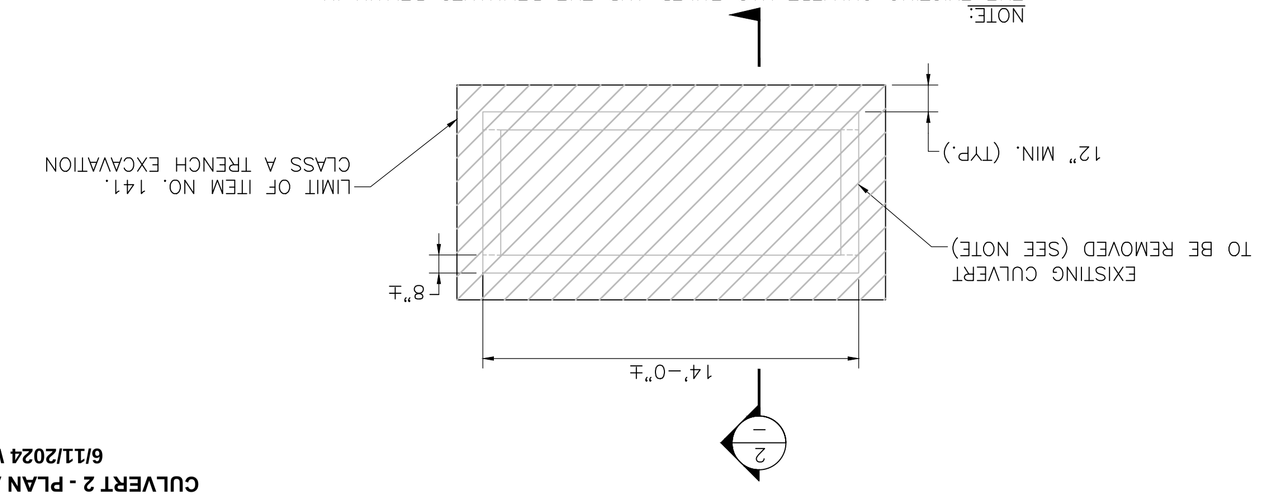
CULVERT NO.2 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
7	346+24.36	0.00 LT	3019677.22	807634.33
8	346+15.02	0.00 LT	3019682.58	807626.68
9	346+9.11	9.11 RT	3019677.35	807634.15
10	346+14.81	8.89 RT	3019682.70	807626.51
11	346+15.24	9.11 LT	3019689.92	807632.09
12	346+24.57	8.89 LT	3019677.10	807634.50

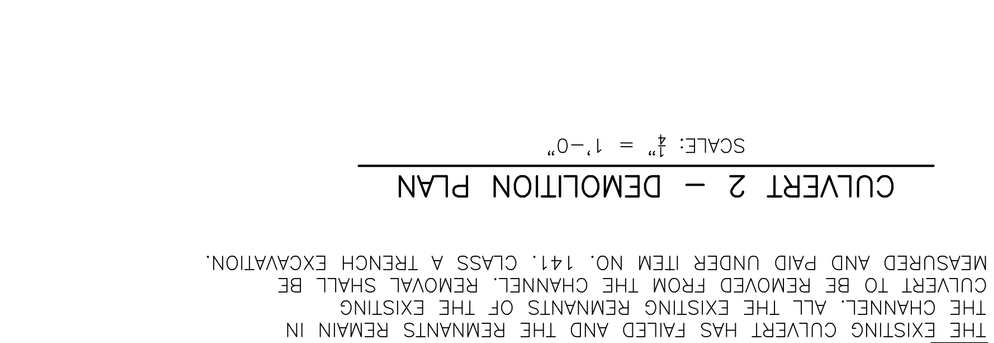
NOTES:
1. SEE SHEET 41 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'–0" MAXIMUM.
3. EXISTING 42" DIAMETER SEWER LINE TO BE MAINTAINED AND PROTECTED DURING CONSTRUCTION. PLEASE SEE SPECIAL PROVISION ITEM NO. 228. CLOSED CIRCUIT TV INSPECTION OF SEWER LINE FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

CULVERT 2 – DEMOLITION PLAN

SCALE: 1" = 1'–0"



NOTE:
THE EXISTING CULVERT HAS FAILED AND THE REMNANTS REMAIN IN THE CHANNEL. ALL THE EXISTING REMNANTS OF THE EXISTING CULVERT TO BE REMOVED FROM THE CHANNEL. REMOVAL SHALL BE MEASURED AND PAID UNDER ITEM NO. 141. CLASS A TRENCH EXCAVATION.



PEABODY, MA

INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	37	143
	PROJECT FILE NO.	609211	

CULVERT 2 - PLAN AND LONGITUDINAL SECTION

6/11/2024 WQC/NOI REVISIONS

609211_BR03.DWG Plotted on 11-Jun-2024 9:03 AM

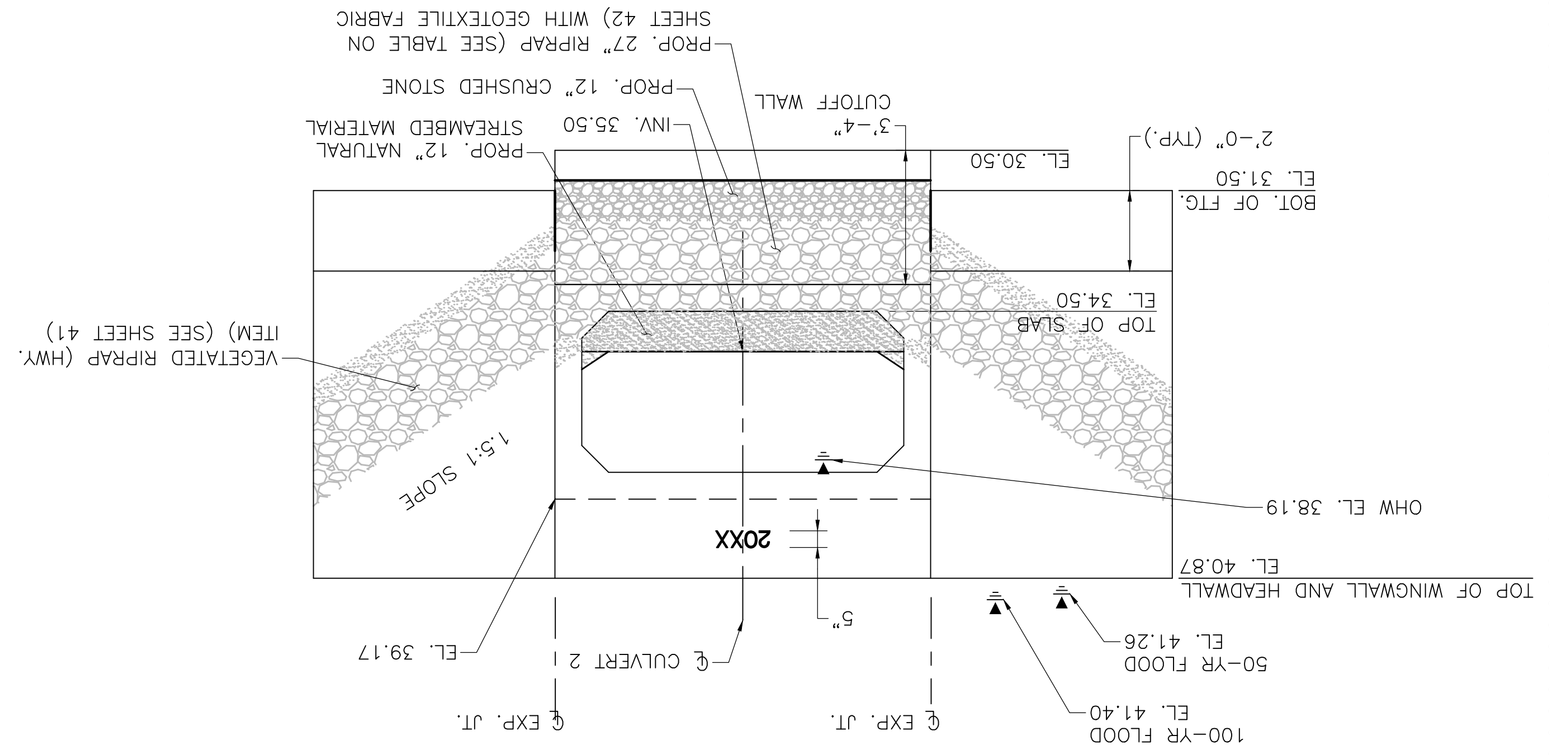
Proposal No. 609211-132091

NOTES:

1. SEE SHEET 36 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

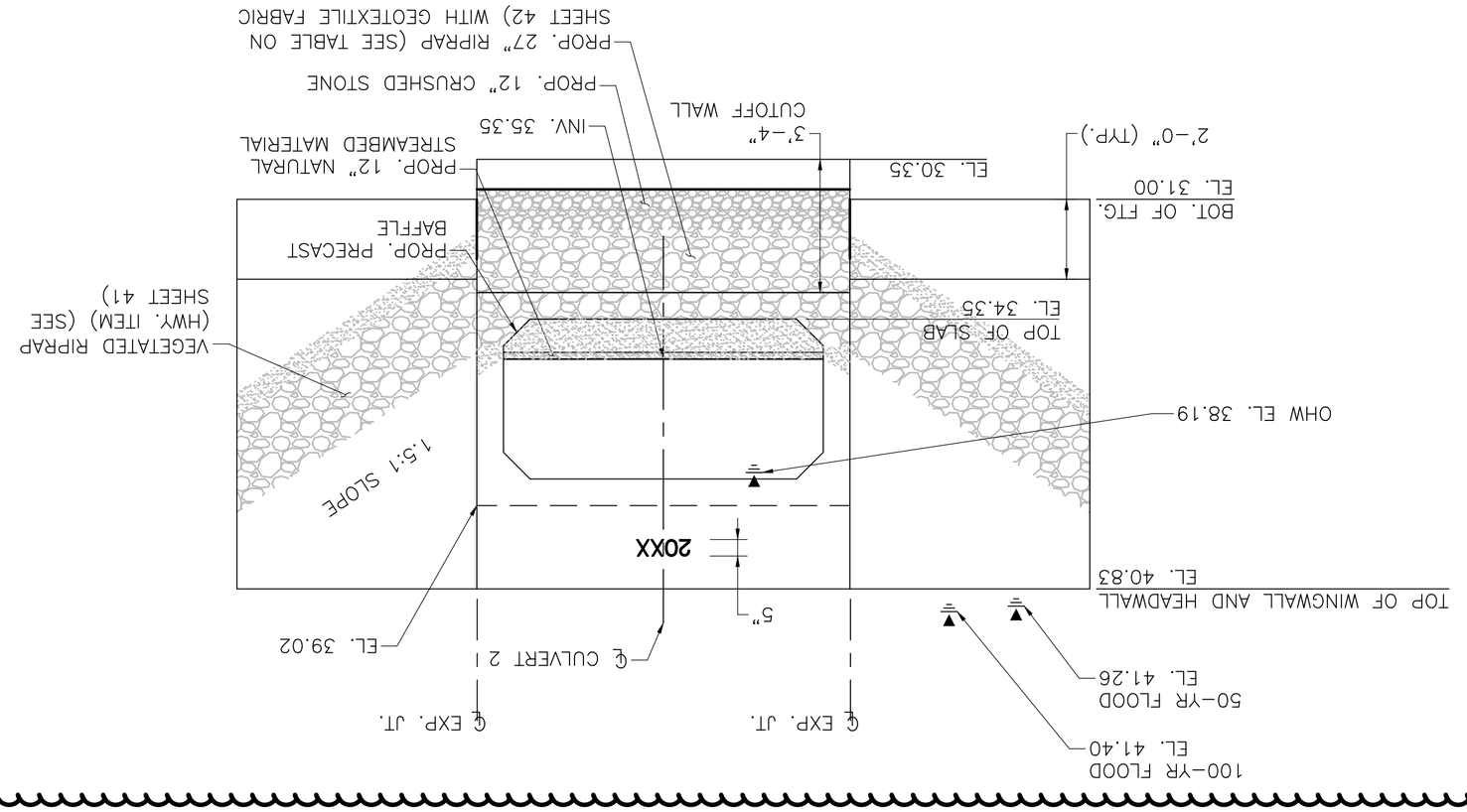
CULVERT 2 – UPSTREAM ELEVATION

SCALE: 3/8" = 1'–0"



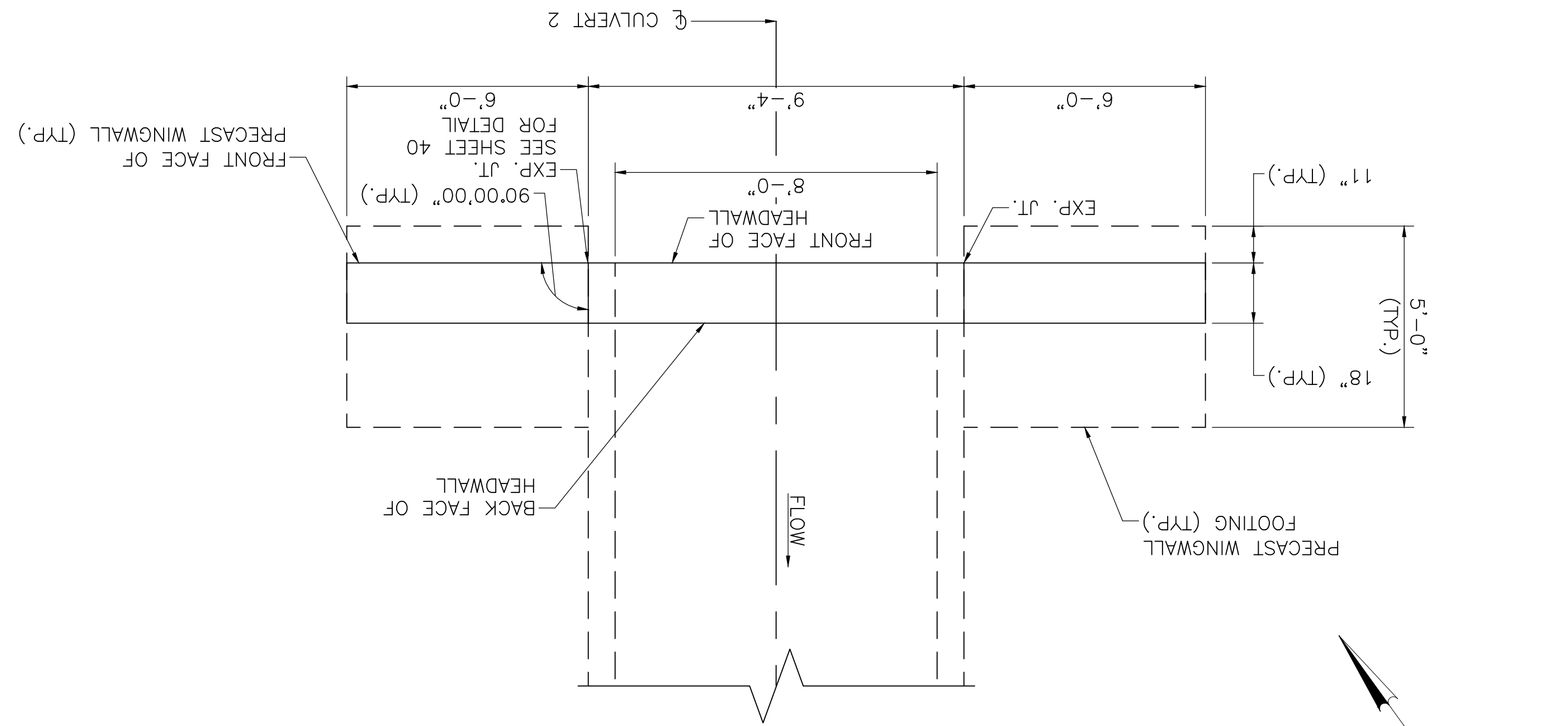
CULVERT 2 – DOWNSTREAM ELEVATION

SCALE: 3/8" = 1'–0"



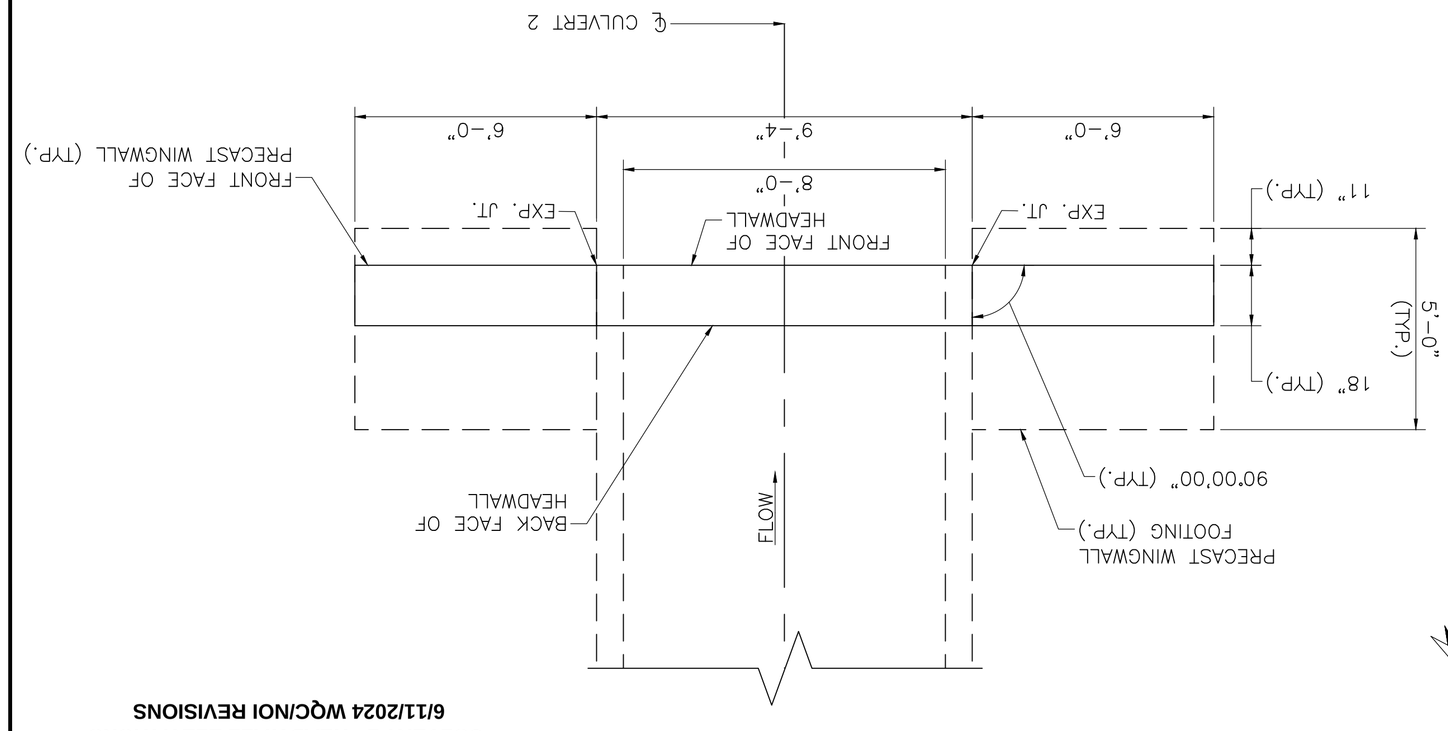
CULVERT 2 – UPSTREAM PLAN

SCALE: 3/8" = 1'–0"



CULVERT 2 – DOWNSTREAM PLAN

SCALE: 3/8" = 1'–0"

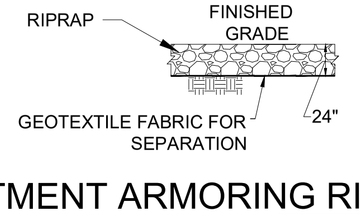


PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION
CULVERT 2 - HEADWALL ELEVATIONS
6/11/2024 WQC/NOI REVISIONS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	38	143
PROJECT FILE NO. 609211			

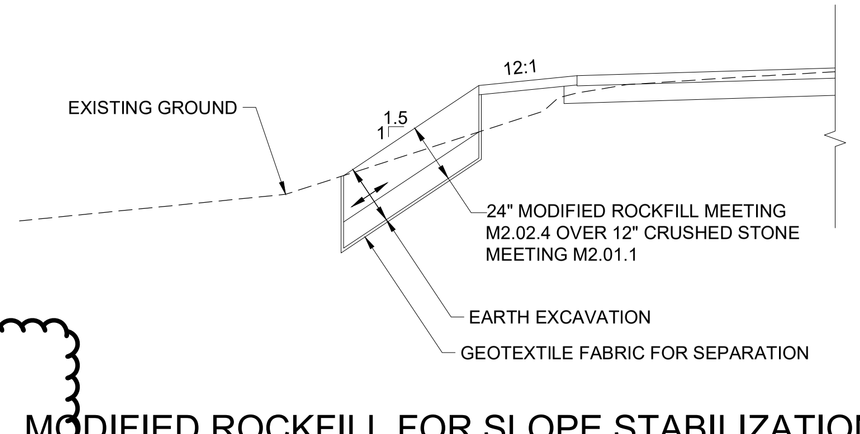
609211_BR04.DWG Plotted on 11-Jun-2024 9:04 AM

Proposal No. 609211-132091
SHT014_HD(CONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG Plotted on 11-Jun-2024 9:14 AM
A00840 - 104



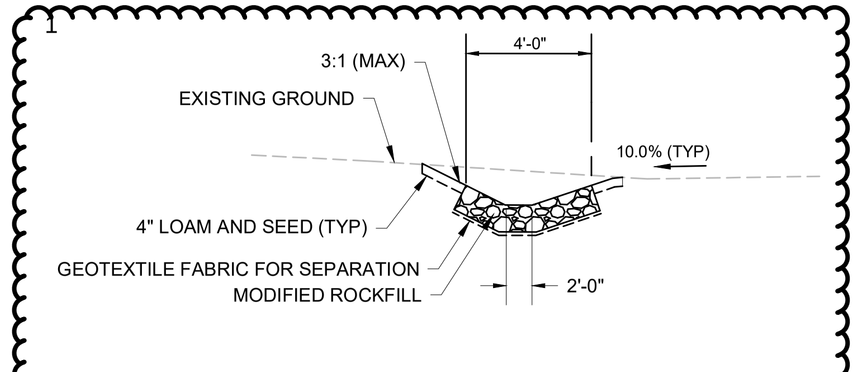
ABUTMENT ARMORING RIPRAP DETAIL

NOT TO SCALE



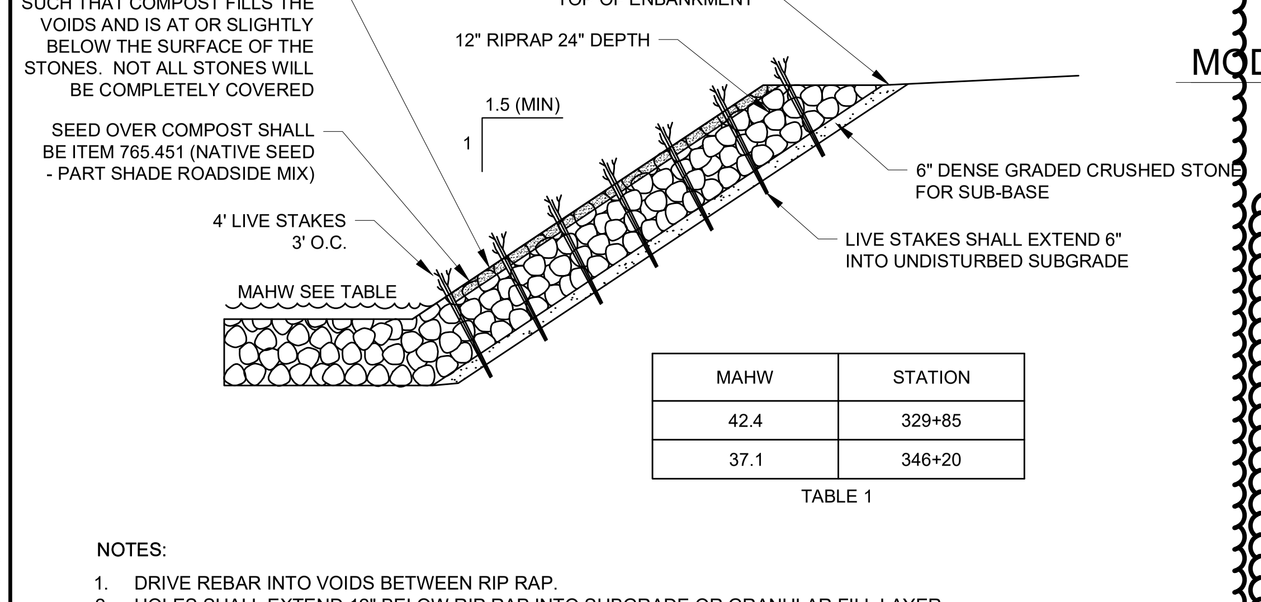
MODIFIED ROCKFILL FOR SLOPE STABILIZATION

NOT TO SCALE



STONE WATERWAY

NOT TO SCALE



MAHW	STATION
42.4	329+85
37.1	346+20

TABLE 1

NOTES:

1. DRIVE REBAR INTO VOIDS BETWEEN RIP RAP.
2. HOLES SHALL EXTEND 12" BELOW RIP RAP INTO SUBGRADE OR GRANULAR FILL LAYER.
3. LIVE STAKES SHALL BE PLACED IN HOLES SO THAT THEY EXTEND 6" INTO SUBGRADE.
4. LIVE STAKES SHALL BE LOCATED APPROXIMATELY 3 FEET ON CENTER STARTING 6" ABOVE MEAN HIGH WATER.

LIVE STAKES PLANT LIST				
QTY	BOTANICAL NAME	COMMON NAME	PLANT SIZE	SPACING
100	CORNUS RACEMOSA	GREY DOGWOOD	4 FEET LENGTH	3' O.C
100	SALIX DISCOLOR	PUSSY WILLOW	4 FEET LENGTH	3' O.C
100	CORNUS SERICEA	REDOSIER DOGWOOD	4 FEET LENGTH	3' O.C

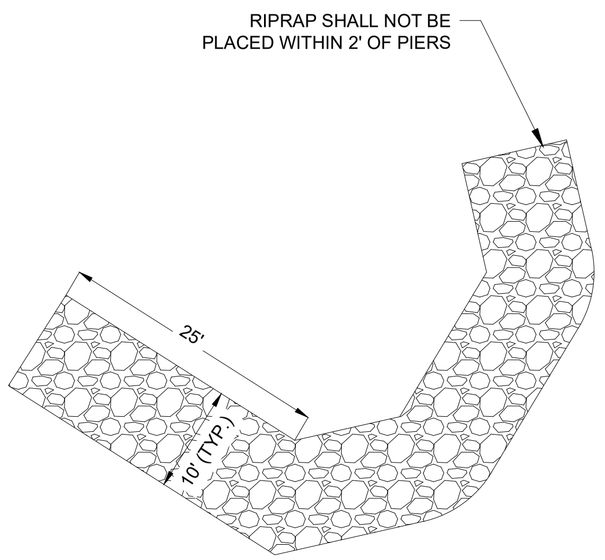
COMPOST AND SEED OVER VEGETATED RIPRAP

NOT TO SCALE

FHWA CLASS	LENGTH OF APRON L (FEET)	DEPTH OF APRON H (FEET)	WIDTH OF APRON (FEET)	MASSDOT RIPRAP SIZE	CULVERTS AT STATION
III	AS SHOWN IN PLANS	2.25	AS SHOWN IN PLANS	M2.02.0	329+85
II	10.0	2.0	13.5	M2.02.3	340+10
II	8.0	2.0	11.0	M2.02.3	342+25
III	AS SHOWN IN PLANS	2.25	AS SHOWN IN PLANS	M2.02.0	346+20
II	10.0	2.0	5.0	M2.02.3	358+51

SOURCE:
FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 23
MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES

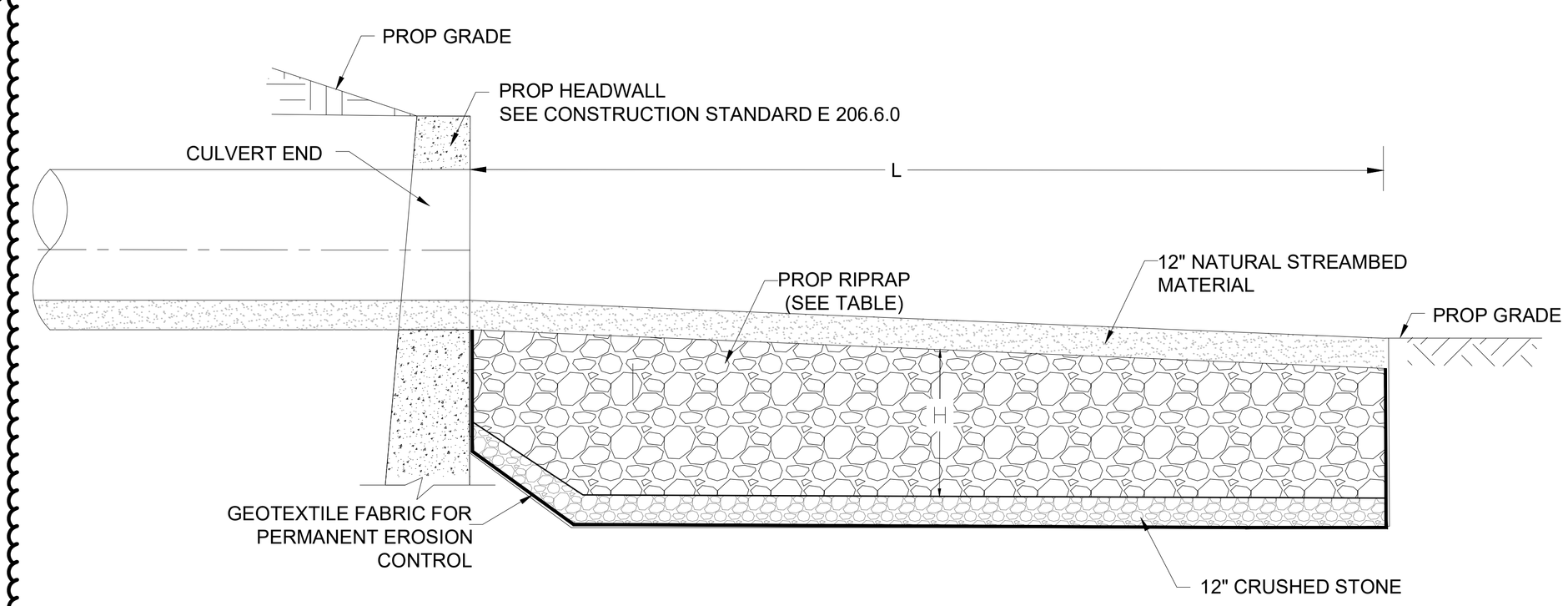
RIPRAP CLASSES AND APRON DIMENSIONS



PLAN
SCALE : 1"=10'

0 10 20 30 40
SCALE: 1" = 10'

ABUTMENT ARMORING RIPRAP PLAN



RIPRAP APRON AT INLETS AND OUTLETS OF CULVERTS

NOT TO SCALE

Wetland Delineation Memo for new Wetland Replication Area

June 4, 2024

To:	Danielle Spicer, P.E. Oxana Fartushnaya
Cc:	
From:	Brandon Faneuf, PWS
Date:	June 5, 2024
Project Name:	609211 Peabody – Independence Greenway Extension Proposed Wetland Replication Area
Project Number:	Green No. 17118
Subject:	Wetland Description - Independence Greenway Extension Proposed Wetland Replication Area, Peabody, MA

Introduction

This memo is to describe the types and extents of wetlands and wetland jurisdictional areas at the proposed wetland replication area site located at 265 Lowell St (A), Peabody, MA (see attached Locus Map Figure). Investigations were conducted on May 23, 2024 to identify, and delineate if present, the extent and location of jurisdictional wetlands and "Waters of the U.S." within the Project Area pursuant to the Federal Clean Water Act (Sections 401 and 404), and in Massachusetts, activities regulated under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40) regulations. In conjunction with the U.S. Army Corps of Engineers (USACE), this program is administered by the Massachusetts Department of Environmental Protection (MassDEP). Jurisdictional wetlands were defined using the 1987 *U.S. Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and subsequent guidance documents including the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* (US Corps of Engineers, January 2012). Waters of the U.S., which include all streams, adjacent wetlands, and other waterbodies, are defined in 33 CFR 328.3(a). Peabody has promulgated a local Wetlands & Rivers Protection Ordinance (The Ordinance) and Wetlands and Rivers Protection Regulations (Chapter 32) that exceed jurisdictional areas and performance standards of the WPA and 310 CMR 10.00.

The above-referenced proposed wetland replication area site is located at 265 Lowell St (A), Peabody, MA with site access off Gilmore Terrace. Investigations were conducted in order to determine a suitable place for the construction of a wetland replication area in accordance with 310 CMR 10.55 (4)(b) provisions. This proposed work will be conducted on and adjacent to a Bordering Vegetated Wetland (BVW) associated with Proctor Brook, making portions of the project subject to the Wetlands Protection Act (WPA).

Area of Interest (AOI)

Investigations were conducted at the parcel located at 265 Lowell St (A), Peabody, MA. The area of the AOI contains medium density residential single-family homes and wooded areas and abutted by non-forested wetland area associated with Proctor Brook to the north.

The land along the southern bank of Proctor Brook was investigated for wetland resource areas. Dominant non-native vegetation present in the AOI includes Norway maple (*Acer platanoides*), black locust (*Robinia pseudoacacia*), common buckthorn (*Rhamnus cathartica*), Oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria petiolata*). Associated native vegetation includes box elder (Acer negundo), black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), common elderberry (*Sambucus canadensis*), silky dogwood (*Cornus amomum*), smooth sumac (*Rhus glabra*), Virginia creeper (*Parthenocissus quinquefolia*), skunk cabbage (*Symplocarpus foetidus*), jewelweed (*Impatiens capensis*), and sensitive fern (*Onoclea sensibilis*). Soil samples revealed that the extant topsoil is likely fill. There is trash scattered throughout the AOI.

Wetland Resource Areas

A Bordering Vegetated Wetland (BVW) exists in the northern half of 265 Lowell St (A) parcel, south of Proctor Brook. The BVW is hydrologically connected with Proctor Brook, and is the sole wetland resource area present on the project site. The BVW was delineated using alpha-numerical flags. Each delineated section of the BVW retains a one-hundred foot (100') buffer zone per 310 CMR 10.00.

The following Wetland Resource Areas are present on site:

- Bordering Vegetated Wetland ("BVW"), as delineated in the field with 'RA' - series flags. These flags represent the edge of the BVW where it changes from vegetated wetland to upland. Per 310 CMR 10.00 , these receive 100' Buffer Zones.

- Bordering Land Subject to Flooding ("BLSF") associated with Proctor Brook. This is the 100-year floodplain as delineated by FEMA (see attached FEMA FIRMETTE). This follows Proctor Brook and includes contiguous portions of the delineated BVW. However, BLSF is not present in the AOI.200' Riverfront Area ("RFA") associated with Proctor Brook. The RFA extends perpendicularly from the Bank of the brook without regard for topography. The entire proposed replication area is located within a Riverfront Area.

Table 1. Delineated Wetland Resource Areas

Flag Series	Wetland Type	Approx. Location
RA1 – RA12 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	200' from the end of Gilmore Terrace. Bisecting the 265 Lowell St (A) parcel from the parcel boundary with 4 Karelitz Road to the parcel boundary with 10 Castle Circle.

Other Resources

A desktop analysis of the Project Area was conducted prior to performing field surveys and included the entire defined area of investigation. A search of other critical resources within the project area was conducted using GIS software and data available through various governmental agencies (FEMA, DEP, and others). The results of our search are listed in the table below.

Table 2. Selected MASSGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓
NHESP Potential Vernal Pool		✓
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones (BLSF)		✓[1]
Surface Water Protection Area		✓
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area		✓
Zone II Wellhead Protection Area		✓
Mass DFW Designated Coldwater Fisheries		✓

✓[1] BLSF follows Proctor Brook and includes contiguous portions of the delineated BVW. However, BLSF is not present in the AOI, which is limited to the outlined limit of work associated with the replication area.

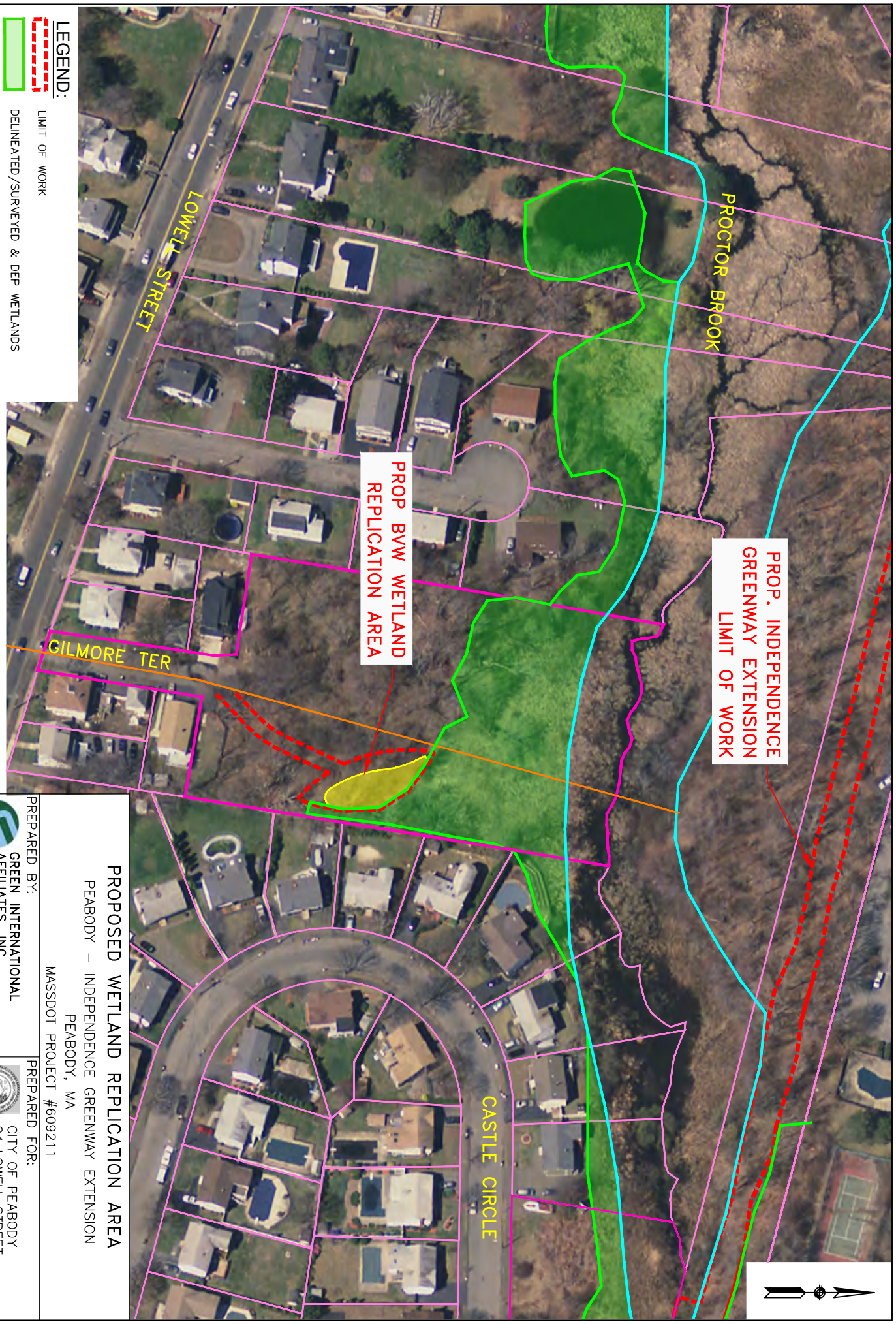
Regulatory Jurisdiction

The wetland resource areas described above are regulated by the Massachusetts Wetlands Protection Act (WPA) and 310 CMR 10.00 which is administered by the City of Peabody Conservation Commission or (upon appeal) by Massachusetts Department of Environmental Protection (MassDEP).

WETLANDS MEMORANDUM ATTACHMENTS

- LOCUS FIGURE
- PHOTO LOG
- FEMA FIRMETTE
- BORDERING VEGETATED WETLAND DETERMINATION FORMS

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\LOCUS FIGURE – Gilmore Replication Area.dwg



LEGEND:

- LIMIT OF WORK
- DELINEATED/SURVEYED & DEP WETLANDS
- PROP. WETLAND REPLICATION AREA BOUNDARY
- BANK/MAHW/PERENNIAL STREAM
- 265 LOWELL ST (A) PARCEL BOUNDARIES
- OTHER PARCEL BOUNDARIES
- APPROXIMATE DRAIN LINE

SCALE IN FEET

60 0 60 120

1" = 120'

NOTE: DATA TAKEN FROM MASSGIS

PROPOSED WETLAND REPLICATION AREA

PEABODY – INDEPENDENCE GREENWAY EXTENSION

PEABODY, MA

MASSDOT PROJECT #609211

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:

CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED

PROJECT NO. 17118

DATE: 06/05/2024

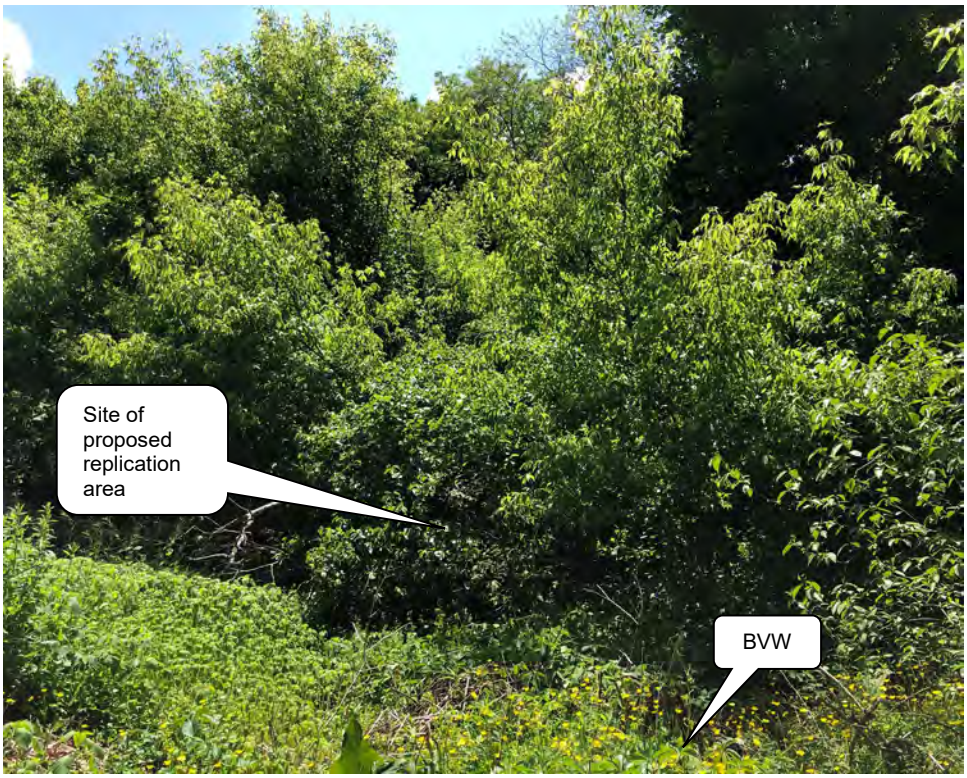
DRAWN BY: JK/OF

REVISED:

CHECKED BY: OF

LOCUS FIGURE

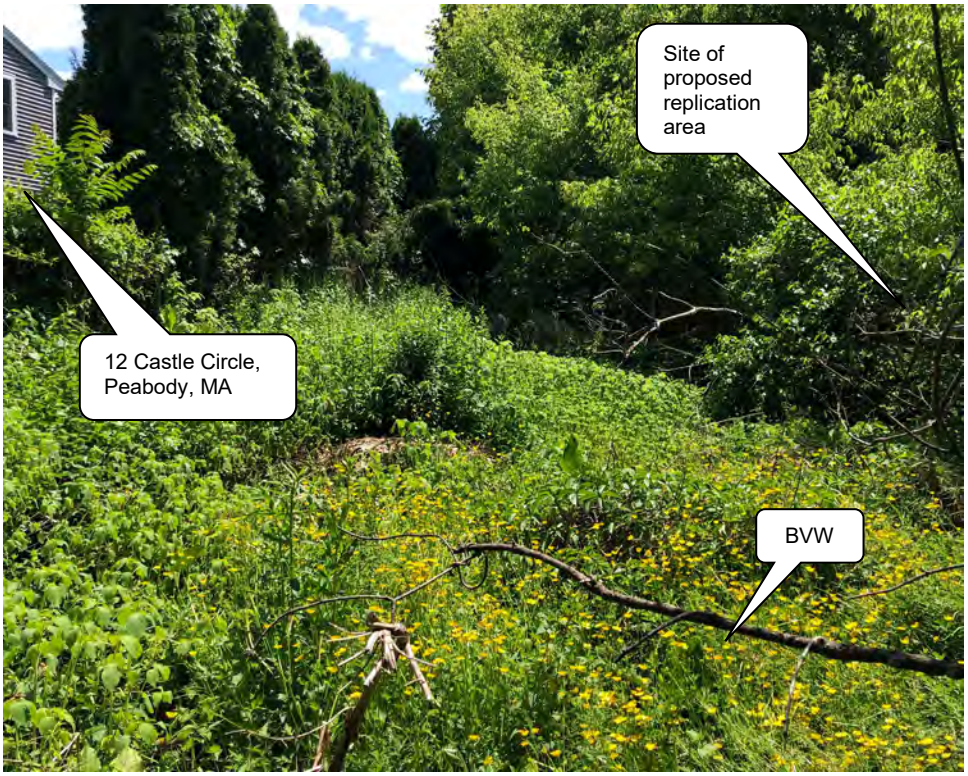
PHOTO LOG: Photos taken 05/31/2024



Picture #1 – View looking southwest at site of proposed replication area.

Picture #2 – View looking north from the center of the site of the proposed replication area.

Picture #3 – View looking northeast towards Proctor Brook inside of BVW.



Picture #4 – View looking south showing site of proposed replication area in relation to the eastern property boundary.

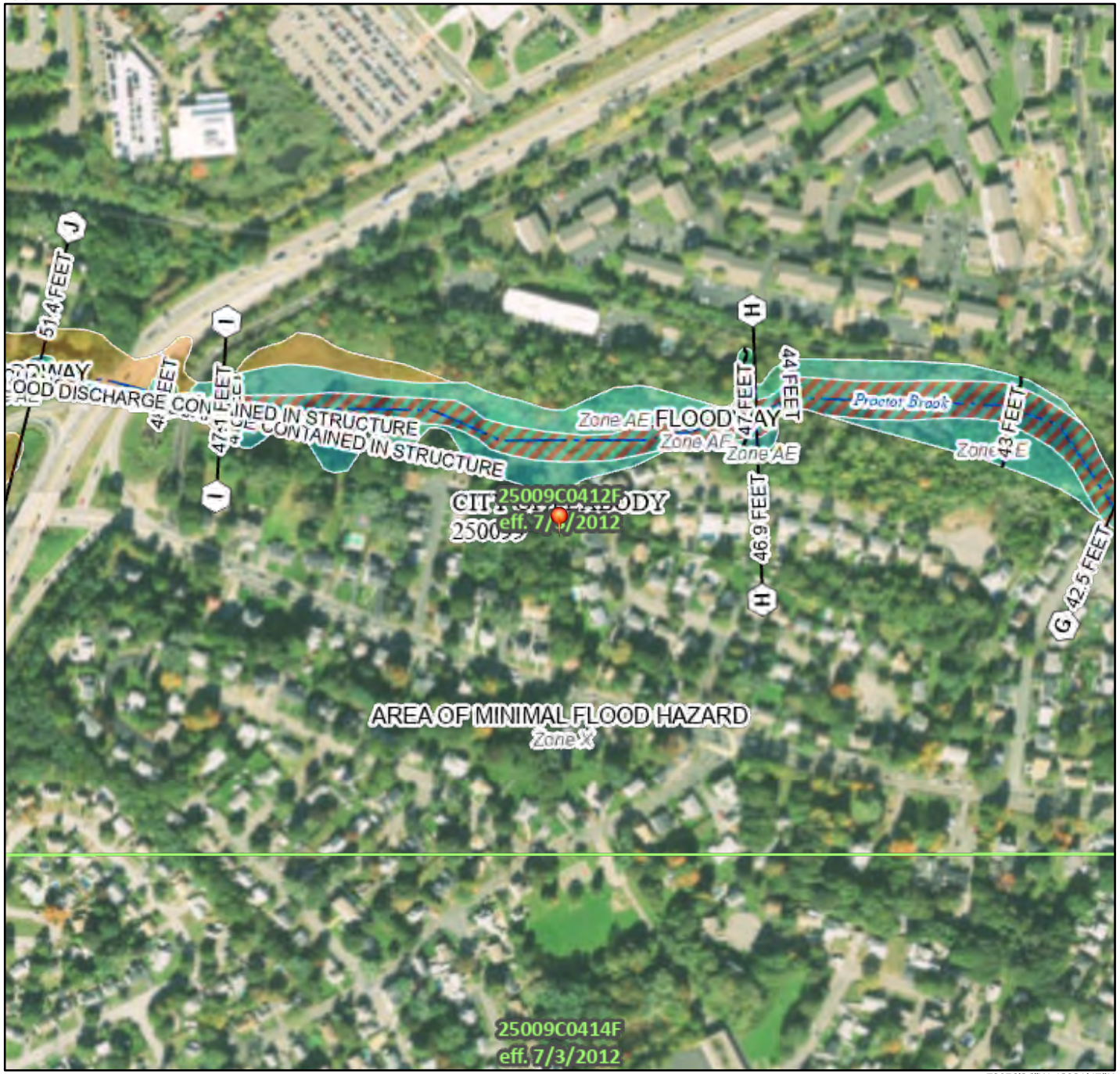
Picture #5 – View looking northeast at site of proposed access road.

Picture #6 – View looking northeast. Site access off Gilmore Terrace.

National Flood Hazard Layer FIRMette

FEMA

70°57'4"W 42°32'14"N



70°56'26"W 42°31'47"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/5/2024 at 9:22 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00840 - 114

BVW Determination Form

Bordering Vegetated Wetland Determination Form

Project Site: 265 Lowell St (A) City/Town: Peabody Sampling Date: 5/23/2024

Applicant/Owner: City of Peabody Sampling Point or Zone: UPLAND RA-5

Invesigators: Brandon Faneuf Lat/Long: 42°32'01.25"N, 70°56'46.

Soil Map Unit Name: 626B- Merrimac-Urban land complex NWI/DEP Classification: SM

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks)

Are vegetation [ ] Soil [X] or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS - Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met? **YES** ***Is the Sampled Area within a wetland?*** **NO**

Hydric Soils criterion met? **NO**

Wetlands hydrology present? **NO**

Remarks, Photo Details, Flagging, etc.:

Site is on historic fill

HYDROLOGY

Field Observation:

Surface Water Present? NO Depth (inches):

Water Table Present? NO Depth (inches):

Saturation Present (including capillary fringe)? NO Depth (inches):

Wetland Hydrology Indicators (Enter x for all that apply)

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained Leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue(aerenchyma)	[ ] Woody plants w/ adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland)
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

VEGETATION - Use both common and scientific names of plants.

Tree Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Black Locust	Robinia pseudoacacia	FACU	63	YES	NO
Sugar Maple	Acer saccharum	FACU	10.5	NO	NO
Black Cherry	Prunus serotina	FACU	10.5	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

84 = *Total Cover*

Shrub/Sapling Stratum Plot size: 15' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Black Cherry	Prunus serotina	FACU	20.5	YES	NO
Red Chokeberry	Aronia arbutifolia	FACW	20.5	YES	YES
Japanese Honeysuckle	Lonicera japonica	FACU	20.5	YES	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

61.5 = *Total Cover*

Herb Stratum Plot size: 5' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Skunk-Cabbage	Symplocarpus foetidus	OBL	3	NO	YES
Spotted Touch-Me-Not	Impatiens capensis	FACW	10.5	NO	YES
Eastern Poison Ivy	Toxicodendron radicans	FAC	3	NO	YES
Virginia-Creeper	Parthenocissus quinquefolia	FACU	3	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

19.5 = *Total Cover*

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

Woody Vine Stratum Plot size: 30' radius

Common Name	Scientific Name	*Indicator Status*	Absolute % Cover	*Dominant?*	*Wetland Indicator?*
				NO	NO
				NO	NO
				NO	NO
				NO	NO
			0	*= Total Cover*	
Rapid Test: Do all dominant species have an indicator status of OBL or FACW?			**NO**		
Dominance Test: Number of dominant species	Number of dominant species that are wetland indicator plants	*Do wetland indicator plants make up ≥ 50% of dominant species?*			
		YES			
Prevalence Index:	Total % Cover (all strata)		Result		
OBL species	3	1	3		
FACW species	31	2	62		
FAC species	3	3	9		
FACU species	128	4	512		
UPL species	0	5	0		
Column Totals	165		586		
Prevalence Index:	3.3		*Is the Prevalence Index ≤ 3.0?*		
			NO		
Wetland vegetation criterion met?	**YES**				

Definitions of Vegetation Strata

Tree - Woody plants 3in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 fs (1 m) tall

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges

Range	Midpoint
1-5 %	3.0%
6-15 %	10.5%
15-25 %	20.5%
26-50%	38.0%
51-75 %	63.0%
76-95 %	85.5%
96-100 %	98.0%

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type1	Location2		
0-8	10YR 2/2	100					sl	
8-14	10YR 3/3	100					sl	
14-20	10YR 2/2	100					fsl	
20+	10YR 5/6	100					sl	

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains 2Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Enter **x** for all that apply)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratisfied Layers (A5)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8)
- [ ] Thin Dark Surface (S9)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F7)
- [ ] Depleted Dark Surface (F8)

Indicators for Problematic Hydric Soils

- [ ] 2 cm Muck (A10)
- [ ] 5 cm Mucky Peat or Peat (S3)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8)
- [ ] Thin Dark Surface (S9)
- [ ] Iron-Manganese Masses (F12)
- [ ] Mesic Spodic (A17)
- [ ] Red Parent Material (F21)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Include Explanation in Remarks)

Restrictive Layer if observed) Type: Depth (inches):

Remarks:

Hydric Soils criterion met? **NO**

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Bordering Vegetated Wetland Determination Form

Project Site: 265 Lowell St (A) City/Town: Peabody Sampling Date: 5/23/2024

Applicant/Owner: City of Peabody Sampling Point or Zone: WETLAND RA-5

Invesigators: Brandon Faneuf Lat/Long: 42°32'01.25"N, 70°56'46.

Soil Map Unit Name 626B- Merrimac-Urban land complex NWI/DEP Classification: SM

Are climatic/hydrologic conditions on the site typical for this time of year? YES (If no, explain in Remarks)

Are vegetation [ ] Soil [X] or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS - Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met? **YES** ***Is the Sampled Area within a wetland?*** **YES**

Hydric Soils criterion met? **NO**

Wetlands hydrology present? **YES**

Remarks, Photo Details, Flagging, etc.:
Site is on historic fill.

HYDROLOGY

Field Observation:

Surface Water Present? NO Depth (inches):

Water Table Present? YES Depth (inches): 10"

Saturation Present (including capillary fringe)? YES Depth (inches): 10"

Wetland Hydrology Indicators **(Enter x for all that apply)**

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained Leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[X] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue(aerenchyma)	[ ] Woody plants w/ adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland)
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

VEGETATION - Use both common and scientific names of plants.

Tree Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Box Elder	Acer negundo	FAC	63	YES	YES
Black Locust	Robinia pseudoacacia	FACU	10.5	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

73.5 *= Total Cover*

Shrub/Sapling Stratum Plot size: 15' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Chinese Privet	Ligustrum sinense	FACU	10.5	NO	NO
Black Cherry	Prunus serotina	FACU	20.5	YES	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

31 *= Total Cover*

Herb Stratum Plot size: 5' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Garlic-Mustard	Alliaria petiolata	FACU	10.5	NO	NO
Northern Lady Fern	Athyrium angustum	FAC	10.5	NO	YES
Skunk-Cabbage	Symplocarpus foetidus	OBL	20.5	YES	YES
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

41.5 *= Total Cover*

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

Woody Vine Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
				NO	NO
				NO	NO
				NO	NO
				NO	NO
			0	*= Total Cover*	
Rapid Test : Do all dominant species have an indicator status of OBL or FACW?			**NO**		
Dominance Test: Number of dominant species	Number of dominant species that are wetland indicator plants	*Do wetland indicator plants make up ≥ 50% of dominant species?*			
		YES			
Prevalence Index:	Total % Cover (all strata)		Result		
OBL species	20.5	1	20.5		
FACW species	0	2	0		
FAC species	73.5	3	220.5		
FACU species	52	4	208		
UPL species	0	5	0		
Column Totals	146		449		
Prevalence Index:	2.9		*Is the Prevalence Index ≤ 3.0?*		
			YES		
Wetland vegetation criterion met?	**YES**				

Definitions of Vegetation Strata

Tree - Woody plants 3in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 fs (1 m) tall

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges

Range	Midpoint
1-5 %	3.0%
6-15 %	10.5%
15-25 %	20.5%
26-50%	38.0%
51-75 %	63.0%
76-95 %	85.5%
96-100 %	98.0%

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type1	Location2		
0-10	10YR 2/2	100					sl	S/I at 10"
18-20	10YR 5/6	100					gcos	

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains 2Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Enter **x** for all that apply)

Histosol (A1)		Polyvalue Below Surface (S8)	2 cm Muck (A10)
Histic Epipedon (A2)		Thin Dark Surface (S9)	5 cm Mucky Peat or Peat (S3)
Black Histic (A3)		Loamy Mucky Mineral (F1)	Dark Surface (S7)
Hydrogen Sulfide (A4)		Depleted Matrix (F3)	Polyvalue Below Surface (S8)
Stratisfied Layers (A5)		Redox Dark Surface (F7)	Thin Dark Surface (S9)
Depleted Below Dark Surface (A11)		Depleted Dark Surface (F8)	Iron-Manganese Masses (F12)
Thick Dark Surface (A12)			Mesic Spodic (A17)
Sandy Mucky Mineral (S1)			Red Parent Material (F21)
Sandy Gleyed Matrix (S4)			Very Shallow Dark Surface (TF12)
Sandy Redox (S5)			Other (Include Explanation in Remarks)
Stripped Matrix (S6)			
Dark Surface (S7)			

Indicators for Problematic Hydric Soils

Restrictive Layer if observed) Type: Depth (inches):

Remarks:

Hydric Soils criterion met? **NO**

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

Hydraulic and Scour Reports

HYDRAULIC AND SCOUR ANALYSIS
SUMMARY REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Prepared for

massDOT Massachusetts Department of Transportation Highway Division

Massachusetts Department of Transportation

November 2023

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for Proctor Brook along the Independence Greenway Extension. The proposed bikeway crosses Proctor Brook at three (3) locations. The Hydraulic Report submitted to MassDOT in February 2021 described the proposed bridge located approximated 800' west of Endicott Street. This study evaluates the hydraulic performance of the existing and proposed conditions for the remaining project area upstream of this proposed bridge, including the two (2) crossing locations that weren't discussed in the previous report.

This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at brook crossing sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the brook; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations.

This project involves the construction of two (2) new culverts that will cross over Proctor Brook in the City of Peabody, Massachusetts. There were previous culvert structures that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the culverts, and the culvert structures have been washed away over time. The purpose of this report is to present the results of a study conducted for the subject culvert sites to evaluate the hydraulic performance of the proposed structures for these crossings.

The scope of this investigation consists of a review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.45 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any

improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 8-span structure will be approximately 60'-0" long with an out-to-out width of 12'-0" and will provide a clear width of 11'-0" to accommodate two 5-0" wide travel lanes, one in each direction.

2.1 Existing Conditions

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject locations are within NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

Refer to Figure 1 for a locus map of the project area.

The remnants of two (2) culverts remain in the channel. There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the culverts are currently wooded and includes Bordering Vegetated Wetlands.

The existing culverts were studied during FEMA's 1978 FIS study. At the time of the study the culverts had not been washed out and were functioning as hydraulic connections to convey Proctor Brook under the railroad bed. More detailed description of the culverts are as follows:

Culvert at Station 329+85

This culvert is located at cross section H of the FEMA FIS study. The existing culvert is a 25' long double 42" barrel RCP culvert. The culvert hasn't been maintained and the railbed above the culvert has been washed away. The culvert piping has remained in place. Remnants of granite guidebanks remain at the upstream entrance to the culvert and remnants of a granite headwall remain on the downstream end of the culvert.

Culvert at Station 346+20

This culvert is located at cross section F of the FEMA FIS study. Review of the FEMA's HEC-2 hydraulic model indicates that the culvert was originally a 6'-5" box culvert. Due to a lack of maintenance along the abandoned railroad bed, the culvert has collapsed, and the remnants remain in the channel.

2.2 Proposed Conditions

Although the culvert crossings have failed to varying degrees, the horizontal alignment of Proctor Brook has remained. The culverts are being replaced at the same locations as the original structures in order to maintain the alignment of Proctor Brook at these crossings. The channel elevation will remain although some sediment will be removed to facilitate construction.

Both of the culverts will be replaced with 8'x4' concrete box culverts. The bottom 1' of each culvert will be filled with streambed material to provide a more natural wildlife habitat. This hydraulic study examines the impact of providing an 8'x3' hydraulic opening at both of these crossings.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 20 Stream Stability at Highway Structures, Fourth Edition, April 2012.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 14 Hydraulic Design of Energy Dissipators for Culverts and Channels, Third Edition, July 2006.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 19, 2021.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- Federal Highway Administration: Hydraulic Toolbox 5.1.4.0 Computer Program

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the culverts have been analyzed to ensure that existing flood elevations will not increase underproposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Figure 3 shows the project location in the flood insurance rate map.

In this hydraulic and scour summary report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. As further described in the Stormwater Report prepared for this project, the peak flow rates have been adjusted to account for the proposed increase in impervious area. Table 4.1 also presents the proposed flow projections for the project area.

Table 4.1 – Summary of Discharges

Description	Alternative	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River and Proctor Brook Upstream of Goldthwait Brook	FEMA FIS	240	285	360	420	610
	Proposed Conditions	243	290	366	428	618

4.2 Hydraulic Analysis

Green used a combination of the topographical survey and the proposed design of the brook crossings to create a proposed conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA.

Table 4.2 shows a comparison between the results of the HEC-2 data received from FEMA and Green's proposed model.

Table 4.2 – Comparison of FEMA and Proposed Base Flood Elevations (BFE - referenced to NAVD88) at several cross sections near the Proposed Structures

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Published Data* (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
34	-	-	46.50	
33	-	-	46.33	
32	-	-	46.33	
31	H	46.89	46.33	-0.56
30	-	-	46.23	
29.5	Culvert at Sta 329+85			
29.4	-	-	42.54	
29.3	-	-	42.44	
28	-	-	42.57	
27	G	42.50	42.50	0.00
26.5	-	-	42.00	
26	F	41.96	41.39	-0.57
25	-		41.40	
24.5	Culvert at Sta 346+20			
24.4	-		40.74	
24.3	-		40.12	
23	-		40.28	
22	E	40.84	40.24	-0.6
21.7	-		40.11	
21.6	-		40.11	
21.5	Bridge			
21.4			39.90	
21.35	-		39.75	
21.3	-		39.80	

21.2	-		39.66	
19	-		39.66	
18	D	39.60	39.60	0.00

Adjusted datum to NAVD 88

As shown in Table 4.2, Proctor Brook will not have an increase in the Water Surface Elevation (WSEL) for the FEMA Base Flood Elevation.

Attachment A includes the 1977 HEC-2 model input/output report received from FEMA Headquarters. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed Independence Greenway Extension boardwalkover Proctor Brook with the new crossing culverts.

Table 4.3 a– Summary of Hydraulic Performance at Culvert at Sta 329+85

AEP [%]	Existing			Proposed		
	Peak Flow (CFS)	WSEL (FT) Sta. 31 FEMA Sta. H	Velocity* (FT/S) (Max. at Bridge)	Peak Flow (CFS)	WSEL (FT) Sta. 31 FEMA Sta. H	Velocity* (FT/S) (Max. at Bridge)
10%	240	44.16	0.41	243	45.01	10.09
4%	285	44.52	0.44	290	45.90	11.26
2%	360	44.97	0.50	366	46.17	11.46
1%	420	45.21	0.55	428	46.33	11.56
0.2%	610	45.70	0.71	618	46.55	11.08

Table 4.3 b– Summary of Hydraulic Performance at Culvert at Sta 346+20

AEP [%]	Existing			Proposed		
	Peak Flow (CFS)	WSEL (FT) Sta. 26 FEMA Sta. F	Velocity* (FT/S) (Max. at Bridge)	Peak Flow (CFS)	WSEL (FT) Sta. 26 FEMA Sta. F	Velocity* (FT/S) (Max. at Bridge)
10%	240	40.41	3.31	243	40.86	5.80
4%	285	40.71	3.58	290	41.03	5.68
2%	360	41.17	3.93	366	41.25	5.62
1%	420	41.53	4.11	428	41.39	5.57
0.2%	610	42.29	4.75	618	41.77	4.70

In Table 4.3a and Table 4.3b, the hydraulic performance of the culverts at station 329+85 and Sta 346+20 is depicted. The velocities and elevations shown in the tables for existing conditions were obtained from the model developed on HEC-RAS by Green. This model was created using survey data and did not account for functioning culverts. The velocities and water surface elevations are anticipated to increase with the restoration of the culverts.

4.3 Scour Safety/Stability Analyses

We calculated the scour hole dimensions (length, width, and depth) using the Hydraulic Engineering Circular

(HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 5:

"Estimating Scour at Culvert Outlets" and using equation 5.1 for cohesionless soils shown below:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g}(R_c^{2.5})}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta}$$

The equations are based on tests that were conducted to determine the maximum scour for the given condition and therefore represent what might be termed worst case scour geometries.

We utilized the flows with the highest exit velocities for analyzing the scour hole dimensions of each culvert. No scour potential under current conditions was assessed, as one of the structures has washed away and based on evidence, there are no indications of vertical or horizontal instability.

Soil samples were taken at points within the brook, upstream of the culverts and the banks of the brook. These samples were analyzed, and the results are included in Attachment C. The grain size (D_x) was estimated for each soil sample. The D_x results of the samples were used in the scour analysis.

The results of the scour analyses are shown on Table 4.3.

Table 4.3 – Summary of Calculated Scour at Proposed Culverts

Alternative	Return Frequency	Scour Hole Depth (Feet)	Scour Hole Width (Feet)	Scour Hole Length (Feet)	Scour Hole Volume (Cubic Feet)	Location of Maximum Scour (Feet)
Sta 329+85	Peak Velocity Flow (100-year)	5.89	32.00	57.82	8,133.98	23.13
Sta 346+20	Peak Velocity Flow (100-year)	4.69	23.64	44.11	3,527.78	17.65

Scour Countermeasures

The scour/stability analyses were performed using Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 10: "Riprap Basins and Aprons" and using equation 10.4 shown below:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

Table 4.4 displays dimensions for riprap apron at the proposed culverts.

Table 4.4 – Summary of Scour Countermeasure Design at Proposed Culverts

Alternative	Riprap Size D_{50} (Inches)	Riprap Class	Riprap Apron Length (Feet)	Riprap Apron Depth (Feet)	Riprap Apron Width (Feet)
Sta 329+85	12	3	57.82	3.0	34
Sta 346+20	12	3	44.11	3.0	31

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The HEC-RAS model under proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile, and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.
B. The natural stream bed will result in a scour depth at culvert at Station 329+85 of 5.89' during peak velocity flow.
C. The natural stream bed will result in a scour depth at culvert at Station 340+26 of 4.69' during peak velocity flow.
D. The dimensions calculated represent worst-case scour geometries, and consideration of site and environmental constraints were considered when designing the riprap apron.
E. Riprap Countermeasures are proposed to mitigate against the risk of scour. The proposed riprap size has been chosen to exceed the minimum size calculated but readily available MassDOT specified material. Depth of riprap apron is sized in accordance with HEC-23 methodology for chosen riprap material.
F. By placing riprap revetment at the ends of the culvert, it is anticipated that the scour depth will be negligible.

Table 5.1a – Hydraulic Data for Culvert at Sta 329+85

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	2.31 SQUARE MILES
DESIGN FLOOD DISCHARGE:	243 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	11.56 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	45.01 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	428 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	46.33 FEET, NAVD 88

DESIGN SCOUR DATA (Peak Velocity Flow)	
DESIGN SCOUR FLOOD DISCHARGE:	277 CUBIC FEET PER SECOND
DESIGN FLOOD SCOUR DEPTH	5.89 FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

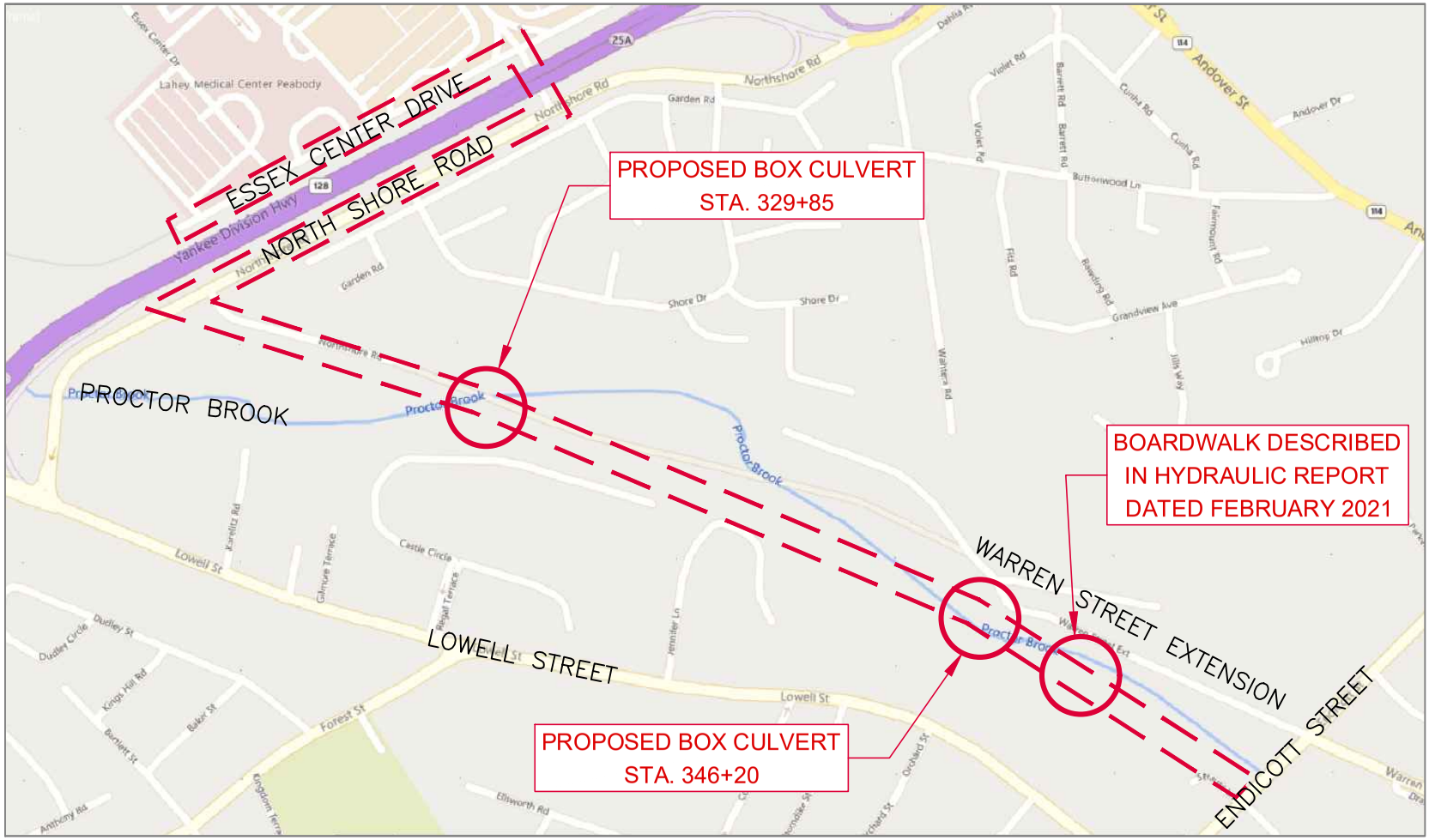
Table 5.1b – Hydraulic Data for Culvert at Sta 346+20

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	2.48 SQUARE MILES
DESIGN FLOOD DISCHARGE:	243 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	5.80 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	40.86 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	428 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	41.39 FEET, NAVD 88

DESIGN SCOUR DATA (Peak Velocity Flow)	
DESIGN SCOUR FLOOD DISCHARGE:	134 CUBIC FEET PER SECOND
DESIGN FLOOD SCOUR DEPTH	4.69 FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

FIGURES

FIGURE 1



LEGEND:

Project Limits

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS TEWKSBURY, MASSACHUSETTS

MASSDOT
PEABODY BIKEWAY EXTENSION
NORTH SHORE MALL TO ENDICOTT STREET
PEABODY, MA

CULVERT LOCATION LOCUS MAP
NOT TO SCALE

Proposal No. 609211-132091

F:\Projects\2013\13033\13033.10X--Weymouth Bridge St\Survey\Research\Utilities\Utility Request\Locus Map.dwg

A00840 - 135

SCALE IN FEET
250' 0 250' 500'
1" = 250'

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.: 17118.0XX
DATE: NOVEMBER, 2023
DESIGNED BY: N/A
DRAWN BY: JRM
CHECKED BY: SS

PROJECT TITLE:
PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

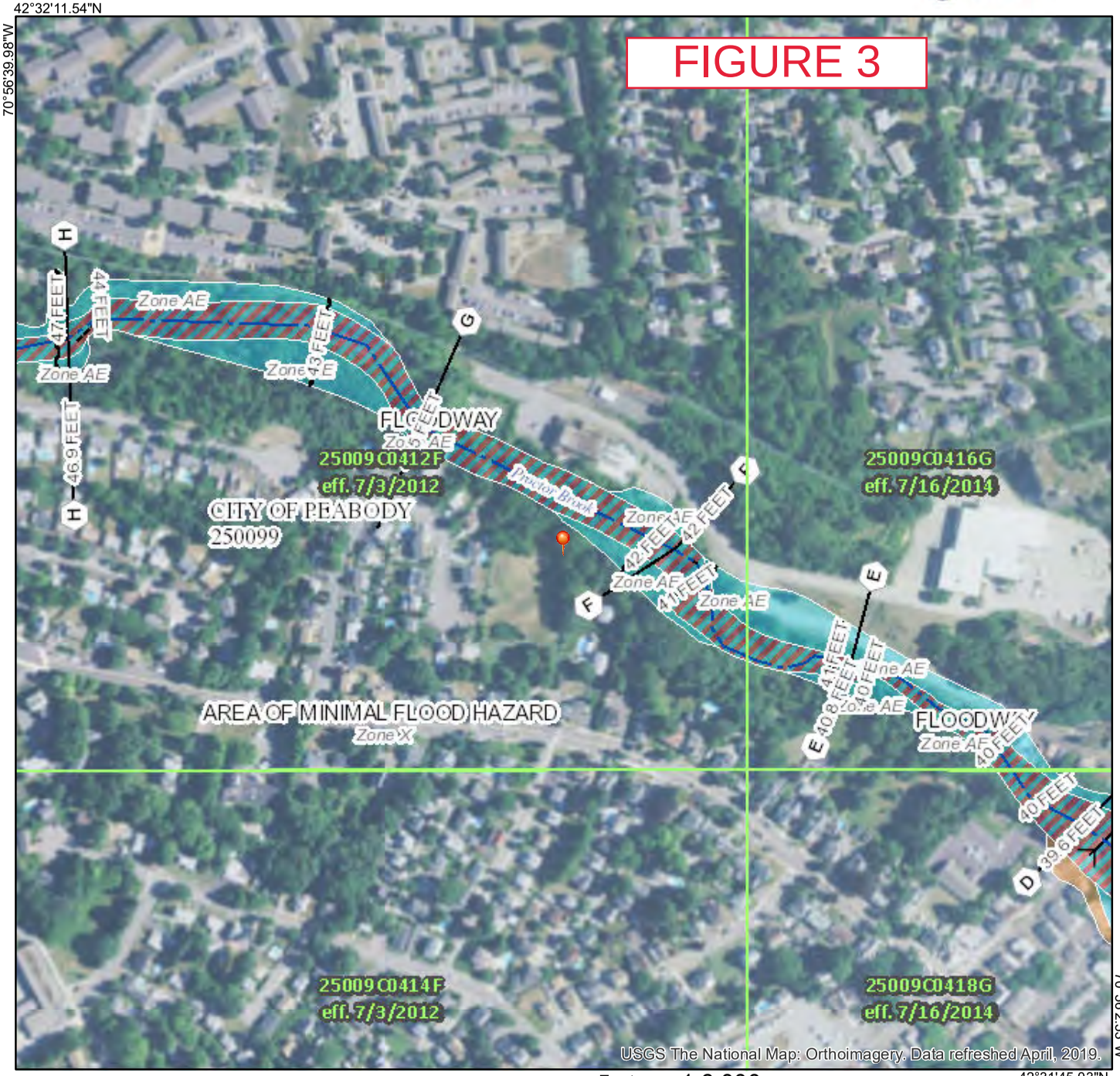
DRAWING TITLE:
FIGURE 2 – CROSS SECTIONS LOCATIONS

NAD 88
N

National Flood Hazard Layer FIRMette

FEMA

FIGURE 3



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/24/2019 at 9:07:12 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00840 - 137

ATTACHMENT A: 1977 HEC-2 MODEL INPUT/RESULTS

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

B.W. FINAL

70'

```
**********************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**********************************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       2.        0.        0.  0.0           0.0       0.0       0.     9.200     0.0
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     1.000     0.0      -1.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
      38.000    1.000     2.000     3.000    40.000    41.000    42.000    53.000    21.000     4.000

      22.000   54.000    34.000     0.0      38.000     1.000    39.000    50.000    61.000    51.000

      26.000   43.000    13.000    14.000    15.000    27.000    28.000     0.0       0.0       0.0
QT     9.000  640.000   970.000  1140.000  1620.000  1140.000  1140.000  1140.000  1140.000  1140.000
NC     0.080    0.060     0.040     0.100     0.300     0.0       0.0       0.0       0.0       0.0
ET     0.0    900.000  1100.000     0.0       0.0       0.0       0.0       0.0       2.100     0.0

X1     0.002   17.000   992.500  1005.500     0.0       0.0       0.0       0.0       0.0       0.0
GR    20.000  625.000    15.000   650.000    10.000   760.000    11.200   949.000    11.200  964.000
GR    10.800  979.500     5.400   992.500     4.200  1000.000     4.600  1005.500     5.300 1008.000
GR     8.300 1011.000     8.700  1025.000     8.700  1040.000     8.700  1055.000     9.500 1082.000
GR    10.000 1140.000    40.000  1140.100     0.0       0.0       0.0       0.0       0.0       0.0
NC     0.075    0.060     0.040     0.100     0.300     0.0       0.0       0.0       0.0       0.0
ET     0.0    900.000  1100.000     0.0       0.0       0.0       0.0       0.0       2.100     0.0

X1     0.056   12.000   994.000  1006.000   340.000   285.000   285.000     0.0       0.0       0.0
GR    20.000  570.000    15.000   630.000    10.000   730.000    10.000   905.000     5.000   980.000
GR     4.800  994.000     4.600  1000.000     4.800  1006.000     5.000  1010.000    10.200 1035.000
GR    10.500 1090.000    40.000  1090.100     0.0       0.0       0.0       0.0       0.0       0.0
NC     0.050    0.050     0.040     0.100     0.300     0.0       0.0       0.0       0.0       0.0
ET     0.0    900.000  1100.000     0.0       0.0       0.0       0.0       0.0       2.100     0.0

X1     0.056   10.000   994.000  1006.000     1.000     1.000     1.000     0.0       0.0       0.0
GR    40.000  950.000    10.000   950.100     5.000   980.000     4.800   994.000     4.600  1000.000
GR     4.800 1006.000     5.000  1010.000    10.200  1035.000    10.500  1090.000    40.000 1090.100
NC     0.040    0.045     0.040     0.300     0.500     0.0       0.0       0.0       0.0       0.0
ET     0.0    900.000  1100.000     0.0       0.0       0.0       0.0       0.0       2.100     0.0

X1     0.069   15.000   985.700  1014.700    70.000    70.000    69.000     0.0       0.0       0.0
```

Proposal No. 609211-132091

A00840 - 139

ET	0.0	805.000	1040.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.020	11.000	805.000	1040.000	227.000	180.000	185.000	0.0	0.0	0.0
GR	50.000	595.000	45.000	695.000	38.000	804.900	32.400	805.000	31.400	1000.000
GR	32.400	1040.000	35.000	1065.000	35.000	1110.000	40.000	1155.000	45.000	1235.000
GR	50.000	1800.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.0	0.0	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	900.000	1100.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.099	10.000	980.000	1030.000	465.000	417.000	417.000	0.0	0.0	0.0
GR	50.000	635.000	45.000	720.000	32.100	980.000	31.100	1000.000	32.100	1030.000
GR	35.000	1070.000	35.000	1100.000	40.000	1120.000	45.000	1260.000	50.000	1350.000
NC	0.0	0.0	0.045	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	871.000	1138.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.108	18.000	995.000	1005.500	50.000	60.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	35.600	35.600	0.0
GR	50.000	635.000	45.000	720.000	39.400	900.000	38.900	925.000	38.100	950.000
GR	37.500	975.000	37.100	994.900	32.500	995.000	31.300	1000.000	31.300	1005.500
GR	31.300	1005.600	32.700	1025.000	34.400	1050.000	35.300	1075.000	35.600	1100.000
GR	40.000	1130.000	45.000	1265.000	50.000	1365.000	0.0	0.0	0.0	0.0
SB	0.0	1.560	2.800	0.0	10.500	0.0	41.100	0.0	31.400	31.300
ET	0.0	871.000	1138.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.118	0.0	0.0	0.0	51.000	51.000	51.000	0.0	0.100	0.0
X2	0.0	0.0	1.000	35.600	35.400	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	37.300	35.400	0.0
BT	9.000	975.000	37.600	0.0	994.900	37.300	0.0	995.000	37.300	35.600
BT	1000.000	37.200	35.500	1005.500	37.300	35.400	1005.600	37.300	0.0	1025.000
BT	36.600	0.0	1050.000	36.000	0.0	1075.000	35.400	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	950.000	1100.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.127	13.000	995.000	1005.000	50.000	60.000	50.000	0.0	0.0	0.0
GR	50.000	720.000	45.000	810.000	38.300	992.000	38.300	992.900	34.200	993.000
GR	32.500	995.000	31.900	1000.000	32.600	1005.000	36.300	1012.000	37.100	1050.000
GR	40.000	1105.000	45.000	1245.000	50.000	1350.000	0.0	0.0	0.0	0.0
NC	0.070	0.070	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	990.000	1015.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.254	11.000	996.000	1006.000	670.000	670.000	670.000	0.0	0.0	0.0
GR	50.000	935.000	45.000	990.000	40.000	990.000	39.100	993.000	39.100	995.900
GR	36.800	996.000	35.900	1000.000	35.900	1006.000	40.000	1012.000	45.000	1100.000
GR	50.000	1150.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.025	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	985.000	1020.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.263	13.000	996.000	1006.000	50.000	50.000	50.000	0.0	0.0	0.0
GR	60.000	860.000	45.000	945.000	40.000	985.000	39.100	993.000	39.100	995.900
GR	36.600	996.000	35.700	1000.000	35.600	1006.000	38.900	1006.100	38.900	1009.000
GR	40.000	1015.000	45.000	1085.000	50.000	1130.000	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.025	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1020.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.267	0.0	0.0	0.0	19.000	19.000	19.000	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	975.000	1035.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.276	12.000	994.000	1006.000	50.000	50.000	50.000	0.0	0.0	0.0

Proposal No. 609211-132091

A00840 - 140

GR	30.000	870.000	45.200	950.000	40.300	964.000	40.200	974.000	40.100	984.000
GR	36.600	994.000	35.900	1000.000	36.500	1006.000	36.900	1011.000	37.600	1041.000
GR	45.000	1070.000	50.000	1110.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.0	0.0	0.050	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	930.000	1030.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.380	12.000	996.500	1003.500	550.000	650.000	549.000	0.0	0.0	0.0
GR	55.000	680.000	50.000	700.000	45.000	820.000	48.000	868.000	37.200	938.500
GR	37.100	1000.000	37.200	1003.500	40.000	1045.000	40.000	1110.000	45.000	1155.000
GR	50.000	1170.000	55.000	1180.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.070	0.075	0.050	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	967.000	1168.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.389	15.000	996.800	1003.200	50.000	50.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	38.900	38.900	0.0
GR	55.000	850.000	50.000	860.000	45.000	930.000	41.100	975.000	35.300	996.700
GR	35.200	996.800	35.700	1000.000	36.300	1003.200	36.300	1003.300	41.200	1025.000
GR	40.900	1080.000	40.900	1160.000	45.000	1200.000	50.000	1210.000	55.000	1220.000
SB	0.0	1.560	2.800	0.0	6.400	0.0	22.700	0.0	35.700	35.700
ET	0.0	956.000	1178.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.393	0.0	0.0	0.0	18.500	18.500	18.500	0.0	0.0	0.0
X2	0.0	0.0	1.000	39.300	41.100	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	41.100	41.200	0.0
BT	7.000	975.000	41.100	0.0	996.700	41.200	0.0	996.800	41.200	39.300
BT	1000.000	41.200	39.300	1003.200	41.200	39.300	1003.300	41.200	0.0	1025.000
BT	41.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	990.000	1090.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.402	16.000	994.000	1006.000	85.000	50.000	50.000	0.0	0.0	0.0
GR	55.000	865.000	50.000	885.000	45.000	960.000	41.000	970.000	38.500	980.000
GR	38.600	993.000	36.700	994.000	36.900	1000.000	37.300	1006.000	40.500	1014.000
GR	41.100	1023.000	40.900	1075.000	40.900	1140.000	45.000	1195.000	50.000	1205.000
GR	55.000	1215.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1080.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.542	15.000	997.000	1004.000	740.000	790.000	739.000	0.0	0.0	0.0
GR	55.000	780.000	50.000	795.000	45.200	960.000	42.200	970.000	40.900	980.000
GR	40.300	994.000	38.900	997.000	39.000	1000.000	39.100	1004.000	40.500	1005.000
GR	40.700	1030.000	41.100	1050.000	50.000	1175.000	50.000	1540.000	55.000	1570.000
NC	0.070	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	935.000	1035.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.726	8.000	996.500	1003.500	972.000	972.000	972.000	0.0	0.0	0.0
GR	55.000	810.000	50.000	845.000	40.200	996.500	40.100	1000.000	40.200	1003.500
GR	46.000	1050.000	50.000	1280.000	55.000	1765.000	0.0	0.0	0.0	0.0
NC	0.065	0.065	0.045	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	982.000	1017.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.735	19.000	996.500	1003.500	30.000	30.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	43.400	43.400	0.0
GR	55.000	745.000	50.000	885.000	46.100	975.000	43.000	994.500	42.000	996.500
GR	41.650	996.600	40.300	997.100	39.900	998.300	40.300	999.400	41.650	1000.000
GR	40.300	1000.600	39.900	1001.700	40.300	1002.900	41.650	1003.400	42.000	1003.500
GR	43.000	1005.500	46.200	1025.000	50.000	1255.000	55.000	1740.000	0.0	0.0
SB	0.0	1.560	2.800	0.0	6.700	0.0	18.200	0.0	39.900	39.900
ET	0.0	940.000	1111.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0

E

F

G

Proposal No. 609211-132091

A00840 - 141

X1	1.740	0.0	0.0	0.0	24.000	24.000	24.000	0.0	0.0	0.0
X2	0.0	0.0	1.000	43.400	46.100	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	46.100	46.400	0.0
BT	13.000	975.000	46.100	0.0	996.500	46.400	0.0	996.600	46.400	41.650
BT	997.100	46.400	43.000	998.300	46.400	43.400	999.400	46.400	43.000	1000.000
BT	46.400	41.650	1000.600	46.400	43.000	1001.700	46.400	43.400	1002.900	46.400
BT	43.000	1003.400	46.400	41.650	1003.500	46.400	0.0	1025.000	46.200	0.0
NC	0.070	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	940.000	1040.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.749	14.000	996.000	1002.000	50.000	105.000	50.000	0.0	0.0	0.0
GR	55.000	745.000	50.000	790.000	42.900	934.000	43.200	949.000	46.100	966.000
GR	42.400	981.000	42.100	991.000	40.000	996.000	39.900	1000.000	40.100	1002.000
GR	41.500	1009.000	41.900	1059.000	50.000	1110.000	55.000	1630.000	0.0	0.0
NC	0.070	0.070	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1050.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	1.882	7.000	994.000	1006.000	1262.000	702.000	702.000	0.0	0.0	0.0
GR	55.000	740.000	50.000	910.000	40.800	994.000	40.800	1000.000	40.800	1006.000
GR	50.000	1160.000	55.000	1230.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.075	0.045	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	980.000	1040.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	2.019	12.000	993.000	1007.000	792.000	781.000	723.000	0.0	0.0	0.0
GR	55.000	855.000	45.300	950.000	45.100	975.000	44.100	993.000	41.400	994.000
GR	41.800	1000.000	42.500	1006.000	44.200	1007.000	44.200	1025.000	44.100	1050.000
GR	50.000	1090.000	55.000	1135.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.075	0.075	0.045	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	995.000	1004.500	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	2.028	16.000	995.000	1004.500	58.000	58.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	48.300	48.300	0.0
GR	55.000	855.000	51.200	900.000	51.000	925.000	51.000	950.000	50.500	975.000
GR	50.000	988.000	42.800	994.900	42.800	995.000	42.600	1000.000	42.800	1004.500
GR	42.800	1004.600	45.500	1025.000	49.000	1050.000	52.400	1075.000	53.100	1100.000
GR	60.000	1245.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SB	0.0	1.560	2.800	0.0	9.500	0.0	40.800	0.0	42.600	42.600
ET	0.0	995.000	1004.500	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	2.036	0.0	995.000	1004.500	44.200	44.200	44.200	0.0	0.0	0.0
X2	0.0	0.0	1.000	47.000	51.000	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	51.000	51.400	0.0
BT	13.000	855.000	55.000	0.0	900.000	51.200	0.0	925.000	51.000	0.0
BT	950.000	51.000	0.0	975.000	51.200	0.0	994.900	51.400	0.0	995.000
BT	51.400	47.000	1000.000	51.400	47.000	1004.500	51.400	47.000	1004.600	51.400
BT	0.0	1025.000	51.600	0.0	1050.000	51.900	0.0	1075.000	52.400	0.0
NC	0.080	0.080	0.040	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	995.500	1004.500	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	2.049	8.000	995.500	1004.500	317.000	79.000	70.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	51.000	51.000	0.0
GR	55.000	950.000	50.000	965.000	42.400	995.500	42.100	1000.000	42.700	1004.500
GR	50.000	1025.000	55.000	1045.000	60.000	1180.000	0.0	0.0	0.0	0.0
SB	0.0	1.730	2.800	0.0	8.000	0.0	41.600	0.0	41.900	42.100
ET	0.0	996.000	1004.000	0.0	0.0	0.0	0.0	0.0	2.100	0.0
X1	2.087	17.000	996.000	1004.000	200.000	200.000	200.000	0.0	0.0	0.0
X2	0.0	0.0	1.000	47.100	56.100	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	56.100	59.400	0.0
BT	15.000	820.000	60.000	0.0	900.000	56.100	0.0	925.000	56.600	0.0
BT	950.000	57.400	0.0	975.000	58.300	0.0	995.900	59.100	0.0	996.000

H

I

Proposal No. 609211-132091

A00840 - 142

SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.02	996.00	35.45	1006.00	1018.47	73.95
1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	210.71
1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

D

E

F

Proposal No. 609211-132091

	SECNO	CWSEL	CR IWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
G	1.542	42.40	0.0	42.47	0.0	0.0	38.90	969.31	997.00	99.03	1004.00	1068.35	55.08
	1.542	43.01	0.0	43.08	0.0	0.0	38.90	967.31	997.00	109.50	1004.00	1076.80	87.37
	1.542	43.28	0.0	43.35	0.0	0.0	38.90	966.41	997.00	114.18	1004.00	1080.59	104.35
	1.542	44.02	0.0	44.09	0.0	0.0	38.90	963.95	997.00	127.00	1004.00	1090.95	159.05
	1.726	43.86	0.0	43.90	0.0	0.0	40.10	939.96	996.50	92.86	1003.50	1032.82	70.24
	1.726	44.45	0.0	44.51	0.0	0.0	40.10	930.82	996.50	106.75	1003.50	1037.56	100.41
	1.726	44.71	0.0	44.77	0.0	0.0	40.10	926.89	996.50	112.71	1003.50	1039.60	115.47
	1.726	45.41	0.0	45.48	0.0	0.0	40.10	916.11	996.50	129.08	1003.50	1045.19	163.74
*	1.735	43.94	43.94	44.88	0.0	0.0	39.90	988.61	996.50	22.60	1003.50	1011.21	15.83
*	1.735	44.67	44.67	45.64	0.0	0.0	39.90	983.97	996.50	31.72	1003.50	1015.70	25.16
*	1.735	44.94	44.94	45.94	0.0	0.0	39.90	982.27	996.50	35.08	1003.50	1017.35	29.57
*	1.735	45.59	45.59	46.69	0.0	0.0	39.90	978.21	996.50	43.08	1003.50	1021.28	42.48
	1.740	46.70	0.0	46.75	46.10	43.40	39.90	961.25	996.50	93.76	1003.50	1055.01	76.86
	1.740	47.35	0.0	47.41	46.10	43.40	39.90	946.04	996.50	148.87	1003.50	1094.91	111.85
	1.740	47.61	0.0	47.67	46.10	43.40	39.90	940.06	996.50	170.52	1003.50	1110.58	129.89
	1.740	48.32	0.0	48.37	46.10	43.40	39.90	923.80	996.50	229.44	1003.50	1153.24	194.12
H	1.749	46.76	0.0	46.77	0.0	0.0	39.90	855.65	996.00	233.97	1002.00	1089.62	413.41
	1.749	47.43	0.0	47.43	0.0	0.0	39.90	842.21	996.00	251.58	1002.00	1093.79	534.17
	1.749	47.69	0.0	47.69	0.0	0.0	39.90	836.95	996.00	258.47	1002.00	1095.42	586.16
	1.749	48.39	0.0	48.39	0.0	0.0	39.90	822.75	996.00	277.08	1002.00	1099.83	740.34
	1.882	46.80	0.0	46.81	0.0	0.0	40.80	939.19	994.00	167.28	1006.00	1106.48	283.97
	1.882	47.48	0.0	47.49	0.0	0.0	40.80	933.01	994.00	184.79	1006.00	1117.81	367.00
	1.882	47.75	0.0	47.75	0.0	0.0	40.80	930.58	994.00	191.68	1006.00	1122.26	403.31
	1.882	48.47	0.0	48.48	0.0	0.0	40.80	924.01	994.00	210.29	1006.00	1134.31	512.35
I	2.019	46.89	0.0	46.91	0.0	0.0	41.40	934.39	993.00	134.55	1007.00	1068.94	136.65
	2.019	47.59	0.0	47.62	0.0	0.0	41.40	927.52	993.00	146.17	1007.00	1073.69	198.05
	2.019	47.87	0.0	47.90	0.0	0.0	41.40	924.80	993.00	150.78	1007.00	1075.58	225.75
	2.019	48.62	0.0	48.65	0.0	0.0	41.40	917.45	993.00	163.22	1007.00	1080.67	310.20
	2.028	46.63	0.0	47.27	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	27.95
	2.028	47.07	0.0	48.24	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	32.86
	2.028	47.19	0.0	48.69	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	34.13
	2.028	48.55	0.0	48.81	0.0	0.0	42.60	989.39	995.00	57.41	1004.50	1046.79	121.45
	2.036	46.90	0.0	47.46	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	30.96
	2.036	48.23	0.0	48.96	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	46.35
	2.036	48.98	0.0	49.75	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	55.57
	2.036	51.68	0.0	51.73	51.00	47.00	42.60	894.32	995.00	175.38	1004.50	1069.70	335.37
	2.049	47.37	0.0	47.80	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	42.29
	2.049	48.71	0.0	49.32	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	58.97
	2.049	49.44	0.0	50.10	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	68.29
	2.049	51.70	0.0	51.80	0.0	0.0	42.10	959.89	995.50	71.92	1004.50	1031.81	295.82
	2.087	47.87	0.0	48.26	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	46.38
	2.087	50.27	0.0	50.73	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	72.87
	2.087	51.73	0.0	52.17	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	89.33
	2.087	56.80	0.0	56.82	56.10	47.10	41.90	835.94	996.00	168.06	1004.00	1004.00	804.85

Proposal No. 609211-132091

A00840 - 144

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

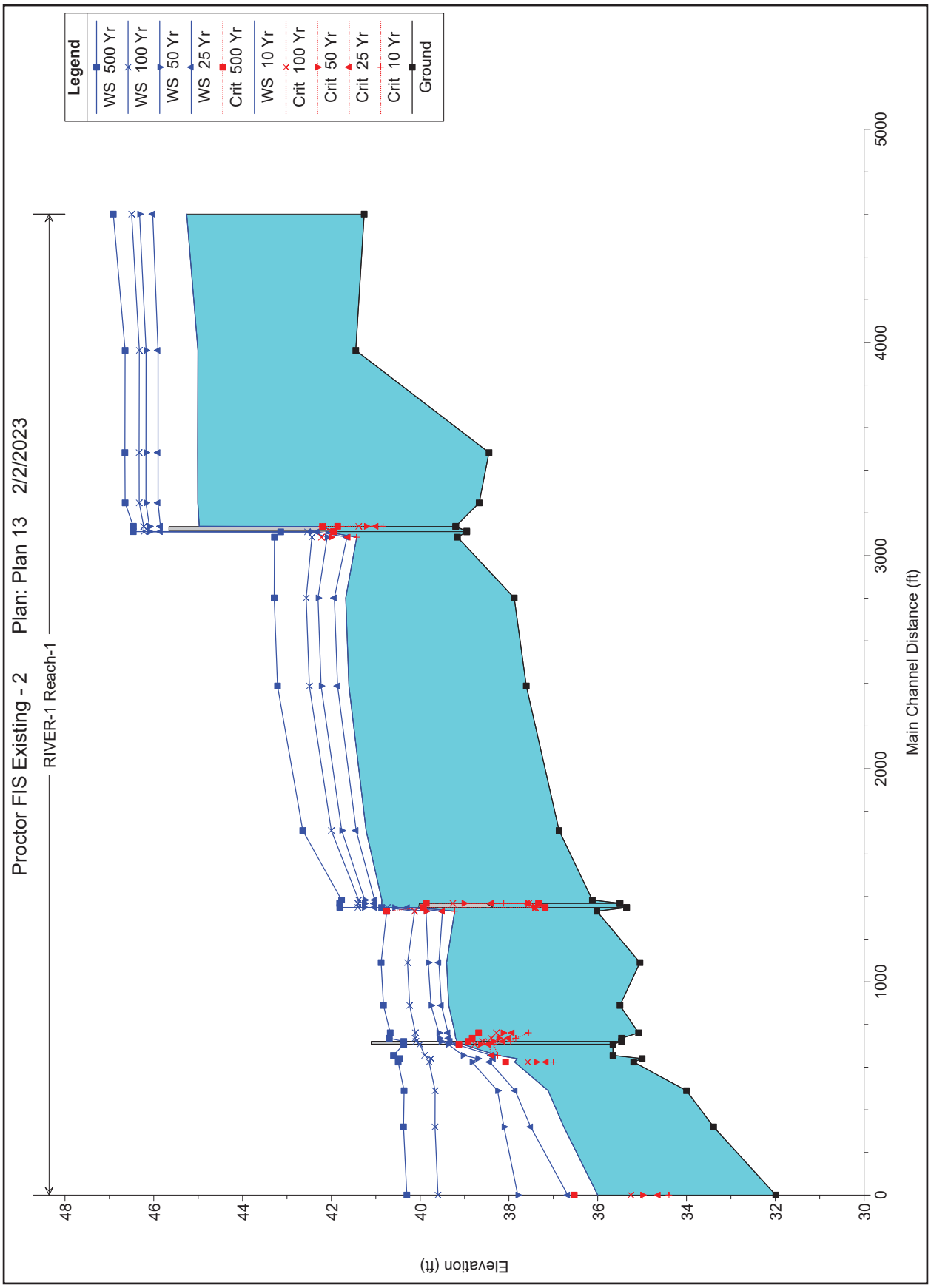
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	34	10 Yr	242.26	41.26	45.26		45.43	0.001879	3.47	97.63	84.71	0.37
Reach-1	34	25 Yr	289.42	41.26	46.02		46.12	0.000911	2.85	165.79	93.11	0.27
Reach-1	34	50 Yr	365.72	41.26	46.32		46.44	0.001017	3.17	193.87	96.36	0.29
Reach-1	34	100 Yr	427.56	41.26	46.50		46.64	0.001136	3.46	211.21	98.32	0.30
Reach-1	34	500 Yr	618.49	41.26	46.91		47.12	0.001543	4.30	252.72	102.84	0.36
Reach-1	33	10 Yr	242.26	41.45	45.01		45.02	0.000267	1.46	319.60	148.08	0.15
Reach-1	33	25 Yr	289.42	41.45	45.90		45.92	0.000140	1.26	461.53	168.49	0.11
Reach-1	33	50 Yr	365.72	41.45	46.17		46.19	0.000173	1.46	508.09	174.67	0.12
Reach-1	33	100 Yr	427.56	41.45	46.33		46.35	0.000206	1.63	534.97	178.14	0.14
Reach-1	33	500 Yr	618.49	41.45	46.64		46.68	0.000327	2.15	592.88	185.39	0.17
Reach-1	32	10 Yr	242.26	38.45	45.01		45.01	0.000006	0.29	871.30	219.19	0.02
Reach-1	32	25 Yr	289.42	38.45	45.90		45.91	0.000005	0.29	1075.76	237.72	0.02
Reach-1	32	50 Yr	365.72	38.45	46.18		46.18	0.000006	0.35	1141.15	243.35	0.03
Reach-1	32	100 Yr	427.56	38.45	46.33		46.33	0.000008	0.39	1178.58	246.52	0.03
Reach-1	32	500 Yr	618.49	38.45	46.65		46.65	0.000014	0.54	1258.64	253.15	0.04
Reach-1	31	10 Yr	242.26	38.67	45.01		45.01	0.000007	0.33	957.81	294.77	0.03
Reach-1	31	25 Yr	289.42	38.67	45.90		45.90	0.000006	0.32	1257.05	373.59	0.02
Reach-1	31	50 Yr	365.72	38.67	46.17		46.18	0.000007	0.39	1361.68	397.48	0.03
Reach-1	31	100 Yr	427.56	38.67	46.33		46.33	0.000009	0.44	1423.28	410.90	0.03
Reach-1	31	500 Yr	618.49	38.67	46.65		46.65	0.000016	0.60	1558.78	438.97	0.04
Reach-1	30	10 Yr	242.26	39.20	44.97	40.84	45.00	0.000123	1.46	233.94	97.19	0.11
Reach-1	30	25 Yr	289.42	39.20	45.85	40.99	45.89	0.000147	1.77	286.00	116.47	0.12
Reach-1	30	50 Yr	365.72	39.20	46.10	41.21	46.16	0.000205	2.14	320.35	168.44	0.15
Reach-1	30	100 Yr	427.56	39.20	46.23	41.38	46.30	0.000261	2.45	344.37	203.35	0.17
Reach-1	30	500 Yr	618.49	39.20	46.46	41.86	46.60	0.000470	3.36	399.49	268.61	0.22
Reach-1	29.5		Culvert									
Reach-1	29.4	10 Yr	242.26	38.95	42.13		42.35	0.002509	3.78	65.97	34.07	0.42
Reach-1	29.4	25 Yr	289.42	38.95	42.32		42.59	0.002777	4.17	71.88	36.81	0.45
Reach-1	29.4	50 Yr	365.72	38.95	42.45		42.84	0.003728	5.00	76.15	38.79	0.53
Reach-1	29.4	100 Yr	427.56	38.95	42.54		43.03	0.004604	5.67	78.75	39.99	0.59
Reach-1	29.4	500 Yr	618.49	38.95	43.14		43.83	0.005019	6.72	97.41	48.63	0.64
Reach-1	29.3	10 Yr	242.26	39.16	41.43	41.43	42.09	0.016855	6.51	37.23	28.61	1.01
Reach-1	29.3	25 Yr	289.42	39.16	41.65	41.62	42.33	0.015409	6.60	43.87	30.87	0.98
Reach-1	29.3	50 Yr	365.72	39.16	42.09	42.01	42.65	0.009391	6.09	75.57	104.97	0.79
Reach-1	29.3	100 Yr	427.56	39.16	42.44	42.22	42.87	0.006204	5.55	119.41	149.42	0.66
Reach-1	29.3	500 Yr	618.49	39.16	43.28		43.51	0.002697	4.55	291.00	258.02	0.46
Reach-1	28	10 Yr	242.26	37.88	41.68		41.69	0.000194	1.04	274.93	163.88	0.12
Reach-1	28	25 Yr	289.42	37.88	41.93		41.95	0.000190	1.11	316.93	165.79	0.12
Reach-1	28	50 Yr	365.72	37.88	42.30		42.32	0.000186	1.20	378.73	168.29	0.12
Reach-1	28	100 Yr	427.56	37.88	42.57		42.59	0.000186	1.27	423.89	170.10	0.12
Reach-1	28	500 Yr	618.49	37.88	43.29		43.32	0.000187	1.45	547.98	174.95	0.13
Reach-1	27	10 Yr	242.26	37.61	41.61		41.62	0.000162	0.94	262.98	122.78	0.11
Reach-1	27	25 Yr	289.42	37.61	41.86		41.88	0.000162	1.01	294.64	125.36	0.11
Reach-1	27	50 Yr	365.72	37.61	42.23		42.25	0.000164	1.11	341.70	129.09	0.11
Reach-1	27	100 Yr	427.56	37.61	42.50		42.52	0.000166	1.18	376.39	131.78	0.12
Reach-1	27	500 Yr	618.49	37.61	43.21		43.24	0.000174	1.39	473.33	138.92	0.12
Reach-1	26.5	10 Yr	242.26	36.87	41.22		41.36	0.001442	3.06	87.17	51.16	0.33
Reach-1	26.5	25 Yr	289.42	36.87	41.44		41.61	0.001540	3.33	99.43	57.56	0.34
Reach-1	26.5	50 Yr	365.72	36.87	41.77		41.97	0.001663	3.72	119.82	68.30	0.36
Reach-1	26.5	100 Yr	427.56	36.87	42.00		42.23	0.001747	3.99	136.75	77.37	0.38
Reach-1	26.5	500 Yr	618.49	36.87	42.64		42.94	0.001857	4.60	194.69	102.52	0.40
Reach-1	26	10 Yr	242.26	36.12	40.86		40.99	0.000887	2.90	97.10	48.82	0.26
Reach-1	26	25 Yr	289.42	36.12	41.03		41.19	0.001086	3.30	105.58	55.12	0.29
Reach-1	26	50 Yr	365.72	36.12	41.25		41.47	0.001415	3.90	118.63	63.60	0.33
Reach-1	26	100 Yr	427.56	36.12	41.39		41.67	0.001704	4.38	127.82	68.95	0.37
Reach-1	26	500 Yr	618.49	36.12	41.77		42.22	0.002529	5.64	157.16	83.79	0.45
Reach-1	25	10 Yr	242.26	35.50	40.87	38.12	40.96	0.000715	2.55	119.60	72.16	0.23
Reach-1	25	25 Yr	289.42	35.50	41.03	38.40	41.15	0.000858	2.88	132.11	78.29	0.26
Reach-1	25	50 Yr	365.72	35.50	41.26	39.01	41.42	0.001087	3.37	150.74	86.62	0.29
Reach-1	25	100 Yr	427.56	35.50	41.40	39.26	41.60	0.001287	3.75	163.64	91.94	0.32
Reach-1	25	500 Yr	618.49	35.50	41.81	39.86	42.11	0.001818	4.73	204.06	106.93	0.39
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	242.26	35.35	40.06		40.30	0.001760	3.99	66.19	24.87	0.36
Reach-1	24.4	25 Yr	289.42	35.35	40.29		40.59	0.002068	4.50	72.65	32.38	0.39

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	24.4	50 Yr	365.72	35.35	40.57		40.99	0.002586	5.26	83.66	44.02	0.44
Reach-1	24.4	100 Yr	427.56	35.35	40.74		41.26	0.003065	5.87	91.57	50.78	0.48
Reach-1	24.4	500 Yr	618.49	35.35	40.87	39.93	41.86	0.005758	8.19	98.31	55.89	0.66
Reach-1	24.3	10 Yr	242.26	36.02	39.22	39.22	40.06	0.016648	7.32	33.08	20.10	1.01
Reach-1	24.3	25 Yr	289.42	36.02	39.50	39.50	40.36	0.014524	7.45	40.48	30.70	0.96
Reach-1	24.3	50 Yr	365.72	36.02	39.87	39.87	40.76	0.012248	7.69	54.77	45.79	0.91
Reach-1	24.3	100 Yr	427.56	36.02	40.12	40.12	41.04	0.011122	7.88	67.75	55.44	0.88
Reach-1	24.3	500 Yr	618.49	36.02	40.75	40.75	41.73	0.009372	8.41	110.23	79.19	0.84
Reach-1	23	10 Yr	242.26	35.05	39.40		39.41	0.000052	0.66	401.39	156.58	0.07
Reach-1	23	25 Yr	289.42	35.05	39.58		39.58	0.000062	0.75	428.63	158.87	0.07
Reach-1	23	50 Yr	365.72	35.05	39.82		39.83	0.000078	0.88	467.37	161.12	0.08
Reach-1	23	100 Yr	427.56	35.05	40.28		40.30	0.000069	0.90	543.40	165.46	0.08
Reach-1	23	500 Yr	618.49	35.05	40.88		40.90	0.000089	1.12	643.56	171.00	0.09
Reach-1	22	10 Yr	242.26	35.50	39.36		39.38	0.000658	1.33	183.03	138.19	0.20
Reach-1	22	25 Yr	289.42	35.50	39.52		39.55	0.000646	1.41	206.41	141.44	0.20
Reach-1	22	50 Yr	365.72	35.50	39.76		39.79	0.000649	1.54	240.00	145.98	0.21
Reach-1	22	100 Yr	427.56	35.50	40.24		40.27	0.000400	1.39	312.34	155.31	0.17
Reach-1	22	500 Yr	618.49	35.50	40.83		40.86	0.000381	1.56	407.24	166.76	0.17
Reach-1	21.7	10 Yr	242.26	35.08	39.22	37.56	39.28	0.000955	1.98	122.64	69.81	0.25
Reach-1	21.7	25 Yr	289.42	35.08	39.37	37.93	39.45	0.001049	2.19	133.79	75.72	0.27
Reach-1	21.7	50 Yr	365.72	35.08	39.58	38.13	39.68	0.001203	2.50	150.44	83.77	0.29
Reach-1	21.7	100 Yr	427.56	35.08	40.11	38.28	40.19	0.000788	2.33	200.47	104.22	0.25
Reach-1	21.7	500 Yr	618.49	35.08	40.67	38.68	40.79	0.000846	2.73	262.26	114.10	0.26
Reach-1	21.6	10 Yr	242.26	35.46	39.20	37.85	39.24	0.001125	1.61	151.05	126.87	0.26
Reach-1	21.6	25 Yr	289.42	35.46	39.36	38.01	39.40	0.001123	1.70	171.47	134.62	0.26
Reach-1	21.6	50 Yr	365.72	35.46	39.57	38.23	39.62	0.001149	1.83	201.40	145.23	0.27
Reach-1	21.6	100 Yr	427.56	35.46	40.11	38.40	40.15	0.000579	1.53	287.30	168.00	0.20
Reach-1	21.6	500 Yr	618.49	35.46	40.69	38.83	40.74	0.000482	1.67	387.91	179.91	0.19
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	242.26	35.66	38.25	38.25	38.69	0.018701	5.36	49.29	69.69	1.00
Reach-1	21.4	25 Yr	289.42	35.66	38.40	38.38	38.84	0.015829	5.45	59.82	75.85	0.94
Reach-1	21.4	50 Yr	365.72	35.66	39.03		39.26	0.004572	4.02	116.63	102.92	0.55
Reach-1	21.4	100 Yr	427.56	35.66	39.90		40.01	0.001307	2.84	221.82	139.83	0.31
Reach-1	21.4	500 Yr	618.49	35.66	40.60		40.71	0.001041	2.98	325.78	155.54	0.29
Reach-1	21.35	10 Yr	242.26	35.00	37.81		38.18	0.004617	4.84	50.10	20.60	0.55
Reach-1	21.35	25 Yr	289.42	35.00	38.35		38.69	0.003646	4.71	61.40	21.66	0.49
Reach-1	21.35	50 Yr	365.72	35.00	38.70		39.14	0.004131	5.29	69.16	22.36	0.53
Reach-1	21.35	100 Yr	427.56	35.00	39.75		39.95	0.003457	3.54	120.75	67.51	0.47
Reach-1	21.35	500 Yr	618.49	35.00	40.46		40.66	0.002652	3.59	172.05	77.22	0.42
Reach-1	21.3	10 Yr	242.26	35.19	37.87	37.00	38.07	0.003009	3.56	68.12	35.00	0.45
Reach-1	21.3	25 Yr	289.42	35.19	38.43	37.16	38.60	0.002006	3.27	88.47	37.88	0.38
Reach-1	21.3	50 Yr	365.72	35.19	38.83	37.39	39.02	0.001886	3.47	118.41	103.01	0.37
Reach-1	21.3	100 Yr	427.56	35.19	39.80	37.57	39.90	0.000750	2.69	226.91	122.06	0.25
Reach-1	21.3	500 Yr	618.49	35.19	40.49	38.08	40.61	0.000756	3.03	316.67	135.81	0.26
Reach-1	21.2	10 Yr	242.26	34.00	37.12		37.53	0.005100	5.16	46.99	19.03	0.58
Reach-1	21.2	25 Yr	289.42	34.00	37.86		38.18	0.004995	4.54	63.78	31.80	0.56
Reach-1	21.2	50 Yr	365.72	34.00	38.26		38.59	0.005840	4.64	78.83	43.52	0.61
Reach-1	21.2	100 Yr	427.56	34.00	39.66		39.77	0.001224	2.63	167.44	82.49	0.30
Reach-1	21.2	500 Yr	618.49	34.00	40.36		40.49	0.001111	2.91	231.71	101.78	0.29
Reach-1	19	10 Yr	242.26	33.39	36.76		36.91	0.002162	3.10	78.03	37.25	0.38
Reach-1	19	25 Yr	289.42	33.39	37.51		37.59	0.002064	2.22	130.62	103.19	0.35
Reach-1	19	50 Yr	365.72	33.39	38.11		38.17	0.000996	1.85	197.34	117.88	0.25
Reach-1	19	100 Yr	427.56	33.39	39.66		39.68	0.000173	1.04	409.41	155.64	0.11
Reach-1	19	500 Yr	618.49	33.39	40.37		40.40	0.000181	1.18	525.96	172.92	0.12
Reach-1	18	10 Yr	242.26	31.99	36.00	34.40	36.21	0.002151	3.71	65.28	23.13	0.39
Reach-1	18	25 Yr	289.42	31.99	36.68	34.63	36.84	0.002605	3.25	93.05	65.81	0.41
Reach-1	18	50 Yr	365.72	31.99	37.80	34.99	37.88	0.000776	2.41	195.57	116.43	0.24
Reach-1	18	100 Yr	427.56	31.99	39.60	35.26	39.63	0.000159	1.49	478.02	197.41	0.12
Reach-1	18	500 Yr	618.49	31.99	40.30	36.53	40.34	0.000184	1.75	627.24	228.91	0.13

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Reach-1	29.5 Culvert #1	10 Yr	45.00	44.97	45.15	45.00	45.67	242.26		2.85	10.09	10.09
Reach-1	29.5 Culvert #1	25 Yr	45.89	45.85	45.92	45.89	45.67	270.18	19.24	3.53	11.26	11.26
Reach-1	29.5 Culvert #1	50 Yr	46.16	46.10	46.16	46.16	45.67	274.98	90.74	3.64	11.46	11.46
Reach-1	29.5 Culvert #1	100 Yr	46.30	46.23	46.28	46.30	45.67	277.33	150.23	3.69	11.56	11.56
Reach-1	29.5 Culvert #1	500 Yr	46.61	46.46	46.58	46.61	45.67	266.02	352.47	3.32	11.08	11.08
Reach-1	24.5 Culvert #1	10 Yr	40.97	40.87	40.58	40.97	40.06	139.22	103.04	0.81	5.80	5.80
Reach-1	24.5 Culvert #1	25 Yr	41.16	41.03	40.83	41.16	40.06	136.42	153.00	0.75	5.68	5.68
Reach-1	24.5 Culvert #1	50 Yr	41.43	41.26	41.12	41.43	40.06	134.93	230.79	0.68	5.62	5.62
Reach-1	24.5 Culvert #1	100 Yr	41.61	41.40	41.32	41.61	40.06	133.78	293.78	0.66	5.57	5.57
Reach-1	24.5 Culvert #1	500 Yr	42.11	41.81	41.88	42.11	40.06	112.70	505.79	0.94	4.70	4.70


Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
Crit 500 Yr
WS 10 Yr
Crit 100 Yr
Crit 50 Yr
Crit 25 Yr
Crit 10 Yr
Ground
Proctor FIS Existing - 2 Plan: Plan 13 2/2/2023
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
48
46
44
42
40
38
36
34
32
30
0
1000
2000
3000
4000
5000

ATTACHMENT C: GEOTECHNICAL ANALYSIS RESULTS

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

LABORATORY TESTING DATA SHEET

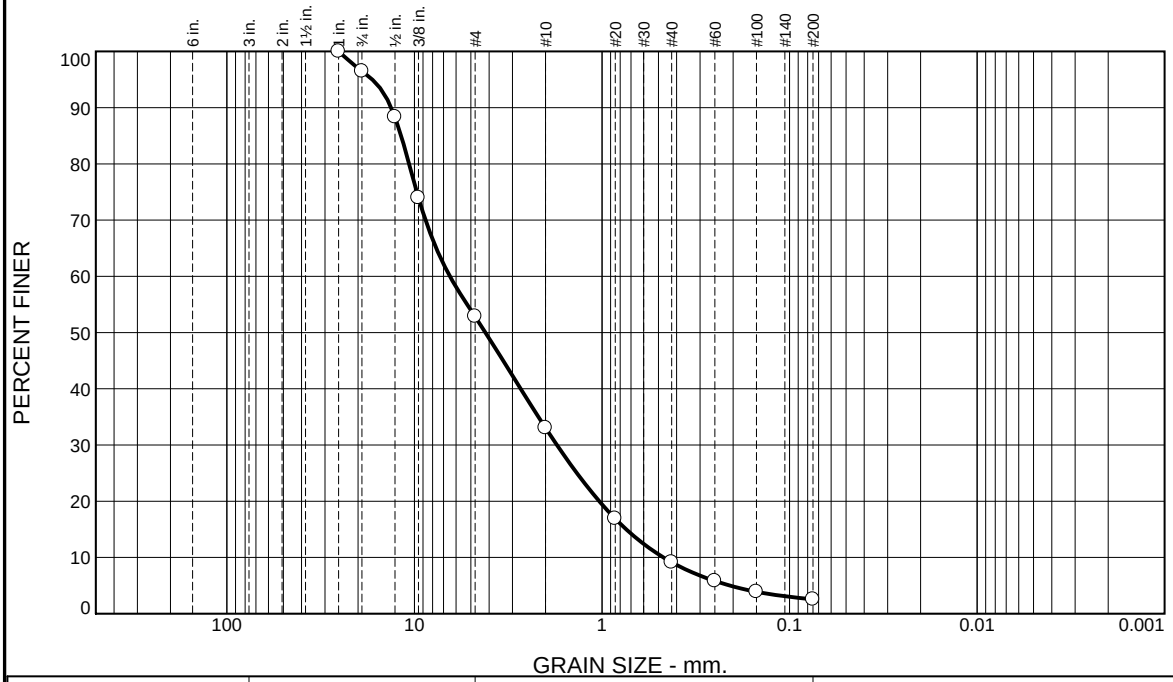
Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f c Gravel, little Silt

Reviewed By _____

01.14.2019

Proposal No. 609211-132091
A00840 - 151

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	43.7	19.8	23.9	6.6	2.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.5		
0.5"	88.3		
0.375"	74.0		
#4	52.8		
#10	33.0		
#20	16.9		
#40	9.1		
#60	5.8		
#100	3.9		
#200	2.5		

* (no specification provided)

Material Description

Brown f-c SAND and fine GRAVEL, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 13.2913 D_{85}= 11.7790 D_{60}= 6.4677
D_{50}= 4.1824 D_{30}= 1.7381 D_{15}= 0.7425
D_{10}= 0.4702 C_u= 13.75 C_c= 0.99

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 7

Thielsch Engineering Inc.

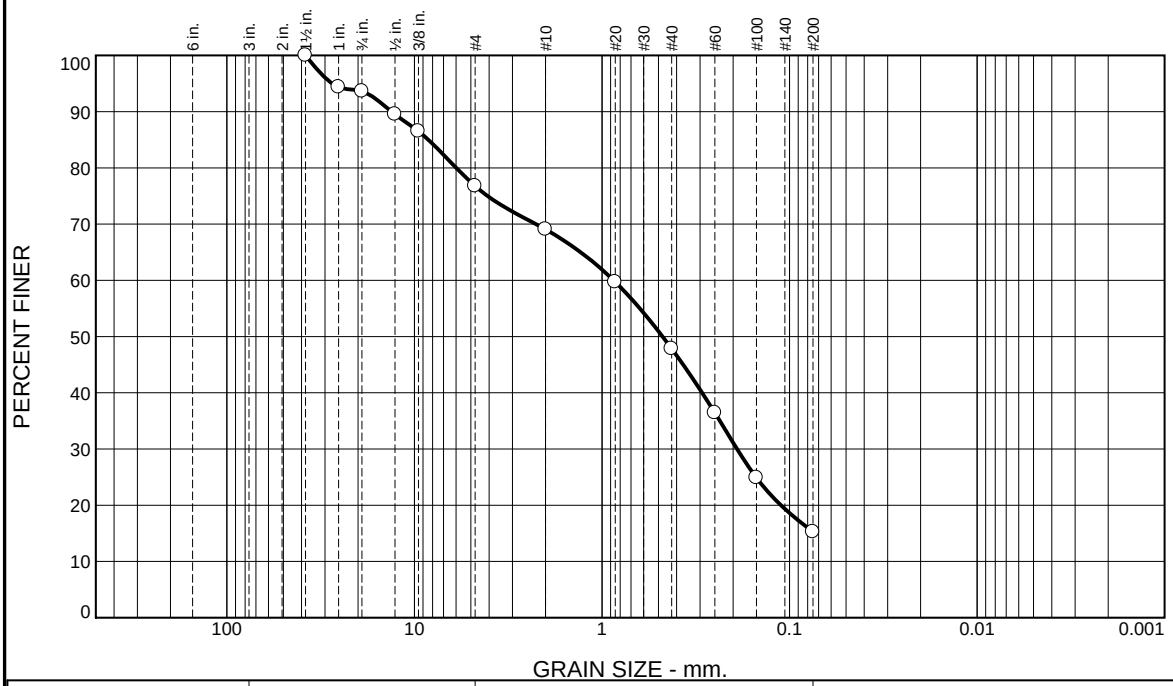
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.4	16.8	7.7	21.3	32.5	15.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	94.4		
0.75"	93.6		
0.5"	89.5		
0.375"	86.5		
#4	76.8		
#10	69.1		
#20	59.7		
#40	47.8		
#60	36.4		
#100	24.9		
#200	15.3		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 13.2491 D_{85}= 8.4302 D_{60}= 0.8673
D_{50}= 0.4754 D_{30}= 0.1904 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 8

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-8

ATTACHMENT D: SCOUR/STABILITY ANALYSES

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

U.S. Department of Transportation
Federal Highway Administration

Hydraulic Engineering Circular No. 14 - Estimating Scour at Culvert Outlets

5.1 COHESIONLESS SOILS

The general expression for determining scour geometry in a cohesionless soil at the culvert outlet is:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Input:

Q (cfs)	277
Slope	0.042
Time (min)	30
Dia (ft)	5.97
R_c *(ft)*	1.49
g (ft/s^2)	32.2
D_{84}	11.779
D_{16}	0.7425
σ	3.98

Output:

Depth, h_s *(ft)*	5.89
Width, W_s *(ft)*	32.00
Length, L_s *(ft)*	57.82
Volume, V_s (ft^3)	8133.98
Location of maximum scour ($L_m = 0.4L_s$) *(ft)*	23.13

Table 5.1. Coefficients for Culvert Outlet Scour in Cohesionless Soils

	α	β	θ
Depth, h_S	2.27	0.39	0.06
Width, W_S	6.94	0.53	0.08
Length, L_S	17.10	0.47	0.10
Volume, V_S	127.08	1.24	0.18

Table 5.2. Coefficient C_h for Outlets above the Bed

H_d[1]	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
1	1.22	1.51	0.73	1.28
2	1.26	1.54	0.73	1.47
4	1.34	1.66	0.73	1.55

[1] H_d is the height above bed in pipe diameters.

Table 5.3. Coefficient C_s for Culvert Slope

Slope %	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
2	1.03	1.28	1.17	1.30
5	1.08	1.28	1.17	1.30
>7	1.12	1.28	1.17	1.30

*Soil data taken from Geotechnical Report prepared by Gza GeoEnvironmental, Inc. on April 19, 2021.

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

U.S. Department of Transportation
Federal Highway Administration

Hydraulic Engineering Circular No. 14 - Estimating Scour at Culvert Outlets

5.1 COHESIONLESS SOILS

The general expression for determining scour geometry in a cohesionless soil at the culvert outlet is:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Input:

Q (cfs)	134
Slope	0.008
Time (min)	30
Dia (ft)	5.53
R_c *(ft)*	1.38
g *(ft/s²)*	32.2
D_{84}	8.4302
D_{16}	0.75
σ	3.35

Output:

Depth, h_s *(ft)*	4.69
Width, W_s *(ft)*	23.64
Length, L_s *(ft)*	44.11
Volume, V_s (ft^3)	3527.78
Location of maximum scour ($L_m = 0.4L_s$) *(ft)*	17.65

Table 5.1. Coefficients for Culvert Outlet Scour in Cohesionless Soils

	α	β	θ
Depth, h_S	2.27	0.39	0.06
Width, W_S	6.94	0.53	0.08
Length, L_S	17.10	0.47	0.10
Volume, V_S	127.08	1.24	0.18

Table 5.2. Coefficient C_h for Outlets above the Bed

H_d[1]	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
1	1.22	1.51	0.73	1.28
2	1.26	1.54	0.73	1.47
4	1.34	1.66	0.73	1.55

[1] H_d is the height above bed in pipe diameters.

Table 5.3. Coefficient C_s for Culvert Slope

Slope %	Depth	Width	Length	Volume
0	1.00	1.00	1.00	1.00
2	1.03	1.28	1.17	1.30
5	1.08	1.28	1.17	1.30
>7	1.12	1.28	1.17	1.30

*Soil data taken from Geotechnical Report prepared by Gza GeoEnvironmental, Inc. on April 19, 2021.

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft		
g=	32.2	ft/s^2		
Q=	277	cfs		
TW=	0.9	ft		
D_{50}=	0.61	ft		
	7.36	in		
	186.90	mm	Use Class 3	Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length=	4.00 x	5.97	
	24 ft		
Apron Depth=	3.30 x	0.61	
	2.0 ft		
Apron Width=	34 ft		
(Figure 10.4)			

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft	
g=	32.2	ft/s^2	
Q=	134	cfs	
TW=	1	ft	
D_{50}=	0.21	ft	
	2.51	in	
	63.88	mm	Use Class 3 Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length= 4.00 x 5.97 = 24 ft

Apron Depth= 3.50 x 0.21 = 1 ft

Apron Width= 34 ft (Figure 10.4)

HYDRAULIC AND SCOUR REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Bridge No. TBD

Prepared for

Massachusetts Department of Transportation

February 2021

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1
1.1 Purpose 1
1.2 Scope of Work 1
2.0 PROJECT DESCRIPTION 1
2.1 Existing Conditions 1
2.2 Proposed Conditions 2
3.0 DATA COLLECTION 2
4.0 ENGINEERING METHODS 3
4.1 Hydrologic Analysis 3
4.2 Duplicate Effective Analysis 4
4.3 Hydraulic Analysis 4
4.4 Scour Safety/Stability Analyses 6
5.0 CONCLUSIONS 9
6.0 REFERENCES 10
6.1 Federal Emergency Management Agency, Flood Insurance Study, Essex County, Massachusetts, July 19, 2018. 10
6.2 Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976. 10
6.3 Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019 10

TABLES

Table 4.1 – Summary of Discharges from 2018 Essex County FIS 3
Table 4.2 – Summary of Duplicate Effective Analysis 4
Table 4.3 – Comparison of FEMA, Existing and Proposed Base Flood Elevations (BFE - referenced to NAVD 88) at several cross sections near the Bridge 5
Table 4.4 – Summary of Hydraulic Performance at the Bridge 6
Table 4.5 – Summary of Calculated Scour at Bridge 7
Table 4.6 – Abutment Scour Depths at Bridge 8
Table 5.1 – Hydraulic Data 9

FIGURES

Figure 1: Locus Map
Figure 2: Existing Conditions
Figure 3: Drainage Area
Figure 4: FEMA Flood Insurance Rate Map - Peabody, MA
Figure 5: Cross-Section Locations Plan
Figure 6: Independence Greenway Extension - Elevation View

ATTACHMENTS

ATTACHMENT A: EXISTING CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS
ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS
ATTACHMENT C: 1977 HEC-2 MODEL INPUT/OUTPUT 1977 HEC-2 MODEL INPUT/OUTPUT AND RESULTANT HEC-RAS SUMMARY TABLE AND PLOT
ATTACHMENT D: SCOUR/STABILITY ANALYSES

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for the Independence Greenway Extension, Bridge No. TBD, a pedestrian bridge over the Proctor Brook in Peabody, Massachusetts. This study evaluates the hydraulic performance of the existing and proposed conditions. This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the bridge; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations. Lastly, Section 6 outlines the references.

This project involves the construction of a timber boardwalk on helical piles that will cross over Proctor Brook in the City of Peabody, Massachusetts. There was a previous bridge structure that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the bridge, and the bridge structure has been washed away over time. The purpose of this report is to present the results of a study conducted at the subject bridge site to evaluate the hydraulic performance of the proposed alternative for this crossing.

The scope of this investigation consisted of review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

2.1 Existing Conditions

A railroad, now abandoned, once crossed Proctor Brook in the city of Peabody, Essex County, Massachusetts (Figure 1).

Scattered blocks of granite in the channel and remnants of stone wingwalls are the only indication that a bridge had once been at this location (Figure 2). There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the bridge is currently wooded and includes Bordering Vegetated Wetlands.

Crossed Waterway at the Bridge Location

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject location is within a NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

2.2 Proposed Conditions

The design loading criteria will be pedestrian loading only. No vehicular access will be permitted on the trail, and bollards will be installed at roadway intersections and access points to prevent any vehicular access. The boardwalk will not be maintained in the winter for snow removal.

The proposed structure over the brook will be a 64'-0" long timber framed boardwalk with helical piles spaced 8'-0" center-to-center. The proposed boardwalk will have a 13'-0" out-to-out width and 12'-0" clear width to accommodate two (2) 5'-0" travel lanes and two (2) 1'-0" shoulders. 4" x 4" timber posts will be spaced 4'-0" apart with a top rail height of 3'-6" with timber pickets between each post. Top and bottom rails will be 2" x 4" timber boards. The proposed boardwalk will also consist of 8" x 1" timber planking or composite wood decking over 2" x 8" timber joists.

Within this present hydraulic study, the existing and proposed bridge waterway openings were evaluated for hydraulic adequacy and scour safety. More alternative bridge opening geometries will be evaluated at the request of the State Bridge Engineer.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019.
- Massachusetts Department of Transportation: LRFD Bridge Manual, January 2020 Revision.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 18 Evaluating Scour at Bridges, Fifth Edition, April 2012.

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the bridge have been analyzed to ensure that existing flood elevations will not increase under proposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Proctor Brook flows west to east in the vicinity of the crossing. Using the U.S. Geological Survey (USGS) Massachusetts StreamStats, the Proctor Brook's watershed basin area at the crossing site is estimated to be 2.5 square miles (Figure 3). Figure 4 shows the project location in the flood insurance rate map.

In this hydraulic and scour report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. The brook's drainage area at the Proctor Brook crossing was delineated using the USGS StreamStats Website. Refer to Figure 3 for drainage area at the bridge.

Table 4.1 – Summary of Discharges from 2018 Essex County FIS

Description	Drainage Area (mi^2)	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River and Proctor Brook Upstream of Goldthwait Brook	3.52	240	285	360	420	610

4.2 Duplicate Effective Analysis

The Duplicate Effective HEC-RAS Model was developed using the HEC-2 model obtained from FEMA. The HEC-2 inputs between FIS cross sections at river sta. 1.402 upstream of the bridge to river sta. 1.127 downstream of the bridge were imported into HEC-RAS. After making minor edits, Green was able to run the imported HEC-2 data in HEC-RAS. The duplicate effective model reproduced relatively close values that are less than 1 ft for the cross sections near the bridge when compared to the current effective Base Flood Elevation (BFE) profile. The variation in BFE is attributed to using different hydraulic programs. The summary of the WSEL's from FIS is presented in Table 4.2.

Table 4.2 – Summary of Duplicate Effective Analysis

River Station HEC-RAS/HEC-2	FIS Cross-Section	[1] Published Data* (FEET, NAVD)	[2] Duplicate Effective Model (FEET, NAVD)	[2] – [1]
26/1.402	F	41.96	41.33	-0.63
25/1.393	-	41.95	41.28	-0.67
24/1.389	-	40.97	41.12	0.15
23/1.380	-	40.99	41.14	0.15
22/1.276	E	40.84	40.97	0.13
21/1.267	-	39.85	40.46	0.61
21.5	Bridge			
20/1.263	-	39.65	39.85	0.20
19/1.254	-	39.40	39.20	-0.20
18/1.127	D	39.60	39.60	0.00

4.3 Hydraulic Analysis

Green used the topographical survey to create an existing conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA, and Green's existing and proposed conditions HEC-RAS models.

The HEC-RAS model parameters such as channel and overbank roughness coefficients (Manning's 'n'), ineffective flow areas, bank stations, and expansion and contraction coefficients were modified to reflect current conditions. Pertinent computational results of the existing and proposed conditions flood simulations performed for the subject bridge in this project hydraulic study are presented in Table 4.3. The table show a comparison between the results of Green's model using the HEC-2 data received from

FEMA, Green's existing model built with the recent topographic survey, and the proposed post construction model. Figure 5 shows the cross sections locations.

Table 4.3 – Comparison of FEMA, Existing and Proposed Base Flood Elevations (BFE - referenced to NAVD 88) at several cross sections near the Bridge

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Existing Condition Model (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
26	F	41.97	41.69	-0.28
25	-	41.97	41.69	-0.28
24.7	-	41.77	41.45	-0.32
24.6	-	41.73	41.46	-0.27
24.4	-	40.41	40.29	-0.12
24.3	-	40.09	40.06	-0.03
24	-	40.38	40.36	-0.02
23	-	40.32	40.29	-0.03
22	E	40.19	40.19	0.00
21.7	-	40.07	40.06	-0.01
21.6	-	40.10	40.10	0.00
21.5	Bridge			
21.4	-	39.89	39.84	-0.05
21.35	-	39.77	39.76	-0.01
21.3	-	39.86	39.85	-0.01
20	-	39.62	39.62	0.00
19	-	39.67	39.67	0.00
18	D	39.60	39.60	0.00

As shown in Tables 4.2 and 4.3, there are variations in the elevations obtained from the existing conditions Green's HEC-RAS model compared to the HEC-2 Imported HEC-RAS model, the FEMA FIS flood elevations. The variations in flood elevations can be explained and justified due to the following reasons:

- Different hydraulic programs were used, and the HEC-2 coding of the bridge is different than its coding in HEC-RAS.
- Ineffective areas were added and modified to ignore ineffective flow areas.
- More cross sections are added in the HEC-RAS model to depict the geometry of the channel and riverbed.
- Based on site observations, the manning (n) coefficients were adjusted to reflect actual conditions.

Because of the above, Green's HEC-RAS model under existing conditions was used as a design base to compare flood elevations under the proposed conditions.

Table 4.4 compares Hydraulic Performance at the Bridge under existing and proposed conditions. The peak head water elevations and the maximum velocity for each return event at the bridge location are shown in the table.

Table 4.4 – Summary of Hydraulic Performance at the Bridge

AEP [%]	Peak Flow (CFS)	Existing		Proposed	
		WSEL (FT) Sta. 22 FEMA Sta. E	Velocity* (FT/S) (Max. at Bridge)	WSEL (FT) Sta. 22 FEMA Sta. E	Velocity* (FT/S) (Max. at Bridge)
10%	240	39.25	5.90	39.33	5.97
4%	285	39.44	6.14	39.53	6.25
2%	360	39.73	6.58	39.82	6.59
1%	420	40.19	3.97	40.19	4.34
0.2%	610	40.95	3.83	40.88	5.01

As shown in Table 4.4, the proposed bridge will not have an increase in the Water Surface Elevation (WSEL) at the upstream face of the bridge for the FEMA Base Flood Elevation.

Note that the velocities decrease for the 100-year and 500-year storms as compared to the more frequent storms. The 100-year and 500-year storms are approaching a backwater condition as demonstrated by a flattening of the energy grade line.

The analysis also shows that the proposed bridge deck is above the 100-year flood elevation and the only components impacting the hydraulics are the western abutment and the piers.

Attachment A includes the output of Green's Existing Conditions HEC-RAS analysis for the Independence Greenway Extension over Proctor Brook. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed bridge scenario for a new Independence Greenway Extension boardwalk over Proctor Brook. Attachment C includes the 1977 HEC-2 model input/output report received from FEMA Headquarters.

4.4 Scour Safety/Stability Analyses

Scour potential at the crossing site under proposed conditions was analyzed using the guidelines set forth in Reference 4, Sections 1.3 and 3.2.9 and AASHTO LRFD Bridge Design Specifications, Sections 2.6.4.4.2 and 3.7.S. In accordance with Section 1.3.4 of Reference 4, we used the river's 25-year and 50-year floods as the scour design and scour check events, respectively, in this analysis. Scour potential under existing conditions was not analyzed because there is no existing structure in place. As said in section 2.1, scattered blocks of granite in the channel and remnants of stone wingwalls are the only indication that a bridge had once been at this location.

Peak 50-year flood discharge used in this analysis was taken from Table 4.1. The peak 25-year flood discharge (285 cfs) was interpolated from 10- and 50-year flood discharge rates presented in the same table and was used as the "Design Scour Event" in the scour analysis.

Soil samples were taken at points within the brook, upstream of the bridge and the banks of the brook. These samples were analyzed, and the results are included in Attachment D. The grain size (D50) was estimated for each soil sample. The D50 results of the samples varied widely from 0.51 to 2.78 mm from left of bank to right of bank, which were used in the scour analysis.

The scour/stability analyses for the 25- and 50-year floods were performed using the equations from FHWA Hydraulic Engineering Circular No. 18 (HEC-18), Evaluation Scour at Bridges. Calculations to determine scour potential were performed according to HEC-18 live-bed equation for the bridge types associated with existing and proposed conditions.

The local scour was calculated for the piers using the HEC-18 pier scour equations (HEC-18, equations 7.1 – 7.4). The variables are based on the results from the HEC-RAS model for the 25-year storm. The scour calculation was also performed for the 50-year design storm as a check. Pressure scour is not applicable at this bridge because the low chord is above the design storms being considered for these calculations.

The results of the scour analyses are shown on Table 4.5.

Table 4.5 – Summary of Calculated Scour at Bridge

Alternative	Return Frequency (year)	[1] Contraction Scour (Feet)	[2] Maximum Local Pier Scour (Feet)	[3]* Long Term Degradation (Feet)	[4] Abutment Scour (Feet)	[3] + [4] Design Total Abutment Scour (Feet)	[1] + [2] + [3] Design Total Pier Scour (Feet)
Existing Condition	Design 25-yr	n/a	n/a	n/a	n/a	n/a	n/a
	Check 50-yr	n/a	n/a	n/a	n/a	n/a	n/a
Proposed Condition	Design 25-yr	0.0	1.17	n/a	1.95	1.95	1.17
	Check 50-yr	0.0	1.22	n/a	2.28	2.28	1.22

*Long Term Degradation Calculations were not computed for this bridge

The HEC-RAS method uses the Froelich equation that has been identified by MassDOT as being too conservative in calculating scour at the abutments. Therefore, the abutment scour depths calculated in the HEC-RAS analysis should not be held for design purposes. Instead, the scour depths for the abutments were

computed using the NCHRP 24-40 Abutment Scour Approach in the FHWA HEC-18, Evaluating Scour at Bridges Section 8.6.3 and shown below.

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

The computed abutment scour depths using the above equation are listed below and should be used for design.

Table 4.6 – Abutment Scour Depths at Bridge

Alternative	Return Frequency (year)	Design Abutment Scour (Feet)	Design Pier Scour (Feet)
Existing Condition	Design 25-yr	n/a	n/a
	Check 50-yr	n/a	n/a
Proposed Condition	Design 25-yr	1.95	1.17
	Check 50-yr	2.28	1.22

Scour Countermeasures

The natural stream bed will result in a scour depth at the left abutment of 1.95' during the 25 year design storm. By placing riprap revetment around the abutment it is anticipated that the scour depth will be negligible as shown in Table 4.7. The proposed right abutment is located on the eastern end of the boardwalk and outside of the flow of the channel. For this reason scour protection is not needed at the right abutment.

The calculated contraction, and pier scour depths resulted in a value of less than 1.5 ft. For this reason, scour countermeasures are not required within the main channel, and are only required at the left abutment.

The scour countermeasure design at the left abutment were computed using HEC-23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition, Volume 2, Section 4, Design Guideline 14 and shown below.

Table 4.7 – Summary of Scour Countermeasure Design at Bridge Abutments

Alternative	Riprap Size D_{50} (Inches)	Riprap Size D_{100} (Inches)	Riprap Thickness (Feet)	Riprap Apron Extend from toe (Feet)	Riprap Extend along u/s and d/s face of the Embankment (Feet)	Vertical Extend up Abutment Slope (Feet)
Existing	n/a	n/a	n/a	n/a	n/a	n/a
Proposed (left abutment)	6	12	1	10	25	10
Proposed (right abutment)	n/a	n/a	n/a	n/a	n/a	n/a

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The project hydraulic model indicates that proposed replacement bridge will safely convey the 10-year design flood event.

B. To minimize the environmental impacts of the western approach on the adjacent wetlands, 1.5 ft of freeboard was maintained over the 10-year design flood event. Although this does not meet the recommended 2 feet of freeboard between the hydraulic design flood water surface elevation and the proposed superstructure low chord, we consider that 1.5 ft of freeboard will be appropriate because it is a recreational pedestrian bridge.

C. HEC-RAS models under existing and proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.

D. The natural stream bed will result in a scour depth at the abutment of 1.95' during the 25 year design storm. By placing riprap revetment around the abutment it is anticipated that the scour depth will be negligible.

E. The calculated contraction, and pier scour depths resulted in a value of less than 1.5ft. For that reason, scour countermeasures are only required at the left abutment for this bridge.

F. The information in Table 5.1 should be presented within the Hydraulic Data Tables in the General Notes of the Bridge Sketch Plans.

Table 5.1 – Hydraulic Data

HYDRAULIC DESIGN DATA	
DRAINAGE AREA:	3.52 SQUARE MILES
DESIGN FLOOD DISCHARGE:	240 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	10 YEARS
DESIGN FLOOD VELOCITY:	5.97 FEET PER SECOND
DESIGN FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	39.33 FEET, NAVD 88
BASE (100-YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE:	420 CUBIC FEET PER SECOND
BASE FLOOD ELEVATION AT UPSTREAM OF BRIDGE:	40.19 FEET, NAVD 88

DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	25 YEAR
DESIGN FLOOD ABUTMENT SCOUR DEPTH	1.95 FEET
DESIGN FLOOD PIER SCOUR DEPTH	1.17 FEET
SCOUR CHECK FLOOD EVENT RETURN FREQUENCY:	50 YEAR
CHECK FLOOD ABUTMENT SCOUR DEPTH	2.28 FEET
CHECK FLOOD PIER SCOUR DEPTH	1.22FEET
FLOOD OF RECORD	
DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	UNKNOWN
EVIDENCE OF SCOUR AND EROSION:	UNKNOWN

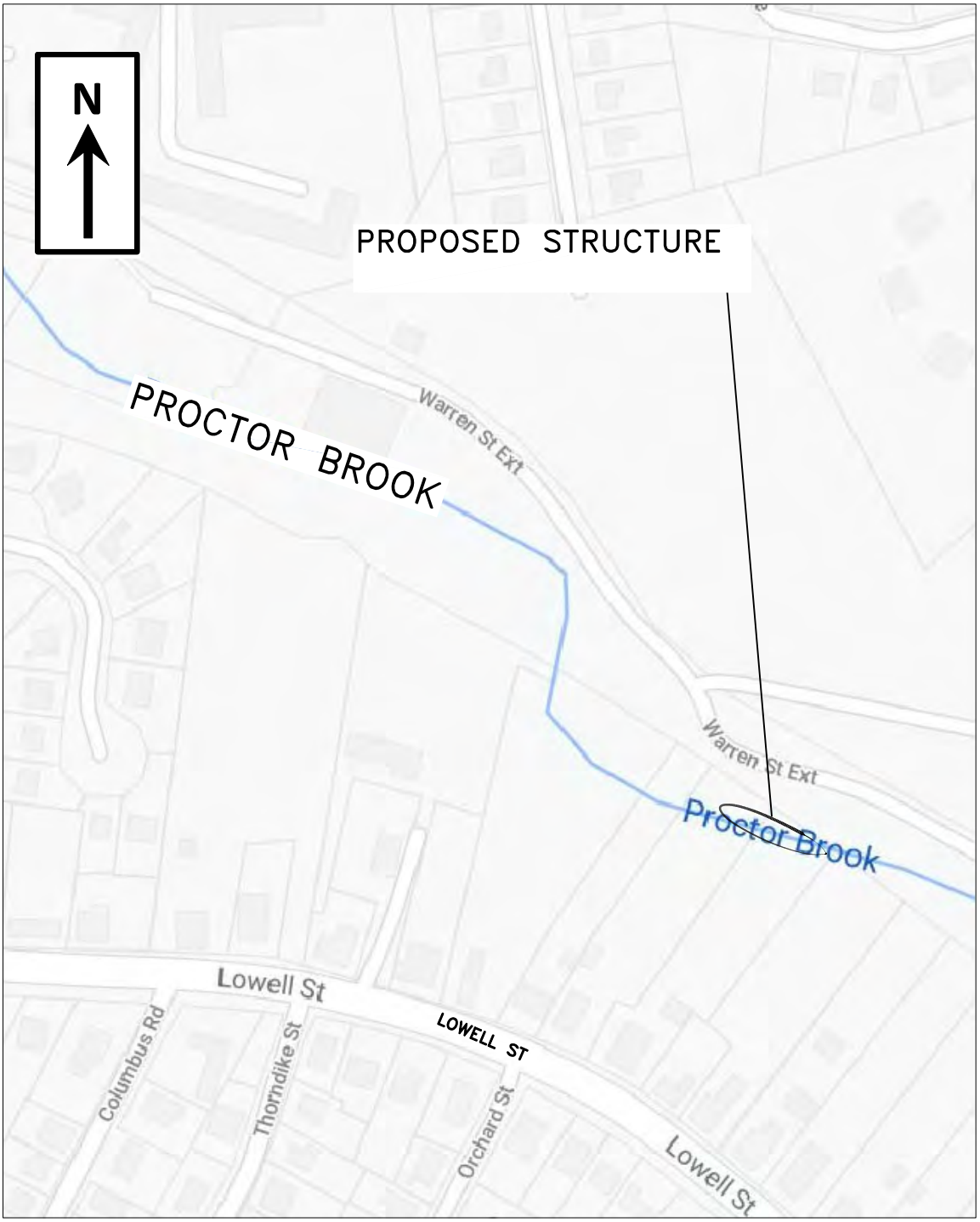
6.0 REFERENCES

6.1 Federal Emergency Management Agency, Flood Insurance Study, Essex County, Massachusetts, July 19, 2018.

6.2 Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.

6.3 Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 22, 2019

FIGURES



GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

PROJECT TITLE:

PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:

FIGURE 1 – LOCUS MAP

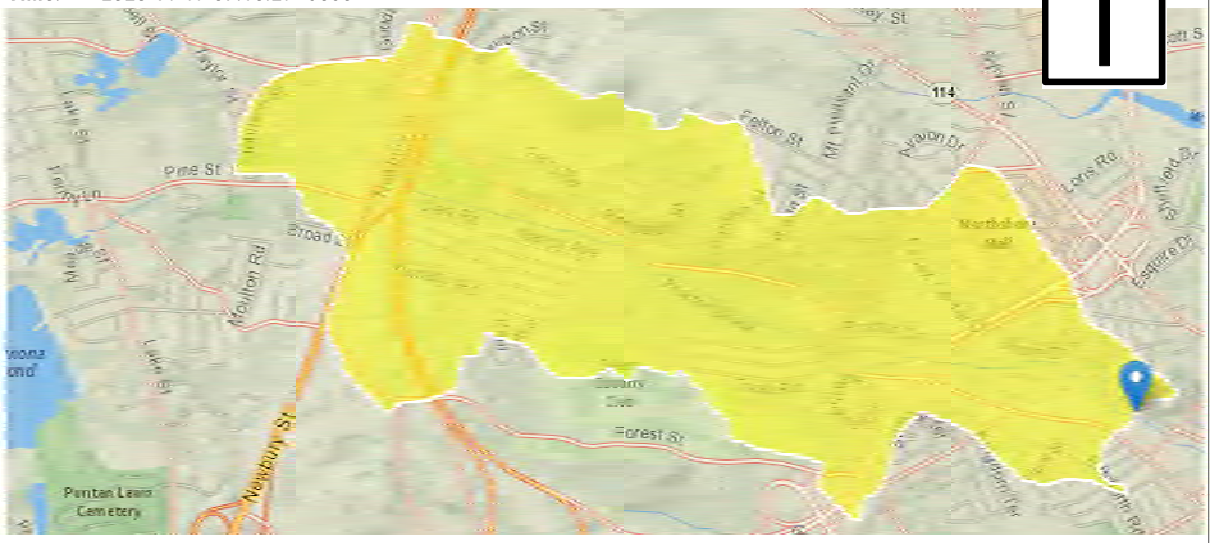
FIGURE 2A: REMNANTS IN CHANNEL

FIGURE 2B: ABANDONED ABUTMENT

GREEN INTERNATIONAL AFFILIATES, INC. *Civil and Structural Engineers*	PROJECT TITLE: PEABODY INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA
GREEN PROJ. NO.: 17118.0XX DATE: OCTOBER, 2020 DESIGNED BY: N/A DRAWN BY: JRM CHECKED BY: SS	DRAWING TITLE: FIGURE 2 – EXISTING CONDITIONS

StreamStats Report

Region ID: MA
Workspace ID: MA20201117121813254000
Clicked Point (Latitude, Longitude): 42.53191, -70.93625
Time: 2020-11-17 07:18:29 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.52	square miles

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.4.0

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

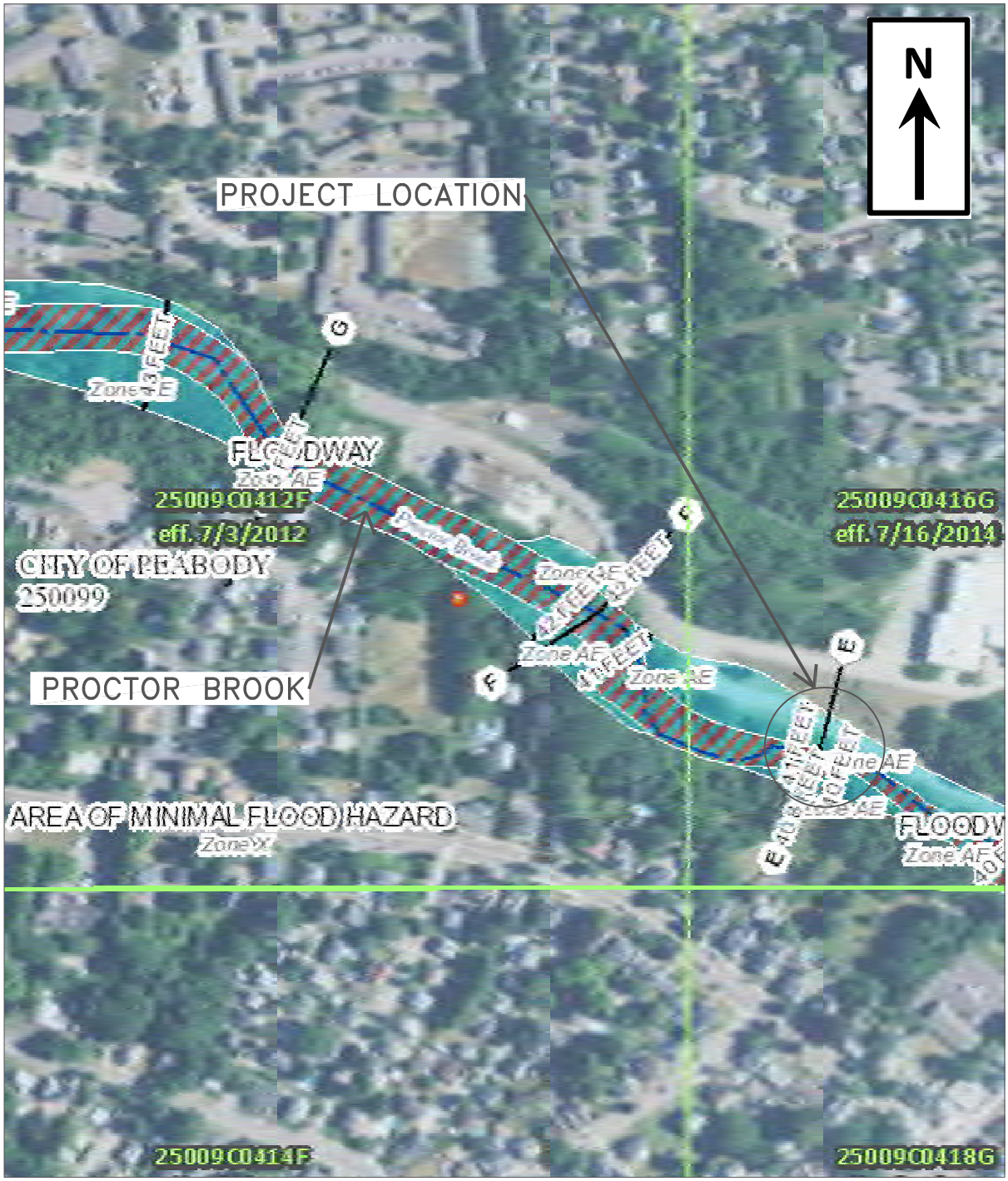
GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

PROJECT TITLE:

PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK – PEABODY, MA

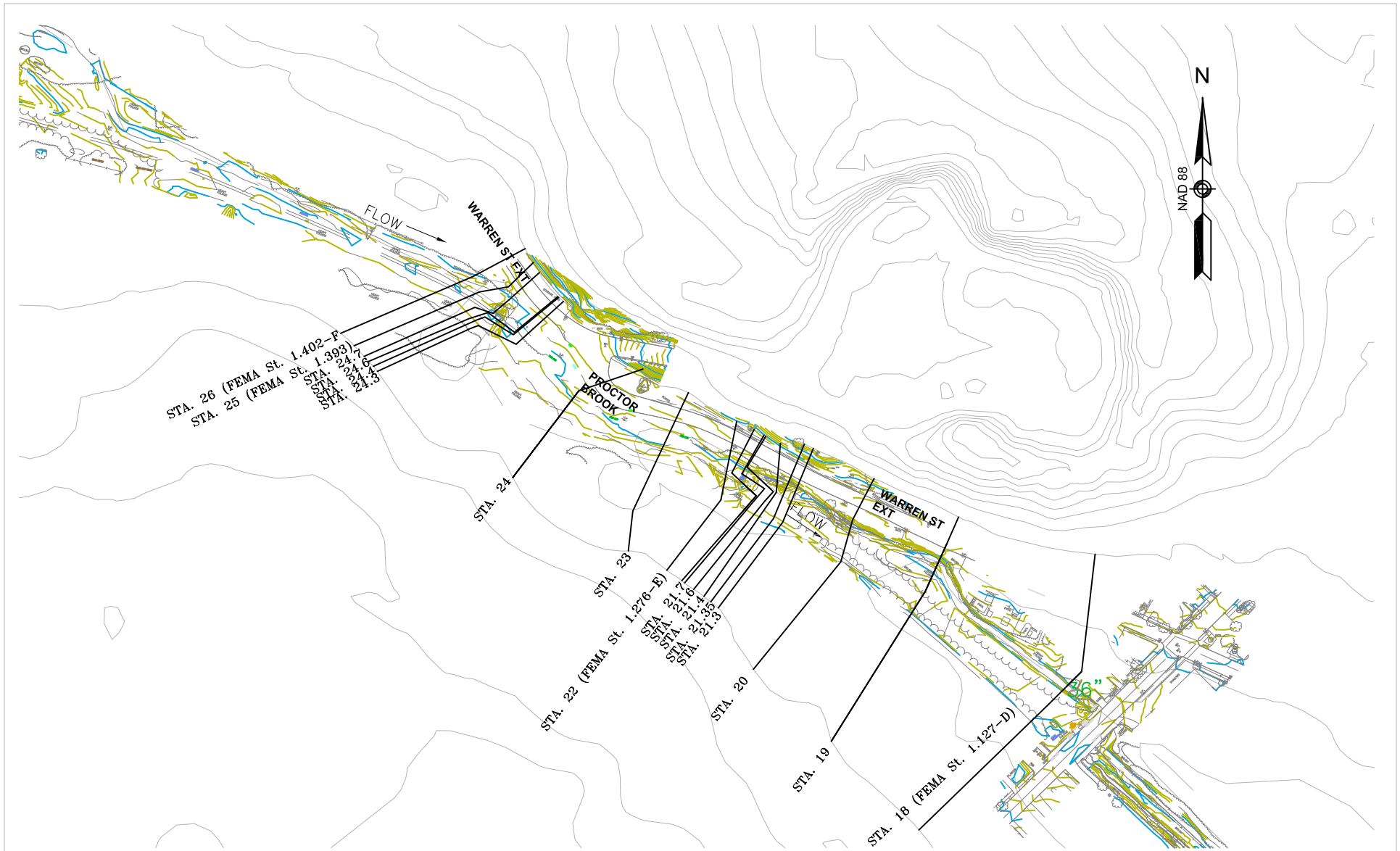
DRAWING TITLE:

FIGURE 3 – DRAINAGE AREA



GREEN INTERNATIONAL AFFILIATES, INC. *Civil and Structural Engineers*	PROJECT TITLE: PEABODY INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA
GREEN PROJ. NO.: 17118.0XX DATE: OCTOBER, 2020 DESIGNED BY: N/A DRAWN BY: JRM CHECKED BY: SS	DRAWING TITLE: FIGURE 4 – FLOOD INSURANCE RATE MAP

Proposal No. 609211-132091



SCALE IN FEET

250' 0 250' 500'

1" = 250'

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.:	17118.0XX
DATE:	OCTOBER, 2020
DESIGNED BY:	N/A
DRAWN BY:	JRM
CHECKED BY:	SS

PROJECT TITLE:

PEABODY

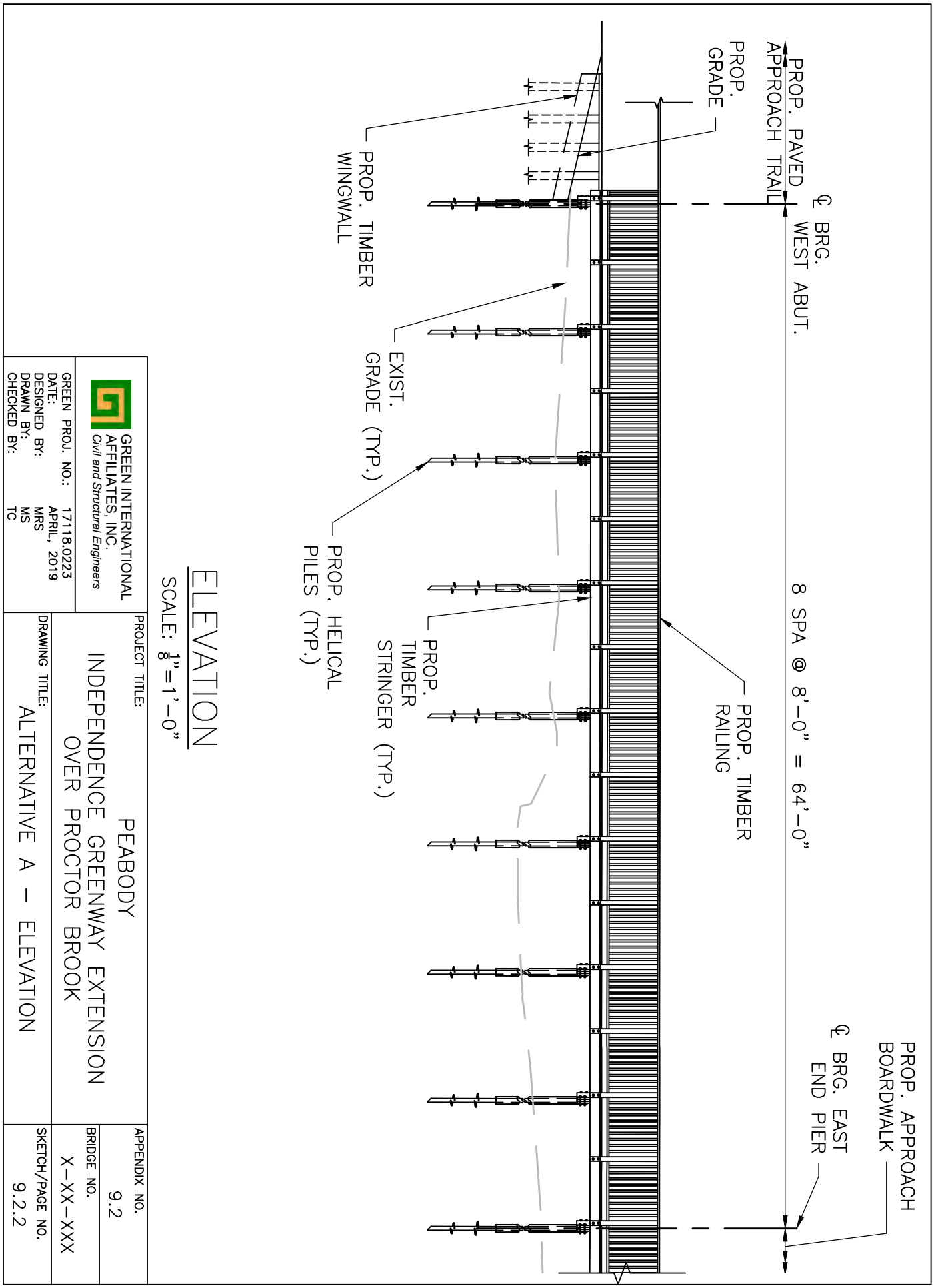
INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK – PEABODY, MA

DRAWING TITLE:

FIGURE 5 – CROSS SECTIONS LOCATIONS

A00840 - 177

FIGURE 6



ELEVATION

SCALE: $\frac{1}{8}$"=1'-0"

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN PROJ. NO.: 17118.0223
DATE: APRIL, 2019
DESIGNED BY: MRS
DRAWN BY: MS
CHECKED BY: TC

PROJECT TITLE:
PEABODY
INDEPENDENCE GREENWAY EXTENSION
OVER PROCTOR BROOK

DRAWING TITLE:
ALTERNATIVE A – ELEVATION

APPENDIX NO. 9.2
BRIDGE NO. X-XX-XXX
SKETCH/PAGE NO. 9.2.2

REFERENCES

REFERENCE 6.1

ESSEX COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

Volume 1 of 4

COMMUNITY NAME	COMMUNITY NUMBER
AMESBURY, CITY OF	250075
ANDOVER, TOWN OF	250076
BEVERLY, CITY OF	250077
BOXFORD, TOWN OF	250078
DANVERS, TOWN OF	250079
ESSEX. TOWN OF	250080
GEORGETOWN, TOWN OF	250081
GLOUCESTER, CITY OF	250082
GROVELAND, TOWN OF	250083
HAMILTON, TOWN OF	250084
HAVERHILL, CITY OF	250085
IPSWICH, TOWN OF	250086
LAWRENCE, CITY OF	250087
LYNN, CITY OF	250088
LYNNFILED, TOWN OF	250089
MANCHESTER BY THE SEA, TOWN OF	250090
MARBLEHEAD, TOWN OF	250091
MERRIMAC, TOWN OF	250092
METHUEN, CITY OF	250093
MIDDLETON, TOWN OF	250094
NAHANT, TOWN OF	250095
NEWBURY, TOWN OF	250096
NEWBURYPORT, CITY OF	250097
NORTH ANDOVER, TOWN OF	250098
PEABODY, CITY OF	250099
ROCKPORT, TOWN OF	250100
ROWLEY, TOWN OF	250101
SALEM, CITY OF	250102
SALISBURY, TOWN OF	250103
SAUGUS, TOWN OF	250104
SWAMPSCOTT, TOWN OF	250105
TOPSFIELD, TOWN OF	250106
WENHAM, TOWN OF	250107
WEST NEWBURY, TOWN OF	250108

REVISION DATE:
JULY 19, 2018

TABLE 6 – SUMMARY OF DISCHARGES-continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
unnamed Tributary downstream of Abandoned dam					
NORTH BEVERLY DRAINAGE DITCH					
Upstream of Boston and Maine Railroad embankment in	1.16	174	253	290	393
NORTH RIVER AND PROCTOR BROOK					
At Salem corporate Limits	9.96	640	990	1,140	1,620
Upstream of Strongwater Brook	8.86	580	880	1,030	1,470
Upstream of Goldthwaite Brook	3.52	240	360	420	610
Upstream of State Route 128	2.52	170	260	310	450
Upstream of Downing Road	2.10	150	240	280	420
150 feet upstream of Downing Road	1.48	140	220	260	380
Downstream of Albert Road	1.22	130	200	230	340
NORTH TRIBUTARY BROOK					
At Pikes Bridge Road	1.35	70	125	150	170
PARKERS RIVER(TOWN OF BOXFORD)					
At downstream Corporate Limits	3.60	170	270	325	460

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
NORTH RIVER								
A	2,212	80	325	3.5	10.0	10.0	11.0	1.0
B	2,841	70	345	3.3	12.4	12.4	12.5	0.1
C	3,326	60	270	3.8	13.6	13.6	14.0	0.4
PROCTOR BROOK								
D	8,152	150	440	1.0	39.6	39.6	39.7	0.1
E	8,939	60	245	1.7	40.8	40.8	40.8	0.0
F	9,604	100	255	1.6	42.0	42.0	42.0	0.0
G	10,344	100	265	1.6	42.5	42.5	42.8	0.3
H	11,436	100	515	0.8	46.9	46.9	46.9	0.0
I	12,862	60	260	1.6	47.1	47.1	47.3	0.2
J	13,306	45	300	1.0	51.4	51.4	52.1	0.7
K	13,712	60	570	0.5	51.5	51.5	52.2	0.7
L	14,404	60	360	0.9	54.9	54.9	55.4	0.5
M	14,837	50	235	1.3	55.1	55.1	55.5	0.4
N	15,808	90	325	0.9	55.2	55.2	55.6	0.4
O	17,778	90	215	1.3	57.1	57.1	57.8	0.7
P	19,626	100	255	1.1	61.4	61.4	61.4	0.0
Q	20,724	100	155	1.7	61.8	61.8	62.0	0.2
R	21,614	65	210	1.1	64.5	64.5	64.5	0.0
S	22,709	50	145	1.6	65.3	65.3	65.3	0.0

[1] FEET ABOVE GROVE STREET

TABLE 12

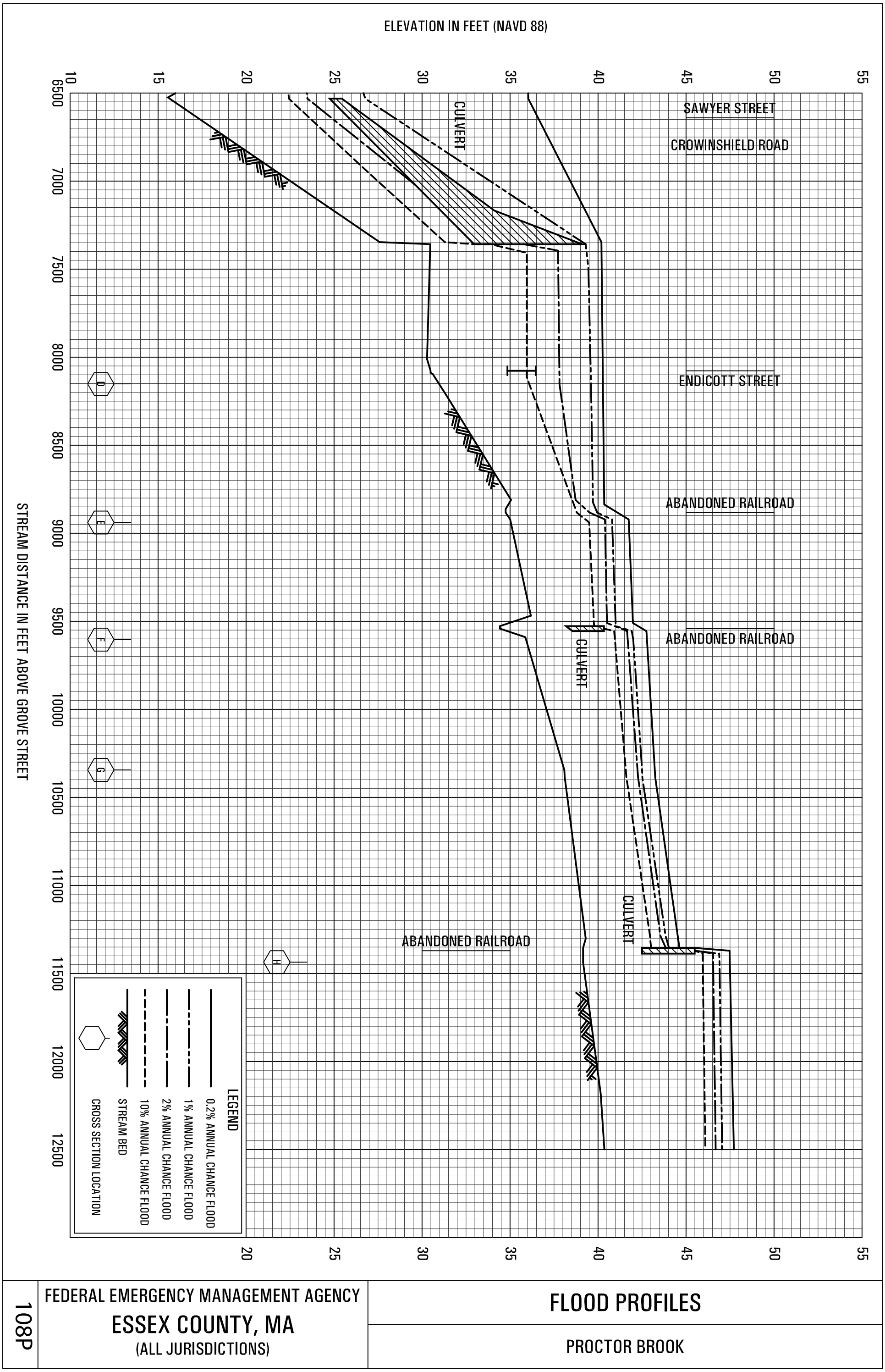
FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

NORTH RIVER AND PROCTOR BROOK

Proposal No. 609211-132091



108P

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA

(ALL JURISDICTIONS)

FLOOD PROFILES

PROCTOR BROOK

REFERENCE 6.2

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

B.W. FINAL

70'

```
**********************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**********************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1  ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
        0.        2.         0.         0.  0.0             0.0        0.0         0.     9.200      0.0
J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
    1.000        0.0     -1.000        0.0        0.0        0.0        0.0        0.0        0.0        0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
     38.000     1.000     2.000     3.000    40.000    41.000    42.000    53.000    21.000     4.000

     22.000    54.000    34.000       0.0    38.000     1.000    39.000    50.000    61.000    51.000

     26.000    43.000    13.000    14.000    15.000    27.000    28.000       0.0       0.0       0.0
QT    9.000   640.000   970.000  1140.000  1620.000  1140.000  1140.000  1140.000  1140.000  1140.000
NC    0.080     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.002    17.000   992.500  1005.500       0.0       0.0       0.0       0.0       0.0       0.0
GR   20.000   625.000    15.000   650.000    10.000   760.000    11.200   949.000    11.200   964.000
GR   10.800   979.500     5.400   992.500     4.200  1000.000     4.600  1005.500     5.300  1008.000
GR    8.300  1011.000     8.700  1025.000     8.700  1040.000     8.700  1055.000     9.500  1082.000
GR   10.000  1140.000    40.000  1140.100       0.0       0.0       0.0       0.0       0.0       0.0
NC    0.075     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.056    12.000   994.000  1006.000   340.000   285.000   285.000       0.0       0.0       0.0
GR   20.000   570.000    15.000   630.000    10.000   730.000    10.000   905.000     5.000   980.000
GR    4.800   994.000     4.600  1000.000     4.800  1006.000     5.000  1010.000    10.200  1035.000
GR   10.500  1090.000    40.000  1090.100       0.0       0.0       0.0       0.0       0.0       0.0
NC    0.050     0.050     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.056    10.000   994.000  1006.000     1.000     1.000     1.000       0.0       0.0       0.0
GR   40.000   950.000    10.000   950.100     5.000   980.000     4.800   994.000     4.600  1000.000
GR    4.800  1006.000     5.000  1010.000    10.200  1035.000    10.500  1090.000    40.000  1090.100
NC    0.040     0.045     0.040     0.300     0.500       0.0       0.0       0.0       0.0       0.0
ET      0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1    0.069    15.000   985.700  1014.700    70.000    70.000    69.000       0.0       0.0       0.0
```

Proposal No. 609211-132091

A00840 - 184

Proposal No. 609211-132091

THIS RUN EXECUTED 11/13/78 19.11.46

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**************************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SALEM CORPORATE LIMIT TO

SUMMARY PRINTOUT

	SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
A	0.002	9.20	8.94	10.03	0.0	0.0	4.20	983.35	992.50	88.52	1005.50	1071.87	79.06
	0.002	10.30	0.0	10.84	0.0	0.0	4.20	753.40	992.50	213.15	1005.50	1140.00	150.74
	0.002	10.80	0.0	11.19	0.0	0.0	4.20	742.40	992.50	304.10	1005.50	1140.00	206.11
	0.002	12.40	0.0	12.50	0.0	0.0	4.20	707.20	992.50	432.81	1005.50	1140.01	536.65
	0.056	10.44	0.0	10.48	0.0	0.0	4.60	721.20	994.00	357.83	1006.00	1079.03	280.90
	0.056	11.19	0.0	11.24	0.0	0.0	4.60	706.25	994.00	383.75	1006.00	1090.00	421.35
	0.056	11.50	0.0	11.54	0.0	0.0	4.60	700.06	994.00	389.94	1006.00	1090.00	492.98
	0.056	12.65	0.0	12.69	0.0	0.0	4.60	676.98	994.00	413.02	1006.00	1090.01	821.60
	0.056	10.42	0.0	10.49	0.0	0.0	4.60	950.10	994.00	125.65	1006.00	1075.75	268.06
	0.056	11.15	0.0	11.25	0.0	0.0	4.60	950.10	994.00	139.91	1006.00	1090.00	361.64
	0.056	11.45	0.0	11.56	0.0	0.0	4.60	950.10	994.00	139.91	1006.00	1090.00	405.70
	0.056	12.59	0.0	12.71	0.0	0.0	4.60	950.09	994.00	139.92	1006.00	1090.01	601.63
	0.069	10.43	0.0	10.58	0.0	0.0	4.30	940.10	985.70	126.47	1014.70	1066.57	208.38
	0.069	11.17	0.0	11.35	0.0	0.0	4.30	940.10	985.70	159.90	1014.70	1100.00	295.57
	0.069	11.48	0.0	11.67	0.0	0.0	4.30	940.10	985.70	159.91	1014.70	1100.00	341.11
	0.069	12.62	0.0	12.79	0.0	0.0	4.30	940.09	985.70	159.91	1014.70	1100.01	555.46
	0.079	11.10	0.0	11.30	10.30	8.90	4.50	986.50	986.60	73.50	1014.50	1060.00	205.15
	0.079	11.91	0.0	12.19	10.30	8.90	4.50	986.50	986.60	73.51	1014.50	1060.00	276.53
	0.079	12.25	0.0	12.57	10.30	8.90	4.50	986.50	986.60	73.51	1014.50	1060.01	310.45
	0.079	13.28	0.0	13.67	10.30	8.90	4.50	986.49	986.60	73.52	1014.50	1060.01	426.23
	0.088	11.18	0.0	11.37	0.0	0.0	5.50	984.00	984.00	86.10	1011.00	1070.10	148.24
	0.088	12.05	0.0	12.28	0.0	0.0	5.50	984.00	984.00	86.10	1011.00	1070.10	211.33
	0.088	12.40	0.0	12.67	0.0	0.0	5.50	983.98	984.00	86.12	1011.00	1070.10	255.50
	0.088	13.48	0.0	13.78	0.0	0.0	5.50	983.98	984.00	86.12	1011.00	1070.10	371.15
	0.106	11.34	0.0	11.59	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	136.73
	0.106	12.29	0.0	12.54	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	168.88
	0.106	12.69	0.0	12.94	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	173.18
	0.106	13.75	0.0	14.07	9.90	12.90	5.50	984.00	984.00	86.10	1011.00	1070.10	226.79
B	0.121	11.51	0.0	11.69	0.0	0.0	3.80	988.59	994.00	75.41	1006.00	1064.00	200.13
	0.121	12.44	0.0	12.67	0.0	0.0	3.80	988.59	994.00	75.42	1006.00	1064.01	282.47
	0.121	12.83	0.0	13.09	0.0	0.0	3.80	988.58	994.00	75.42	1006.00	1064.01	321.59
	0.121	13.91	0.0	14.24	0.0	0.0	3.80	988.58	994.00	75.43	1006.00	1064.01	443.21

A00840 - 185

SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
0.121	11.64	0.0	11.71	0.0	0.0	3.80	890.40	994.00	173.60	1006.00	1064.00	296.34
0.121	12.62	0.0	12.69	0.0	0.0	3.80	872.75	994.00	191.26	1006.00	1064.01	452.55
0.121	13.04	0.0	13.11	0.0	0.0	3.80	865.21	994.00	198.80	1006.00	1064.01	530.58
0.121	14.19	0.0	14.26	0.0	0.0	3.80	844.60	994.00	219.41	1006.00	1064.01	778.52
0.127	11.67	0.0	11.72	0.0	0.0	4.10	900.18	992.30	143.82	1007.80	1044.00	366.52
0.127	12.64	0.0	12.70	0.0	0.0	4.10	867.77	992.30	176.24	1007.80	1044.01	514.40
0.127	13.05	0.0	13.12	0.0	0.0	4.10	853.92	992.30	190.09	1007.80	1044.01	589.49
0.127	14.20	0.0	14.27	0.0	0.0	4.10	816.32	992.30	227.69	1007.80	1044.01	832.55
0.135	12.29	0.0	12.37	9.80	8.30	3.80	857.17	992.60	162.84	1007.40	1020.01	318.13
0.135	13.51	0.0	13.58	9.80	8.30	3.80	815.72	992.60	204.29	1007.40	1020.01	509.22
0.135	14.06	0.0	14.13	9.80	8.30	3.80	796.92	992.60	223.09	1007.40	1020.01	617.94
0.135	15.54	0.0	15.60	9.80	8.30	3.80	756.89	992.60	263.12	1007.40	1020.02	998.89
0.144	12.30	0.0	12.40	0.0	0.0	5.20	869.26	994.00	160.74	1006.00	1030.01	244.99
0.144	13.52	0.0	13.61	0.0	0.0	5.20	826.59	994.00	203.42	1006.00	1030.01	413.01
0.144	14.08	0.0	14.15	0.0	0.0	5.20	807.24	994.00	222.77	1006.00	1030.01	509.64
0.144	15.55	0.0	15.61	0.0	0.0	5.20	765.54	994.00	264.48	1006.00	1030.02	852.14
0.165	12.36	0.0	12.49	0.0	0.0	5.50	897.48	994.00	122.52	1006.00	1020.00	199.66
0.165	13.57	0.0	13.69	0.0	0.0	5.50	875.67	994.00	144.34	1006.00	1020.01	328.16
0.165	14.12	0.0	14.23	0.0	0.0	5.50	865.79	994.00	154.22	1006.00	1020.01	399.50
0.165	15.57	0.0	15.67	0.0	0.0	5.50	829.08	994.00	190.94	1006.00	1020.02	638.98
0.165	12.40	0.0	12.50	0.0	0.0	5.50	908.85	994.00	111.16	1006.00	1020.01	225.69
0.165	13.59	0.0	13.69	0.0	0.0	5.50	893.29	994.00	126.72	1006.00	1020.01	369.83
0.165	14.14	0.0	14.23	0.0	0.0	5.50	886.37	994.00	133.64	1006.00	1020.01	447.48
0.165	15.58	0.0	15.67	0.0	0.0	5.50	875.00	994.00	145.02	1006.00	1020.02	709.44
0.187	12.45	0.0	12.66	0.0	0.0	5.90	940.10	994.00	121.78	1006.00	1061.88	145.57
0.187	13.67	0.0	13.81	0.0	0.0	5.90	940.09	994.00	180.51	1006.00	1120.61	266.45
0.187	14.22	0.0	14.34	0.0	0.0	5.90	940.09	994.00	207.41	1006.00	1147.50	345.10
0.187	15.68	0.0	15.75	0.0	0.0	5.90	940.09	994.00	244.91	1006.00	1185.00	647.71
0.213	12.65	0.0	12.95	0.0	0.0	6.30	938.10	994.00	102.03	1006.00	1041.52	122.34
0.213	13.80	0.0	14.03	0.0	0.0	6.30	938.09	994.00	139.10	1006.00	1077.19	217.13
0.213	14.33	0.0	14.52	0.0	0.0	6.30	938.09	994.00	146.91	1006.00	1085.00	279.01
0.213	15.73	0.0	15.87	0.0	0.0	6.30	938.09	994.00	146.92	1006.00	1085.01	494.55
0.222	12.83	0.0	13.05	0.0	0.0	6.90	930.10	992.00	78.00	1008.00	1008.10	145.27
0.222	13.88	0.0	14.11	0.0	0.0	6.90	930.10	992.00	135.44	1008.00	1065.54	223.66
0.222	14.38	0.0	14.59	0.0	0.0	6.90	930.09	992.00	144.91	1008.00	1075.00	279.01
0.222	15.76	0.0	15.92	0.0	0.0	6.90	930.09	992.00	144.92	1008.00	1075.01	478.94
0.222	12.85	0.0	13.05	0.0	0.0	6.90	930.10	992.00	78.00	1008.00	1008.10	148.86
0.222	13.88	0.0	14.11	0.0	0.0	6.90	930.10	992.00	108.84	1008.00	1038.94	224.93
0.222	14.37	0.0	14.60	0.0	0.0	6.90	930.09	992.00	127.76	1008.00	1057.85	272.89
0.222	15.75	0.0	15.94	0.0	0.0	6.90	930.09	992.00	165.30	1008.00	1095.39	447.15
0.231	13.43	0.0	13.60	12.40	12.00	7.20	930.10	992.00	79.12	1008.00	1009.21	167.71
0.231	14.26	0.0	14.48	12.40	12.00	7.20	930.09	992.00	112.82	1008.00	1042.91	231.93
0.231	14.63	0.0	14.87	12.40	12.00	7.20	930.09	992.00	126.42	1008.00	1056.52	267.95
0.231	15.92	0.0	16.13	12.40	12.00	7.20	930.09	992.00	161.59	1008.00	1091.68	426.75

Proposal No. 609211-132091

A00840 - 186

SECNO	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.02	996.00	35.45	1006.00	1018.47	73.95
1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	210.71
1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

D

E

F

Proposal No. 609211-132091

A00840 - 187

REFERENCE 6.3

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

for

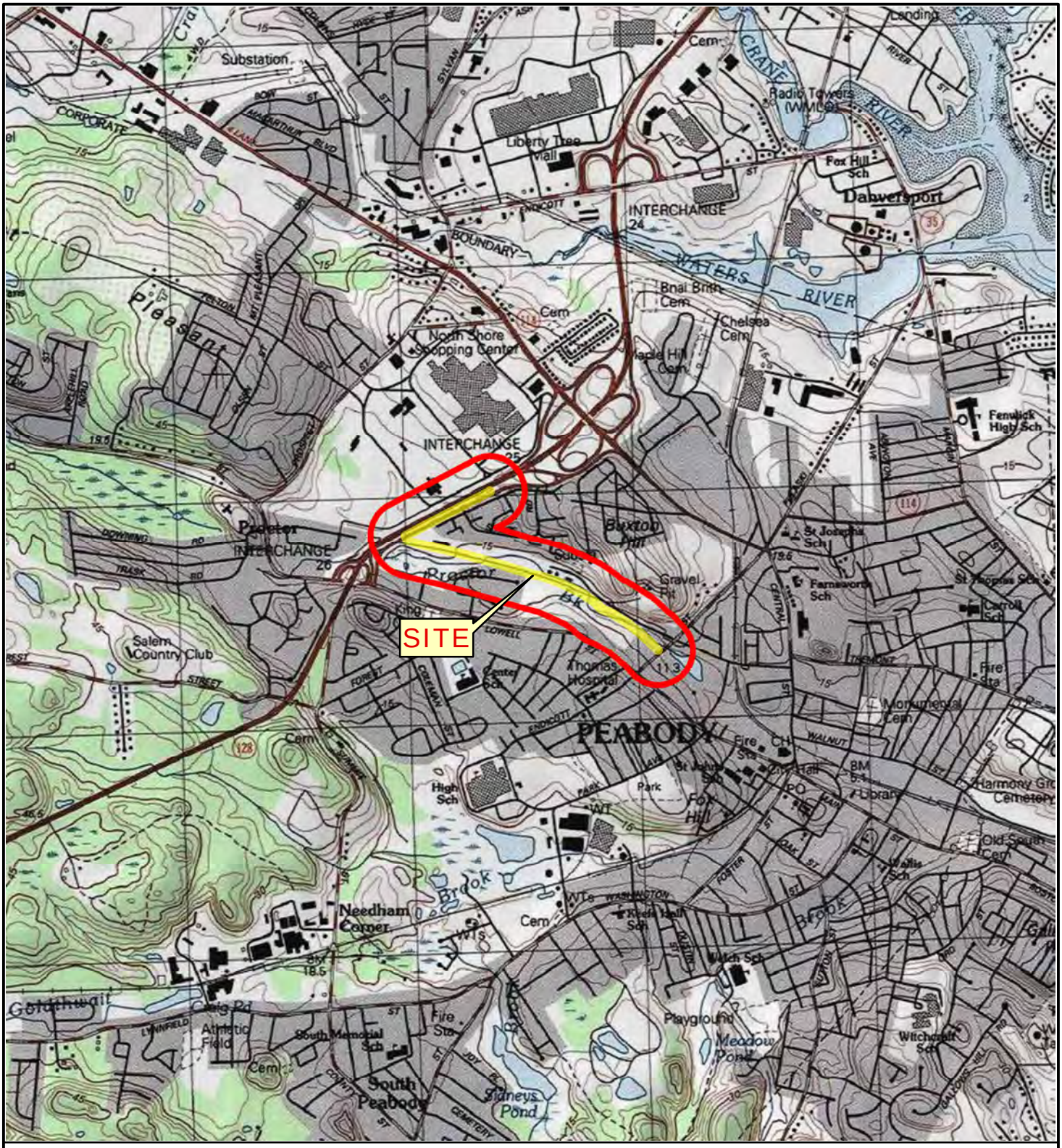
Proposed Peabody Bikeway – Phase II
Peabody, MA

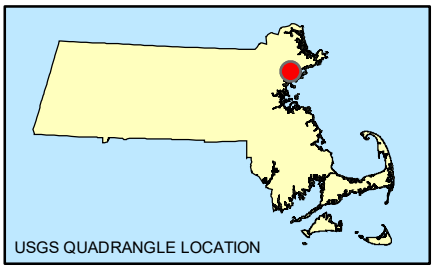
April 22, 2019
File No. 01.0174019.00

PREPARED FOR:
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue | Norwood, MA 02062

31 Offices Nationwide
www.gza.com





SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED SEPTEMBER 26, 2018 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

PROJ. MGR.: MPS
DESIGNED BY: ZSM
REVIEWED BY: TMK
OPERATOR: EMD

DATE: 01-30-2019

SITE LOCUS PLAN

JOB NO. 01.0174019.00

PEABODY BIKEWAY - PHASE II
PEABODY, MASSACHUSETTS

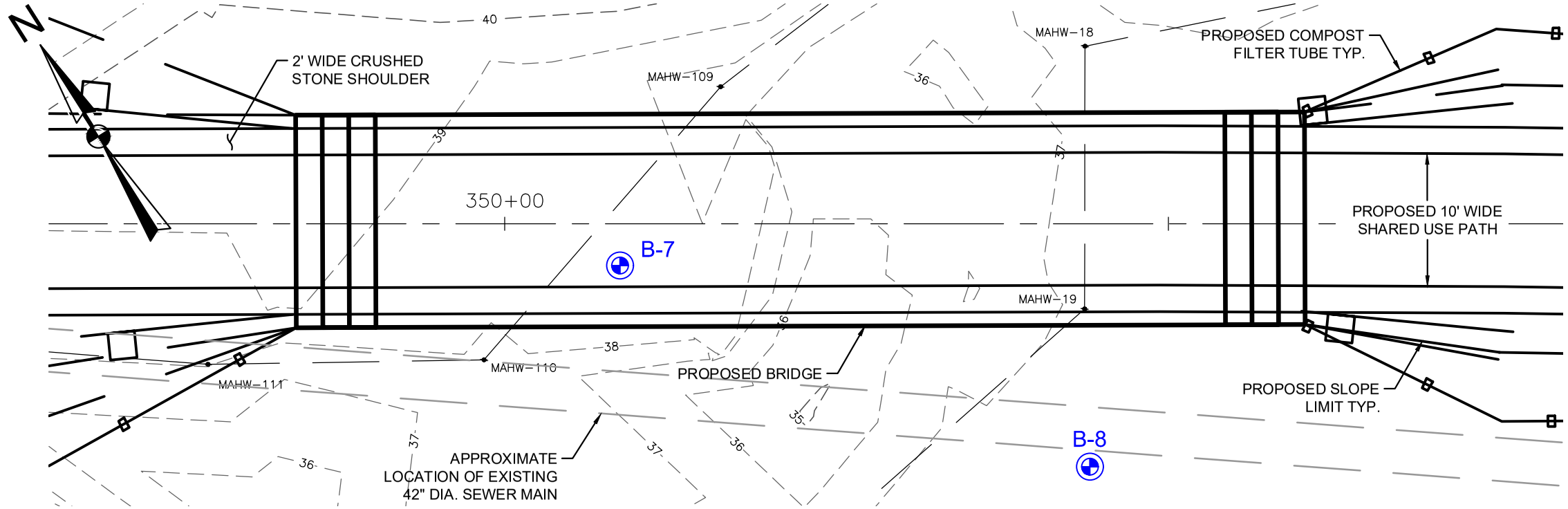
FIGURE NO. 1

© 2019 - GZA GeoEnvironmental, Inc., J:\170,000-179,999\174019\174019-00.MPS\Figures_GIS\174019_SiteLocus_PeabodyBikePath_FIG1.mxd, 1/30/2019, 10:43:13 AM, elaine.donohue

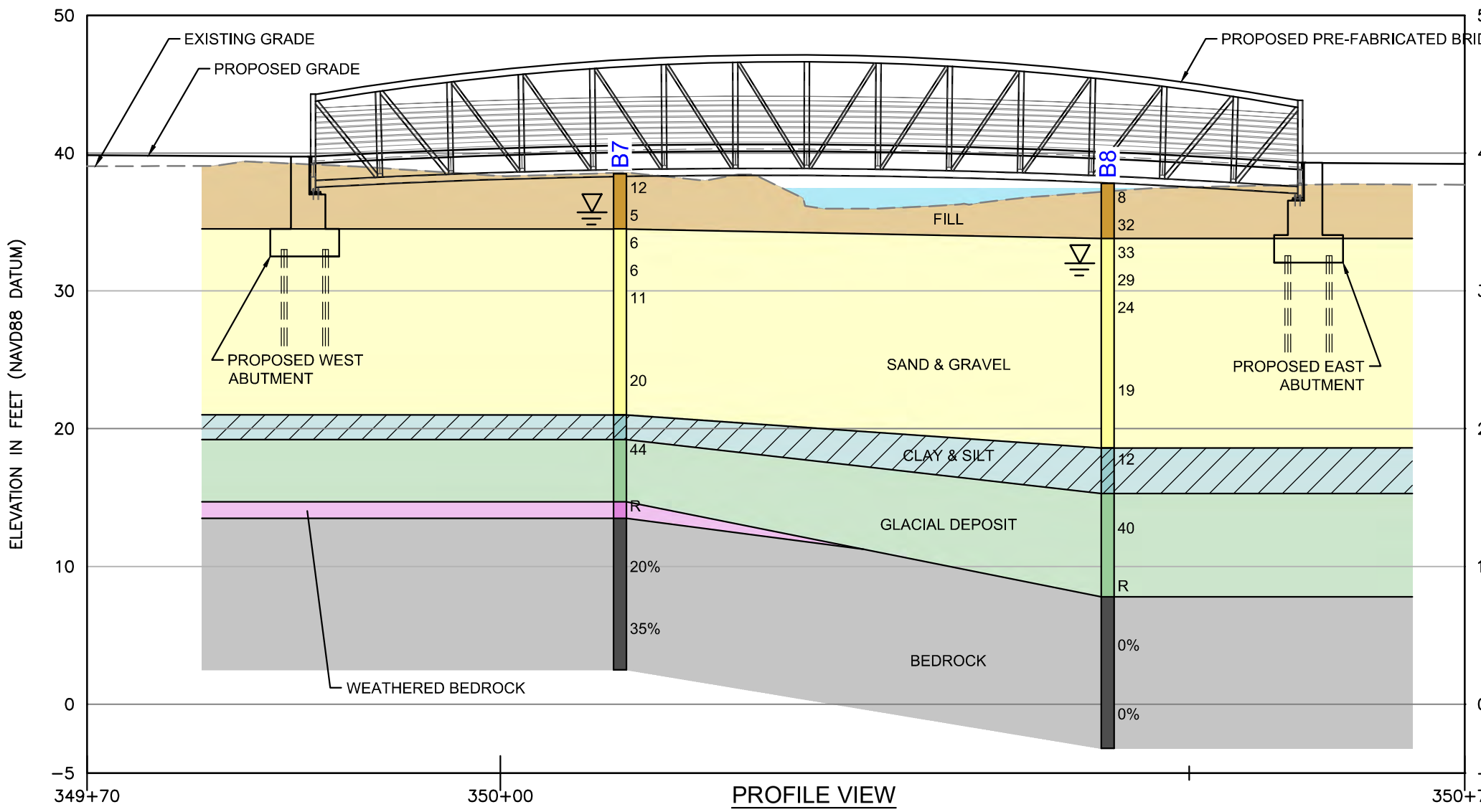
Proposal No. 609211-132091

© 2019 – GZA GeoEnvironmental, Inc. GZA–\\gzanor\jobs\170,000–179,999\174019\174019–00.MPS\Figures–CAD\174019_BASE.dwg [PROF–FIG3] April 18, 2019 – 11:07am michael.smith

A00840 - 190



PLAN VIEW



PROFILE VIEW

LEGEND

- B7 — BOREHOLE DESIGNATION
- INDICATES WATER LEVEL MEASURED IN BOREHOLE
- 11 — INDICATES STANDARD PENETRATION TEST (SPT) N-VALUE
- R — INDICATES REFUSAL
- 35% — INDICATES RQD VALUE

LITHOLOGY KEY

- FILL
- SAND & GRAVEL
- CLAY & SILT
- GLACIAL DEPOSIT
- WEATHERED BEDROCK
- BEDROCK

NOTES:

1. THE STRATIFICATION LINES SHOWN ON ARE BASED ON INTERPOLATIONS BETWEEN WIDELY SPACED EXPLORATION LOCATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.

VERTICAL SCALE IN FEET
0 5 10 20
0 5 10 20
HORIZONTAL SCALE IN FEET

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

PEABODY BIKE PATH - PHASE II
PEABODY, MASSACHUSETTS

EXPLORATION LOCATION PLAN & SUBSURFACE PROFILE

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		GREEN INTERNATIONAL AFFILIATES, INC. Civil and Structural Engineers	
PROJ MGR: MPS	REVIEWED BY: TMK	CHECKED BY: ABB	FIGURE 3
DESIGNED BY: ZSM	DRAWN BY: ADP	SCALE: AS SHOWN	
DATE: 02-06-2019	PROJECT NO. 01.0174019.00	REVISION NO.	

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

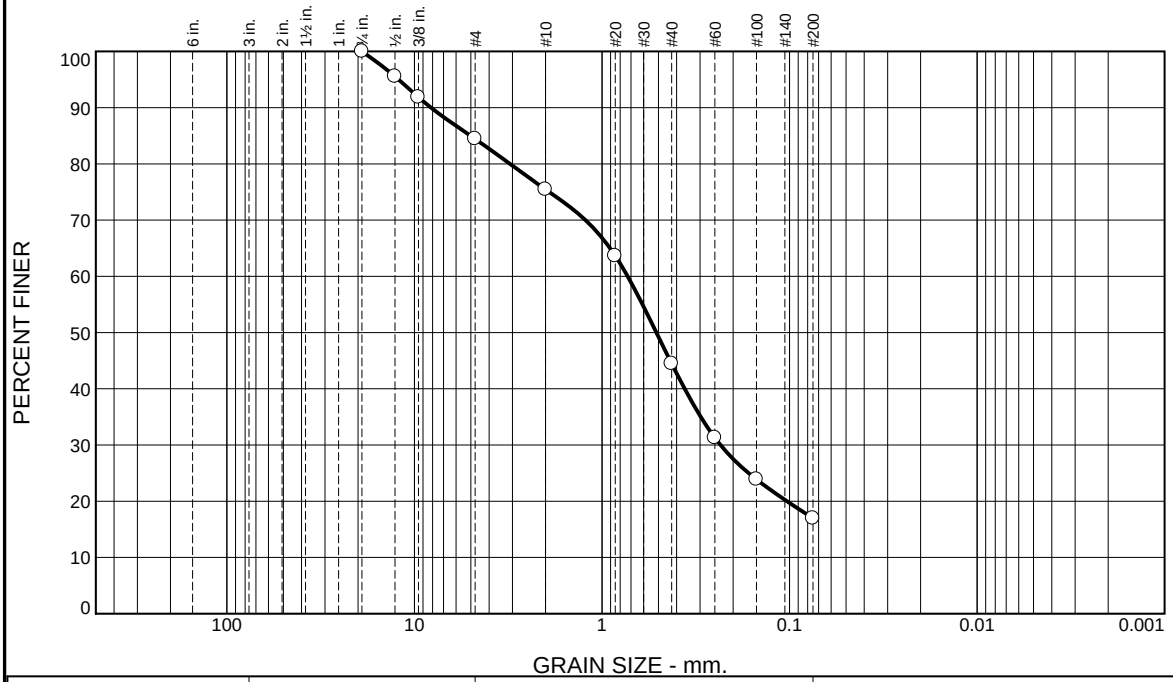
LABORATORY TESTING DATA SHEET

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f c Gravel, little Silt

Reviewed By _____ 01.14.2019

Proposal No. 609211-132091
A00840 - 191

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.6	8.9	31.0	27.5	17.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	95.6		
0.375"	91.9		
#4	84.4		
#10	75.5		
#20	63.6		
#40	44.5		
#60	31.3		
#100	23.9		
#200	17.0		

* (no specification provided)

Material Description

Brown f-c SAND, little Silt, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 8.1481 D_{85}= 5.0207 D_{60}= 0.7300
D_{50}= 0.5128 D_{30}= 0.2334 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 1

Thielsch Engineering Inc.

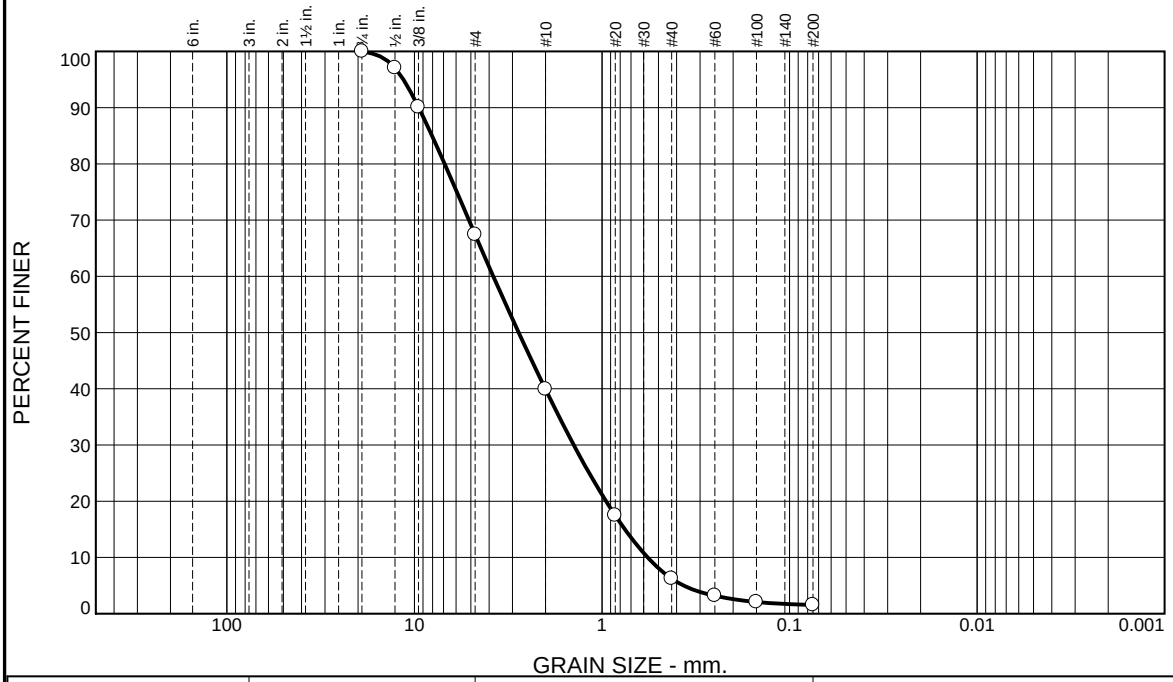
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	32.6	27.5	33.7	4.6	1.6	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.1		
0.375"	90.1		
#4	67.4		
#10	39.9		
#20	17.5		
#40	6.2		
#60	3.2		
#100	2.1		
#200	1.6		

* (no specification provided)

Material Description

Brown m-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 9.4954 D_{85}= 8.0567 D_{60}= 3.7970
D_{50}= 2.7818 D_{30}= 1.4137 D_{15}= 0.7552
D_{10}= 0.5709 C_u= 6.65 C_c= 0.92

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 2

Thielsch Engineering Inc.

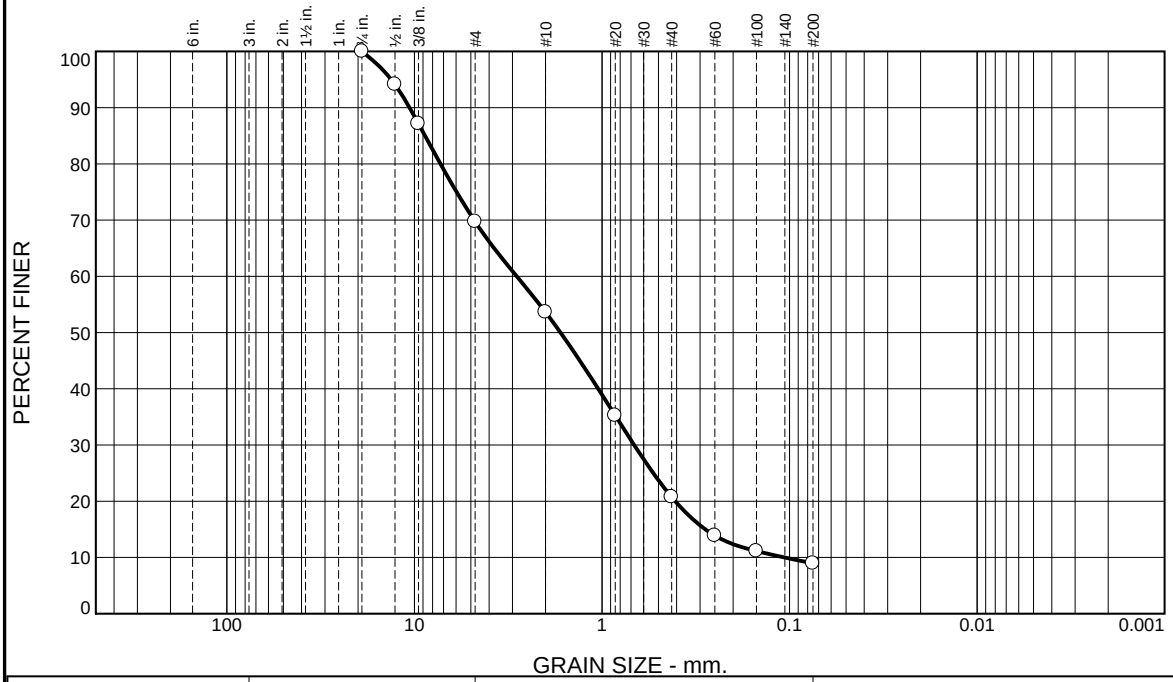
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.3	16.1	32.9	11.7	9.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.1		
0.375"	87.2		
#4	69.7		
#10	53.6		
#20	35.2		
#40	20.7		
#60	13.9		
#100	11.1		
#200	9.0		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 10.6243 D_{85}= 8.7796 D_{60}= 2.8502
D_{50}= 1.6634 D_{30}= 0.6736 D_{15}= 0.2815
D_{10}= 0.1064 C_u= 26.78 C_c= 1.50

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 3

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-3

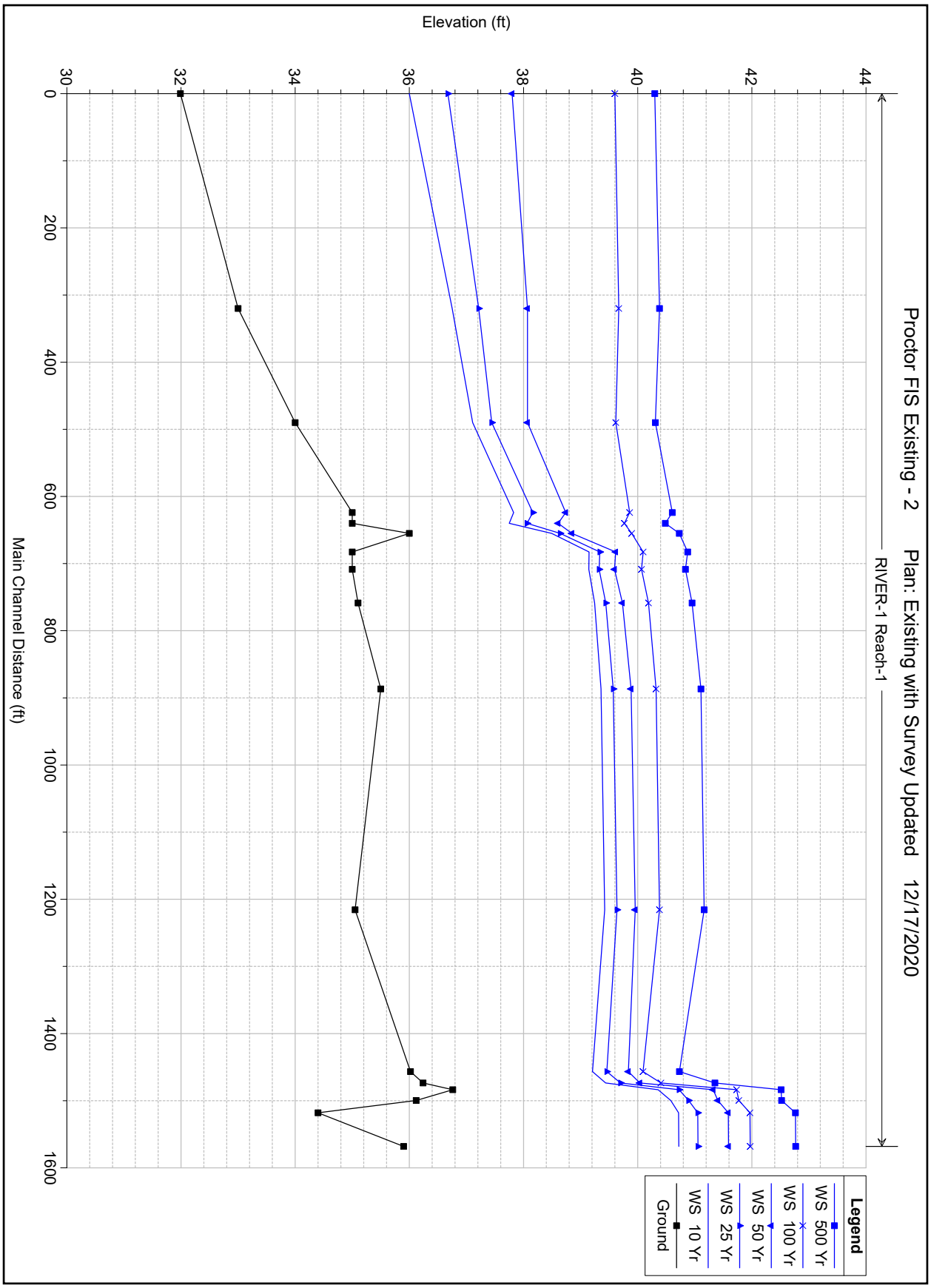
ATTACHMENT A: EXISTING CONDITIONS HEC-RAS ANALYSIS – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: ExistingUpdated River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.72		40.76	0.000345	1.62	212.81	179.63	0.16
Reach-1	26	25 Yr	285.00	35.90	41.06		41.09	0.000304	1.63	274.13	184.98	0.16
Reach-1	26	50 Yr	360.00	35.90	41.59		41.62	0.000249	1.62	375.38	193.49	0.14
Reach-1	26	100 Yr	420.00	35.90	41.97		42.00	0.000223	1.63	449.95	199.53	0.14
Reach-1	26	500 Yr	610.00	35.90	42.77		42.80	0.000219	1.82	614.05	212.22	0.14
Reach-1	25	10 Yr	240.00	34.40	40.72	38.45	40.74	0.000198	1.33	247.94	195.81	0.13
Reach-1	25	25 Yr	285.00	34.40	41.05	38.87	41.08	0.000183	1.36	315.00	202.97	0.12
Reach-1	25	50 Yr	360.00	34.40	41.59	39.54	41.61	0.000159	1.38	426.73	214.37	0.12
Reach-1	25	100 Yr	420.00	34.40	41.97	40.04	41.99	0.000147	1.41	509.67	222.46	0.11
Reach-1	25	500 Yr	610.00	34.40	42.76	40.31	42.79	0.000151	1.58	693.76	239.43	0.12
Reach-1	24.7	10 Yr	240.00	36.12	40.58		40.72	0.001164	3.05	84.79	37.86	0.29
Reach-1	24.7	25 Yr	285.00	36.12	40.89		41.06	0.001198	3.29	98.56	49.96	0.30
Reach-1	24.7	50 Yr	360.00	36.12	41.40		41.59	0.001173	3.54	129.17	69.71	0.30
Reach-1	24.7	100 Yr	420.00	36.12	41.77		41.97	0.001139	3.69	157.46	83.92	0.30
Reach-1	24.7	500 Yr	610.00	36.12	42.52		42.77	0.001251	4.28	230.94	112.77	0.33
Reach-1	24.6	10 Yr	240.00	36.76	40.36		40.65	0.003713	4.36	62.54	53.45	0.51
Reach-1	24.6	25 Yr	285.00	36.76	40.72		41.00	0.002943	4.29	84.58	66.94	0.47
Reach-1	24.6	50 Yr	360.00	36.76	41.32		41.55	0.002035	4.10	131.16	88.97	0.40
Reach-1	24.6	100 Yr	420.00	36.76	41.73		41.94	0.001659	4.01	170.72	104.08	0.37
Reach-1	24.6	500 Yr	610.00	36.76	42.51		42.73	0.001470	4.30	263.12	132.83	0.36
Reach-1	24.4	10 Yr	240.00	36.24	39.44	39.44	40.39	0.014481	7.84	32.25	20.42	0.98
Reach-1	24.4	25 Yr	285.00	36.24	39.70	39.70	40.72	0.013342	8.17	37.83	22.30	0.96
Reach-1	24.4	50 Yr	360.00	36.24	40.04	40.04	41.22	0.013038	8.87	45.76	24.73	0.97
Reach-1	24.4	100 Yr	420.00	36.24	40.41	40.41	41.61	0.011172	8.97	56.92	37.26	0.92
Reach-1	24.4	500 Yr	610.00	36.24	41.35	41.35	42.44	0.007686	8.95	110.26	75.52	0.80
Reach-1	24.3	10 Yr	240.00	36.02	39.21	39.21	40.04	0.016759	7.32	32.78	20.02	1.01
Reach-1	24.3	25 Yr	285.00	36.02	39.46	39.46	40.33	0.015041	7.49	39.34	29.80	0.97
Reach-1	24.3	50 Yr	360.00	36.02	39.84	39.84	40.74	0.012474	7.70	53.40	44.65	0.91
Reach-1	24.3	100 Yr	420.00	36.02	40.09	40.09	41.01	0.011238	7.86	66.12	54.32	0.88
Reach-1	24.3	500 Yr	610.00	36.02	40.73	40.73	41.70	0.009424	8.39	108.29	78.26	0.84
Reach-1	24	10 Yr	240.00	35.05	39.42		39.43	0.000055	0.73	404.11	156.92	0.07
Reach-1	24	25 Yr	285.00	35.05	39.64		39.65	0.000062	0.81	438.33	159.44	0.07
Reach-1	24	50 Yr	360.00	35.05	39.96		39.97	0.000074	0.93	489.64	162.41	0.08
Reach-1	24	100 Yr	420.00	35.05	40.38		40.39	0.000070	0.97	559.57	166.36	0.08
Reach-1	24	500 Yr	610.00	35.05	41.16		41.18	0.000082	1.17	692.61	173.64	0.09
Reach-1	23	10 Yr	240.00	35.50	39.36		39.38	0.000644	1.31	183.22	138.22	0.20
Reach-1	23	25 Yr	285.00	35.50	39.57		39.60	0.000567	1.34	213.18	142.37	0.19
Reach-1	23	50 Yr	360.00	35.50	39.89		39.92	0.000499	1.40	258.96	148.48	0.18
Reach-1	23	100 Yr	420.00	35.50	40.32		40.35	0.000340	1.31	325.82	156.99	0.16
Reach-1	23	500 Yr	610.00	35.50	41.11		41.14	0.000265	1.38	455.05	173.76	0.14
Reach-1	22	10 Yr	240.00	35.10	39.25		39.30	0.000557	2.38	175.14	66.43	0.22
Reach-1	22	25 Yr	285.00	35.10	39.44		39.52	0.000667	2.70	189.13	81.36	0.24
Reach-1	22	50 Yr	360.00	35.10	39.73		39.83	0.000792	3.08	214.90	89.63	0.27
Reach-1	22	100 Yr	420.00	35.10	40.19		40.28	0.000699	3.10	256.58	93.61	0.25
Reach-1	22	500 Yr	610.00	35.10	40.95		41.07	0.000777	3.63	330.62	100.29	0.28
Reach-1	21.7	10 Yr	240.00	35.00	39.14		39.26	0.001078	2.88	114.10	68.82	0.29
Reach-1	21.7	25 Yr	285.00	35.00	39.32		39.47	0.001217	3.18	127.00	73.64	0.31
Reach-1	21.7	50 Yr	360.00	35.00	39.59		39.77	0.001417	3.61	147.78	80.79	0.34
Reach-1	21.7	100 Yr	420.00	35.00	40.07		40.23	0.001166	3.56	189.74	103.78	0.31
Reach-1	21.7	500 Yr	610.00	35.00	40.84		41.02	0.001137	3.94	274.78	117.32	0.32
Reach-1	21.6	10 Yr	240.00	35.00	39.15		39.21	0.000773	2.07	165.76	131.09	0.23
Reach-1	21.6	25 Yr	285.00	35.00	39.34		39.40	0.000811	2.22	191.00	138.74	0.24
Reach-1	21.6	50 Yr	360.00	35.00	39.62		39.69	0.000853	2.43	230.69	150.18	0.25
Reach-1	21.6	100 Yr	420.00	35.00	40.10		40.16	0.000611	2.27	303.44	167.89	0.21
Reach-1	21.6	500 Yr	610.00	35.00	40.88		40.94	0.000534	2.43	426.09	183.93	0.21
Reach-1	21.4	10 Yr	240.00	36.00	38.49	38.49	39.01	0.015189	5.90	47.24	58.55	0.92
Reach-1	21.4	25 Yr	285.00	36.00	38.64	38.64	39.20	0.014211	6.14	56.52	65.41	0.91
Reach-1	21.4	50 Yr	360.00	36.00	38.85	38.85	39.47	0.013579	6.58	71.03	74.90	0.91
Reach-1	21.4	100 Yr	420.00	36.00	39.89		40.09	0.002543	3.97	174.55	122.91	0.43
Reach-1	21.4	500 Yr	610.00	36.00	40.73		40.89	0.001649	3.83	286.57	143.69	0.36
Reach-1	21.35	10 Yr	240.00	35.00	37.75		38.13	0.004869	4.92	48.82	20.50	0.56
Reach-1	21.35	25 Yr	285.00	35.00	38.06		38.47	0.004775	5.16	55.28	21.12	0.56
Reach-1	21.35	50 Yr	360.00	35.00	38.61		39.05	0.004349	5.37	67.08	22.21	0.54
Reach-1	21.35	100 Yr	420.00	35.00	39.77		40.03	0.001863	4.26	126.02	71.64	0.37
Reach-1	21.35	500 Yr	610.00	35.00	40.48		40.81	0.001971	4.88	180.98	79.64	0.39

HEC-RAS Plan: ExistingUpdated River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	21.3	10 Yr	240.00	35.00	37.83		38.01	0.002694	3.45	69.50	34.31	0.43
Reach-1	21.3	25 Yr	285.00	35.00	38.16		38.35	0.002373	3.51	81.26	35.49	0.41
Reach-1	21.3	50 Yr	360.00	35.00	38.74		38.93	0.001898	3.52	102.21	37.22	0.37
Reach-1	21.3	100 Yr	420.00	35.00	39.86		39.97	0.000735	2.72	204.09	116.07	0.25
Reach-1	21.3	500 Yr	610.00	35.00	40.61		40.73	0.000735	3.06	296.44	131.72	0.25
Reach-1	20	10 Yr	240.00	34.00	37.11		37.51	0.004888	5.11	46.97	18.22	0.56
Reach-1	20	25 Yr	285.00	34.00	37.44		37.89	0.004841	5.36	53.16	18.88	0.56
Reach-1	20	50 Yr	360.00	34.00	38.07		38.54	0.004249	5.50	66.48	37.00	0.54
Reach-1	20	100 Yr	420.00	34.00	39.62		39.83	0.001273	3.90	158.52	81.84	0.31
Reach-1	20	500 Yr	610.00	34.00	40.31		40.58	0.001471	4.59	222.08	101.84	0.34
Reach-1	19	10 Yr	240.00	33.00	36.75		36.90	0.002193	3.15	76.21	35.79	0.38
Reach-1	19	25 Yr	285.00	33.00	37.21		37.35	0.001621	3.02	106.75	102.26	0.33
Reach-1	19	50 Yr	360.00	33.00	38.07		38.16	0.000810	2.55	201.57	119.80	0.25
Reach-1	19	100 Yr	420.00	33.00	39.67		39.70	0.000218	1.68	419.66	152.67	0.13
Reach-1	19	500 Yr	610.00	33.00	40.38		40.43	0.000262	1.99	533.75	167.32	0.15
Reach-1	18	10 Yr	240.00	31.99	36.00	34.38	36.21	0.002111	3.68	65.28	23.13	0.39
Reach-1	18	25 Yr	285.00	31.99	36.68	34.61	36.86	0.001461	3.45	93.73	66.48	0.33
Reach-1	18	50 Yr	360.00	31.99	37.80	34.97	37.91	0.000705	2.90	196.96	117.04	0.24
Reach-1	18	100 Yr	420.00	31.99	39.60	35.22	39.64	0.000187	1.87	480.42	197.92	0.13
Reach-1	18	500 Yr	610.00	31.99	40.30	35.96	40.35	0.000228	2.21	629.98	229.38	0.15


Proctor FIS Existing - 2 Plan: Existing with Survey Updated 12/17/2020
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
30
32
34
36
38
40
42
44
0
200
400
600
800
1000
1200
1400
1600
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1

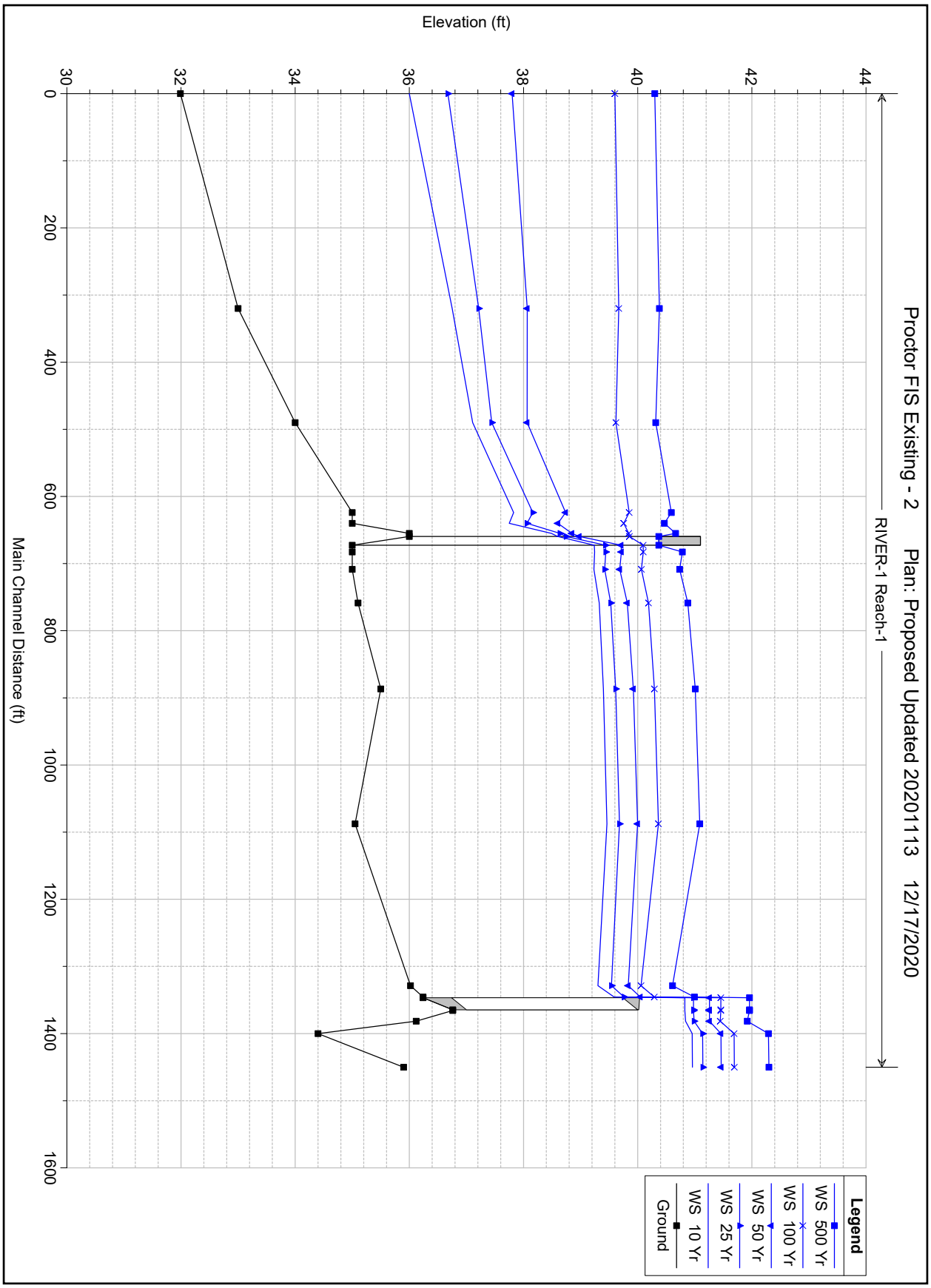
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.96		40.99	0.000246	1.44	255.94	183.41	0.14
Reach-1	26	25 Yr	285.00	35.90	41.14		41.17	0.000271	1.56	289.73	186.32	0.15
Reach-1	26	50 Yr	360.00	35.90	41.46		41.50	0.000287	1.71	350.66	191.45	0.15
Reach-1	26	100 Yr	420.00	35.90	41.69		41.73	0.000298	1.81	395.20	195.12	0.16
Reach-1	26	500 Yr	610.00	35.90	42.30		42.35	0.000333	2.10	515.98	204.73	0.17
Reach-1	25	10 Yr	240.00	34.40	40.95	38.45	40.97	0.000146	1.19	295.26	200.89	0.11
Reach-1	25	25 Yr	285.00	34.40	41.14	38.87	41.16	0.000165	1.31	332.20	204.77	0.12
Reach-1	25	50 Yr	360.00	34.40	41.46	39.54	41.49	0.000182	1.45	399.22	211.62	0.13
Reach-1	25	100 Yr	420.00	34.40	41.69	40.04	41.72	0.000193	1.55	448.46	216.52	0.13
Reach-1	25	500 Yr	610.00	34.40	42.29	40.31	42.33	0.000225	1.82	582.91	229.36	0.14
Reach-1	24.7	10 Yr	240.00	36.12	40.84		40.96	0.000893	2.81	95.92	47.88	0.26
Reach-1	24.7	25 Yr	285.00	36.12	40.99		41.14	0.001088	3.18	103.47	53.62	0.29
Reach-1	24.7	50 Yr	360.00	36.12	41.26		41.46	0.001338	3.70	119.38	64.06	0.32
Reach-1	24.7	100 Yr	420.00	36.12	41.45		41.69	0.001524	4.07	132.17	71.35	0.35
Reach-1	24.7	500 Yr	610.00	36.12	41.92		42.29	0.002089	5.11	170.21	89.60	0.41
Reach-1	24.6	10 Yr	240.00	36.76	40.83	39.63	40.93	0.001629	2.67	97.84	70.69	0.33
Reach-1	24.6	25 Yr	285.00	36.76	40.98	39.81	41.11	0.001767	2.92	109.01	76.29	0.35
Reach-1	24.6	50 Yr	360.00	36.76	41.26	40.05	41.41	0.001805	3.20	131.86	86.63	0.36
Reach-1	24.6	100 Yr	420.00	36.76	41.46	40.24	41.63	0.001839	3.41	149.72	93.92	0.37
Reach-1	24.6	500 Yr	610.00	36.76	41.96	40.66	42.19	0.002001	4.00	201.47	112.41	0.40
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	240.00	36.24	39.59	39.48	40.30	0.014076	6.79	35.36	21.49	0.93
Reach-1	24.4	25 Yr	285.00	36.24	39.76	39.71	40.58	0.015149	7.26	39.23	22.75	0.98
Reach-1	24.4	50 Yr	360.00	36.24	40.05	40.05	41.00	0.015958	7.83	45.99	24.79	1.01
Reach-1	24.4	100 Yr	420.00	36.24	40.29	40.29	41.30	0.014556	8.05	52.87	32.55	0.99
Reach-1	24.4	500 Yr	610.00	36.24	40.99	40.99	42.07	0.010902	8.47	85.79	61.01	0.90
Reach-1	24.3	10 Yr	240.00	36.02	39.30	39.30	40.04	0.017893	6.87	34.97	26.10	1.02
Reach-1	24.3	25 Yr	285.00	36.02	39.54	39.54	40.29	0.015203	6.96	41.81	31.71	0.96
Reach-1	24.3	50 Yr	360.00	36.02	39.83	39.83	40.65	0.014382	7.28	53.28	44.55	0.96
Reach-1	24.3	100 Yr	420.00	36.02	40.06	40.06	40.90	0.012861	7.44	64.24	53.01	0.92
Reach-1	24.3	500 Yr	610.00	36.02	40.61	40.61	41.55	0.010966	8.07	99.26	73.79	0.89
Reach-1	24	10 Yr	240.00	35.05	39.46		39.47	0.000052	0.72	410.37	157.71	0.07
Reach-1	24	25 Yr	285.00	35.05	39.68		39.69	0.000059	0.80	445.22	159.84	0.07
Reach-1	24	50 Yr	360.00	35.05	40.00		40.01	0.000070	0.92	496.49	162.80	0.08
Reach-1	24	100 Yr	420.00	35.05	40.36		40.38	0.000070	0.97	556.56	166.19	0.08
Reach-1	24	500 Yr	610.00	35.05	41.09		41.11	0.000085	1.18	679.20	172.92	0.09
Reach-1	23	10 Yr	240.00	35.50	39.40		39.44	0.000468	1.71	189.16	139.05	0.19
Reach-1	23	25 Yr	285.00	35.50	39.61		39.66	0.000475	1.82	219.37	143.21	0.19
Reach-1	23	50 Yr	360.00	35.50	39.92		39.98	0.000491	1.98	264.62	149.22	0.20
Reach-1	23	100 Yr	420.00	35.50	40.29		40.34	0.000420	1.98	321.21	156.42	0.19
Reach-1	23	500 Yr	610.00	35.50	41.01		41.07	0.000409	2.21	438.15	170.46	0.19
Reach-1	22	10 Yr	240.00	35.10	39.33		39.38	0.000496	2.28	180.52	69.50	0.21
Reach-1	22	25 Yr	285.00	35.10	39.53		39.59	0.000567	2.52	196.63	87.82	0.22
Reach-1	22	50 Yr	360.00	35.10	39.82		39.90	0.000678	2.89	222.46	90.36	0.25
Reach-1	22	100 Yr	420.00	35.10	40.19		40.28	0.000652	3.00	256.57	93.60	0.25
Reach-1	22	500 Yr	610.00	35.10	40.88		40.99	0.000770	3.57	323.09	99.63	0.27
Reach-1	21.7	10 Yr	240.00	35.00	39.23	37.45	39.34	0.000680	2.80	120.42	71.22	0.27
Reach-1	21.7	25 Yr	285.00	35.00	39.42	37.64	39.55	0.000765	3.08	134.24	76.20	0.29
Reach-1	21.7	50 Yr	360.00	35.00	39.69	37.90	39.85	0.000902	3.52	155.33	83.24	0.32
Reach-1	21.7	100 Yr	420.00	35.00	40.06	38.20	40.23	0.000820	3.58	189.40	103.73	0.31
Reach-1	21.7	500 Yr	610.00	35.00	40.73	38.80	40.94	0.000895	4.14	262.94	115.53	0.34
Reach-1	21.6	10 Yr	240.00	35.00	39.25	37.42	39.30	0.000474	2.00	178.75	135.08	0.22
Reach-1	21.6	25 Yr	285.00	35.00	39.44	37.60	39.50	0.000499	2.15	205.54	143.00	0.22
Reach-1	21.6	50 Yr	360.00	35.00	39.71	37.87	39.79	0.000543	2.38	245.20	154.23	0.24
Reach-1	21.6	100 Yr	420.00	35.00	40.10	38.11	40.17	0.000454	2.35	303.58	167.91	0.22
Reach-1	21.6	500 Yr	610.00	35.00	40.78	38.61	40.87	0.000447	2.62	411.27	182.01	0.23
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	240.00	36.00	38.49	38.49	39.02	0.010776	5.95	46.99	58.35	0.93
Reach-1	21.4	25 Yr	285.00	36.00	38.64	38.64	39.21	0.010102	6.21	56.29	65.25	0.92
Reach-1	21.4	50 Yr	360.00	36.00	38.85	38.85	39.49	0.009664	6.66	70.96	74.85	0.92
Reach-1	21.4	100 Yr	420.00	36.00	39.84		40.07	0.002046	4.21	168.11	120.48	0.46
Reach-1	21.4	500 Yr	610.00	36.00	40.66		40.86	0.001364	4.13	277.46	142.29	0.39
Reach-1	21.35	10 Yr	240.00	35.00	37.75		38.13	0.004869	4.92	48.82	20.50	0.56
Reach-1	21.35	25 Yr	285.00	35.00	38.06		38.47	0.004776	5.16	55.27	21.12	0.56

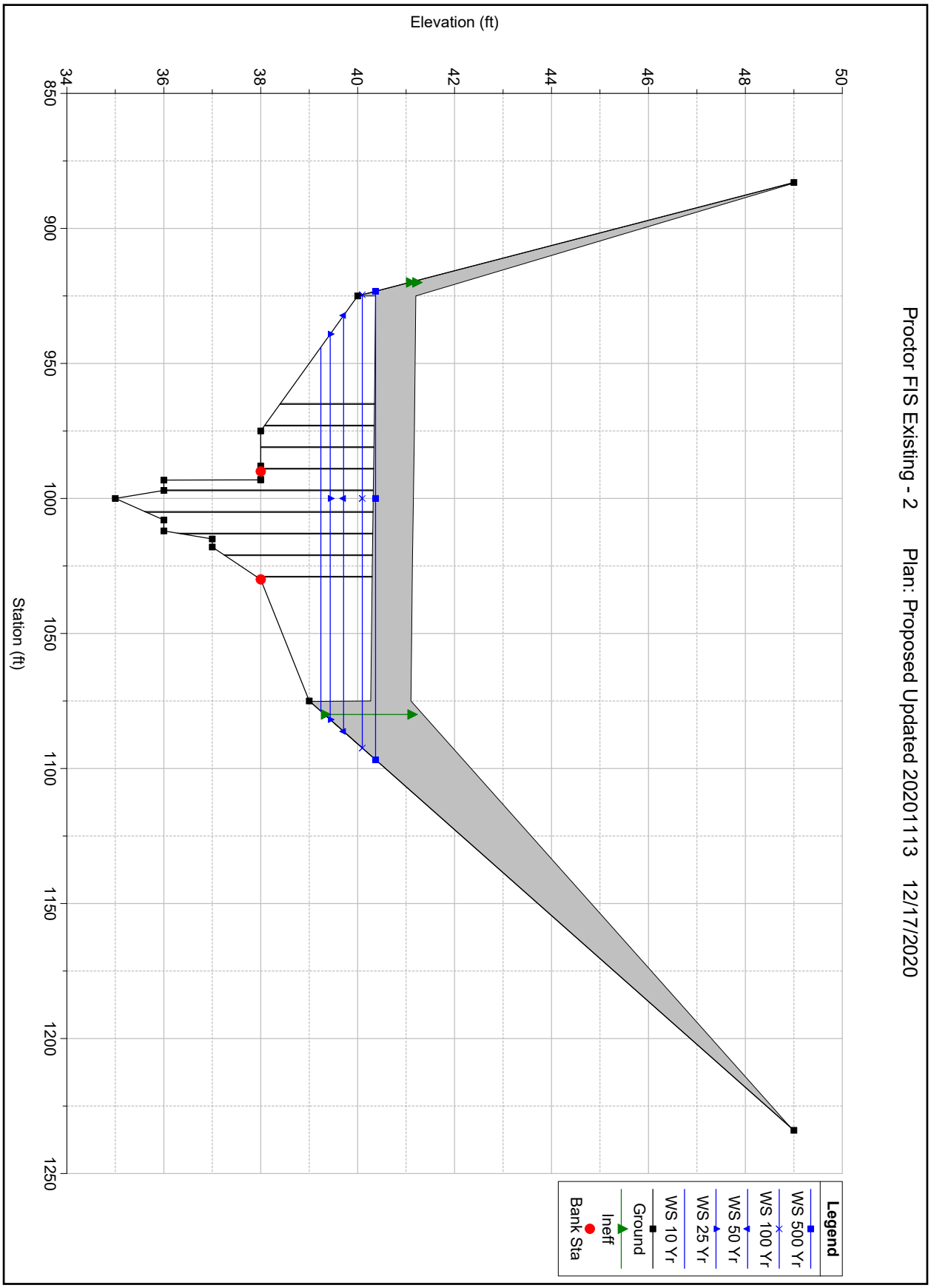
HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	21.35	50 Yr	360.00	35.00	38.60		39.05	0.004359	5.37	67.03	22.21	0.54
Reach-1	21.35	100 Yr	420.00	35.00	39.76		40.03	0.001873	4.27	125.38	71.49	0.37
Reach-1	21.35	500 Yr	610.00	35.00	40.47		40.80	0.001978	4.88	179.75	79.54	0.39
Reach-1	21.3	10 Yr	240.00	35.00	37.83	36.85	38.01	0.002694	3.45	69.50	34.31	0.43
Reach-1	21.3	25 Yr	285.00	35.00	38.16	37.01	38.35	0.002373	3.51	81.26	35.49	0.41
Reach-1	21.3	50 Yr	360.00	35.00	38.74	37.25	38.93	0.001903	3.53	102.12	37.21	0.38
Reach-1	21.3	100 Yr	420.00	35.00	39.85	37.44	39.96	0.000739	2.72	203.06	115.88	0.25
Reach-1	21.3	500 Yr	610.00	35.00	40.59	37.95	40.72	0.000738	3.06	294.35	131.39	0.25
Reach-1	20	10 Yr	240.00	34.00	37.11		37.51	0.004888	5.11	46.97	18.22	0.56
Reach-1	20	25 Yr	285.00	34.00	37.44		37.89	0.004842	5.36	53.15	18.88	0.56
Reach-1	20	50 Yr	360.00	34.00	38.06		38.54	0.004270	5.51	66.30	36.86	0.54
Reach-1	20	100 Yr	420.00	34.00	39.62		39.82	0.001240	3.85	158.60	81.87	0.31
Reach-1	20	500 Yr	610.00	34.00	40.32		40.57	0.001399	4.48	222.65	102.01	0.34
Reach-1	19	10 Yr	240.00	33.00	36.75		36.90	0.002193	3.15	76.21	35.79	0.38
Reach-1	19	25 Yr	285.00	33.00	37.21		37.35	0.001621	3.02	106.72	102.26	0.33
Reach-1	19	50 Yr	360.00	33.00	38.07		38.16	0.000806	2.55	201.25	119.74	0.25
Reach-1	19	100 Yr	420.00	33.00	39.67		39.70	0.000212	1.65	419.43	152.64	0.13
Reach-1	19	500 Yr	610.00	33.00	40.38		40.42	0.000252	1.95	533.45	167.28	0.15
Reach-1	18	10 Yr	240.00	31.99	36.00	34.38	36.21	0.002111	3.68	65.28	23.13	0.39
Reach-1	18	25 Yr	285.00	31.99	36.68	34.61	36.86	0.001460	3.45	93.73	66.48	0.33
Reach-1	18	50 Yr	360.00	31.99	37.80	34.97	37.91	0.000698	2.89	196.96	117.04	0.24
Reach-1	18	100 Yr	420.00	31.99	39.60	35.22	39.64	0.000183	1.85	480.42	197.92	0.13
Reach-1	18	500 Yr	610.00	31.99	40.30	35.96	40.35	0.000222	2.19	629.98	229.38	0.15

HEC-RAS Plan: ProposedUpdatedNew River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	21.7	10 Yr	39.34	39.23	37.45	0.01	0.03	71.22	3.53	217.17	19.30	2.80
Reach-1	21.7	25 Yr	39.55	39.42	37.64	0.02	0.03	76.20	4.89	253.01	27.10	3.08
Reach-1	21.7	50 Yr	39.85	39.69	37.90	0.02	0.05	83.24	7.58	311.04	41.38	3.52
Reach-1	21.7	100 Yr	40.23	40.06	38.20	0.02	0.05	103.73	11.71	349.00	59.29	3.58
Reach-1	21.7	500 Yr	40.94	40.73	38.80	0.02	0.06	115.53	29.31	470.53	110.16	4.14
Reach-1	21.6	10 Yr	39.30	39.25	37.42	0.01	0.00	135.08	15.45	212.59	11.97	2.00
Reach-1	21.6	25 Yr	39.50	39.44	37.60	0.01	0.00	143.00	21.41	245.35	18.24	2.15
Reach-1	21.6	50 Yr	39.79	39.71	37.87	0.01	0.00	154.23	32.31	298.09	29.59	2.38
Reach-1	21.6	100 Yr	40.17	40.10	38.11	0.01	0.00	167.91	46.39	330.25	43.36	2.35
Reach-1	21.6	500 Yr	40.87	40.78	38.61			182.01	89.78	440.94	79.28	2.62
Reach-1	21.5 BR U	10 Yr	39.29	39.24	37.48	0.03	0.14	128.10	18.50	204.94	16.56	2.01
Reach-1	21.5 BR U	25 Yr	39.49	39.43	37.66	0.03	0.15	132.93	25.63	234.09	25.28	2.14
Reach-1	21.5 BR U	50 Yr	39.78	39.71	37.92	0.04	0.16	139.77	38.71	280.30	40.99	2.34
Reach-1	21.5 BR U	100 Yr	40.16	40.10	38.19	0.02	0.05	146.98	55.61	304.20	60.19	2.26
Reach-1	21.5 BR U	500 Yr	40.86	40.37	38.70				86.83	443.02	80.15	3.10
Reach-1	21.5 BR D	10 Yr	39.12	38.60	38.60	0.06	0.00	56.77	4.65	226.92	8.43	5.97
Reach-1	21.5 BR D	25 Yr	39.31	38.75	38.75	0.06	0.00	63.55	8.23	263.35	13.42	6.25
Reach-1	21.5 BR D	50 Yr	39.58	38.98	38.98	0.05	0.01	73.33	16.34	319.80	23.87	6.59
Reach-1	21.5 BR D	100 Yr	40.08	39.85	39.14	0.01	0.00	113.59	48.50	316.37	55.13	4.34
Reach-1	21.5 BR D	500 Yr	40.86	40.37	39.57				92.29	430.04	87.67	5.01
Reach-1	21.4	10 Yr	39.02	38.49	38.49	0.10	0.08	58.35	2.43	232.53	5.04	5.95
Reach-1	21.4	25 Yr	39.21	38.64	38.64	0.10	0.08	65.25	4.82	271.63	8.55	6.21
Reach-1	21.4	50 Yr	39.49	38.85	38.85	0.09	0.10	74.85	10.05	334.54	15.41	6.66
Reach-1	21.4	100 Yr	40.07	39.84		0.03	0.01	120.48	36.67	341.65	41.68	4.21
Reach-1	21.4	500 Yr	40.86	40.66		0.02	0.04	142.29	87.30	439.98	82.72	4.13
Reach-1	21.35	10 Yr	38.13	37.75		0.06	0.06	20.50		240.00		4.92
Reach-1	21.35	25 Yr	38.47	38.06		0.05	0.07	21.12		285.00		5.16
Reach-1	21.35	50 Yr	39.05	38.60		0.04	0.08	22.21		360.00		5.37
Reach-1	21.35	100 Yr	40.03	39.76		0.02	0.05	71.49	0.04	398.51	21.46	4.27
Reach-1	21.35	500 Yr	40.80	40.47		0.02	0.06	79.54	0.23	535.83	73.94	4.88

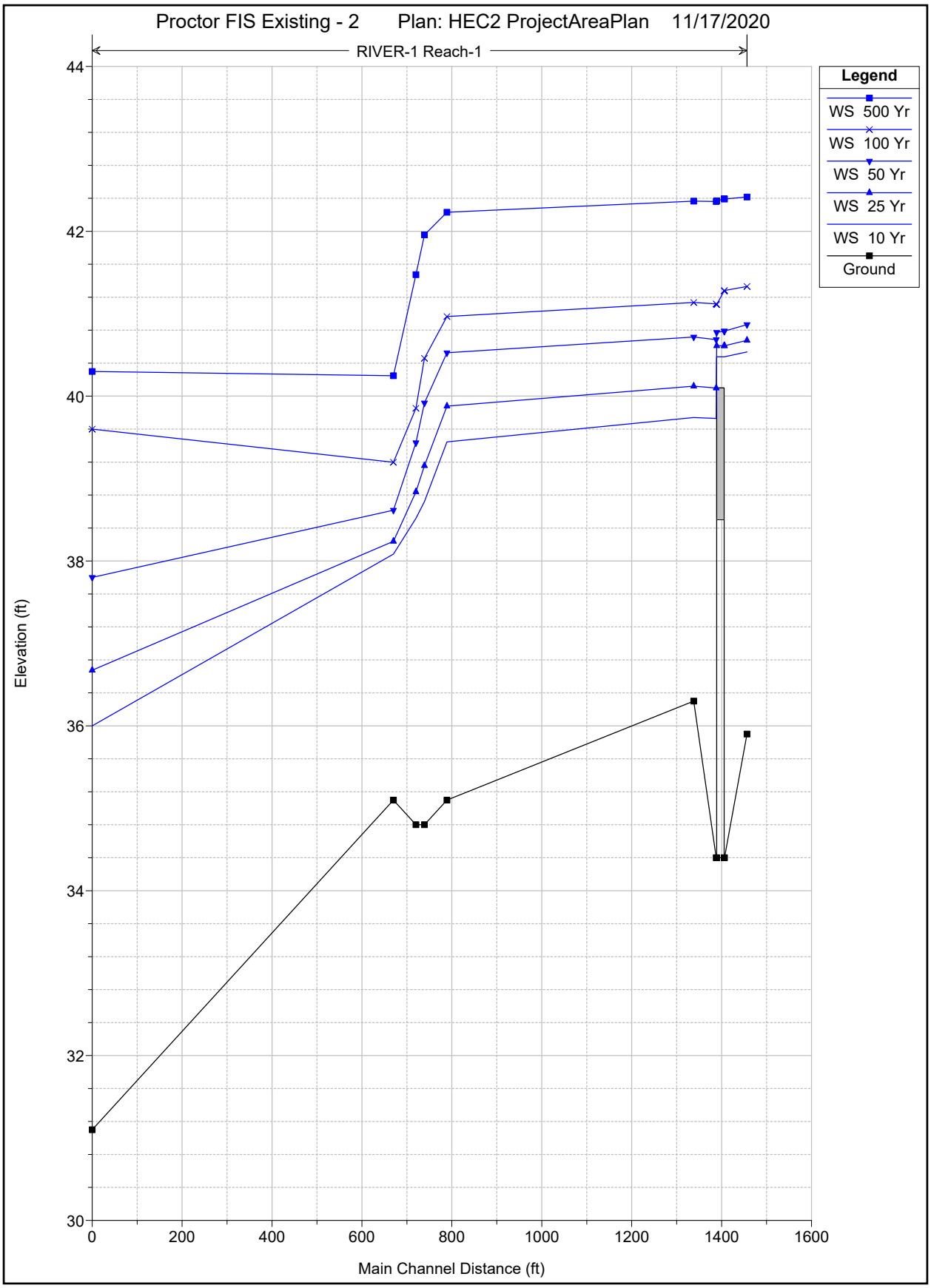

Proctor FIS Existing - 2 Plan: Proposed Updated 20201113 12/17/2020
RIVER-1 Reach-1
Elevation (ft)
Main Channel Distance (ft)
30
32
34
36
38
40
42
44
0
200
400
600
800
1000
1200
1400
1600
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground


Proctor FIS Existing - 2 Plan: Proposed Updated 20201113 12/17/2020
Elevation (ft)
Station (ft)
34
36
38
40
42
44
46
48
50
850
900
950
1000
1050
1100
1150
1200
1250
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground
Ineff
Bank Sta

ATTACHMENT C: 1977 HEC-2 MODEL INPUT/OUTPUT AND RESULTANT HEC-RAS SUMMARY TABLE AND PLOT

HEC-RAS Plan: HEC2ProjectArea River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	26	10 Yr	240.00	35.90	40.54		40.62	0.001039	2.85	179.96	176.69	0.24
Reach-1	26	25 Yr	285.00	35.90	40.68		40.77	0.001165	3.08	205.01	178.93	0.26
Reach-1	26	50 Yr	360.00	35.90	40.87		40.98	0.001373	3.44	239.56	181.98	0.28
Reach-1	26	100 Yr	420.00	35.90	41.33		41.40	0.000950	3.04	325.38	189.34	0.24
Reach-1	26	500 Yr	610.00	35.90	42.42		42.46	0.000554	2.64	540.14	206.60	0.19
Reach-1	25	10 Yr	240.00	34.40	40.48	38.45	40.56	0.000951	3.16	201.95	190.74	0.24
Reach-1	25	25 Yr	285.00	34.40	40.61	38.87	40.69	0.001098	3.45	227.42	193.56	0.26
Reach-1	25	50 Yr	360.00	34.40	40.79	39.54	40.89	0.001338	3.89	262.21	197.35	0.28
Reach-1	25	100 Yr	420.00	34.40	41.28	40.04	41.35	0.000894	3.35	362.17	207.86	0.23
Reach-1	25	500 Yr	610.00	34.40	42.39	40.41	42.43	0.000500	2.79	605.91	231.49	0.18
Reach-1	24.5		Bridge									
Reach-1	24	10 Yr	240.00	34.40	39.73	38.10	39.83	0.001652	3.41	122.46	44.89	0.27
Reach-1	24	25 Yr	285.00	34.40	40.10	38.10	40.21	0.001672	3.60	139.59	47.91	0.28
Reach-1	24	50 Yr	360.00	34.40	40.69	38.10	40.80	0.001690	3.89	242.07	195.17	0.29
Reach-1	24	100 Yr	420.00	34.40	41.12	38.27	41.19	0.001222	3.47	328.79	204.41	0.25
Reach-1	24	500 Yr	610.00	34.40	42.36	38.94	42.39	0.000568	2.67	599.10	230.86	0.17
Reach-1	23	10 Yr	240.00	36.30	39.74		39.75	0.000360	1.27	406.62	258.12	0.12
Reach-1	23	25 Yr	285.00	36.30	40.12		40.13	0.000266	1.17	505.88	263.82	0.11
Reach-1	23	50 Yr	360.00	36.30	40.72		40.72	0.000185	1.08	665.80	272.76	0.09
Reach-1	23	100 Yr	420.00	36.30	41.14		41.14	0.000155	1.05	781.54	279.05	0.08
Reach-1	23	500 Yr	610.00	36.30	42.37		42.37	0.000106	1.01	1135.67	297.48	0.07
Reach-1	22	10 Yr	240.00	35.10	39.45		39.48	0.000600	1.83	189.57	81.92	0.16
Reach-1	22	25 Yr	285.00	35.10	39.88		39.91	0.000532	1.85	227.99	90.89	0.15
Reach-1	22	50 Yr	360.00	35.10	40.53		40.56	0.000452	1.87	288.61	96.55	0.15
Reach-1	22	100 Yr	420.00	35.10	40.97		41.00	0.000421	1.90	331.91	100.40	0.14
Reach-1	22	500 Yr	610.00	35.10	42.23		42.26	0.000350	1.99	465.93	111.46	0.13
Reach-1	21	10 Yr	240.00	34.80	38.72		39.34	0.008300	6.40	41.95	23.12	0.59
Reach-1	21	25 Yr	285.00	34.80	39.16		39.78	0.007459	6.54	53.41	29.38	0.57
Reach-1	21	50 Yr	360.00	34.80	39.92		40.45	0.005544	6.31	81.86	45.78	0.50
Reach-1	21	100 Yr	420.00	34.80	40.46		40.91	0.004381	6.02	109.91	57.70	0.46
Reach-1	21	500 Yr	610.00	34.80	41.96		42.21	0.002245	5.07	220.98	90.65	0.34
Reach-1	20	10 Yr	240.00	34.80	38.52	37.65	39.25	0.002594	6.89	37.54	20.20	0.65
Reach-1	20	25 Yr	285.00	34.80	38.84	37.96	39.68	0.002665	7.41	44.80	24.83	0.67
Reach-1	20	50 Yr	360.00	34.80	39.43	38.61	40.35	0.002459	7.84	62.34	35.16	0.66
Reach-1	20	100 Yr	420.00	34.80	39.85	39.07	40.80	0.002323	8.10	78.93	44.34	0.65
Reach-1	20	500 Yr	610.00	34.80	41.47	40.29	42.13	0.001302	7.36	179.85	80.04	0.51
Reach-1	19	10 Yr	240.00	35.10	38.08	37.81	39.05	0.004764	8.10	34.65	14.46	0.85
Reach-1	19	25 Yr	285.00	35.10	38.24	38.12	39.46	0.005584	9.09	36.91	14.69	0.93
Reach-1	19	50 Yr	360.00	35.10	38.62	38.62	40.11	0.005879	10.11	43.64	19.20	0.98
Reach-1	19	100 Yr	420.00	35.10	39.20	39.00	40.60	0.004522	9.87	55.62	21.99	0.88
Reach-1	19	500 Yr	610.00	35.10	40.25	40.25	41.92	0.004071	10.97	88.36	40.43	0.87
Reach-1	18	10 Yr	240.00	31.10	36.00	33.92	36.28	0.003140	4.56	75.12	42.81	0.38
Reach-1	18	25 Yr	285.00	31.10	36.68	34.20	36.90	0.002257	4.24	112.84	64.19	0.33
Reach-1	18	50 Yr	360.00	31.10	37.80	34.63	37.93	0.001216	3.54	198.56	94.60	0.25
Reach-1	18	100 Yr	420.00	31.10	39.60	34.93	39.64	0.000335	2.19	444.29	181.24	0.14
Reach-1	18	500 Yr	610.00	31.10	40.30	35.43	40.34	0.000403	2.54	584.68	219.86	0.15


Proctor FIS Existing - 2 Plan: HEC2 ProjectAreaPlan 11/17/2020
RIVER-1 Reach-1
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
WS 10 Yr
Ground
Elevation (ft)
Main Channel Distance (ft)
44
42
40
38
36
34
32
30
0
200
400
600
800
1000
1200
1400
1600

ATTACHMENT D: SCOUR/STABILITY ANALYSES

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	10/13/2020
CHECKED BY	AGF	DATE	10/13/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 5 General Scour
Live-Bed Equation
25 YEAR DESIGN FLOW RATE

Live Bed Contraction Scour calculations:

$$y_2/y_1 = (Q_2/Q_1)^{6/7}(W_1/W_2)^{k1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:
y_1= Average depth in the upstream main channel (ft)
y_2= Average depth in the contracted section (ft)
y_0= Existing depth in the contracted section before scour (ft)
Q_1= Flow in the upstream channel transporting sediment (ft^3/s)
Q_2= Flow in the contracted channel (ft^3/s)
W_1= Bottom width of the upstream main channel that is transporting bed material (ft)
W_2= Bottom width of the main channel in the contracted section less pier width(s) (ft)
K_1= Exponent determined below

V*/w	K_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

For D_{50} = 2.7818 mm

y_1 =	y_0	Q_1	Q_2	W_1	W_2	K_1	y_2	y_s	
2.02	3.65	285	247	134	101	0.64	2.14	**-1.51**	*NO SCOUR*

Where,

$$V^* = (t/q)^{1/2} = (gy_1s_1)^{1/2}$$

s_1	Slope of energy grade line of main channel (ft/ft)
y_1	Average depth in the upstream main channel (ft)
g	Acceleration of Gravity(32.2 ft/s^2)
w	Fall velocity of bed material based on D_{50}, m/s (figure 5.8, HEC-18) (for velocity in english units (ft/s), multiply w in m/s by 3.28
t	Shear stress on the bed, Pa (N/m^2) (lb/ft^2)
q	Density of water (1000 Kg/m^3) (1.94 $slug/ft^3$)

Then for s_1 = 0.0034

V* = 0.47 ft/s

And for D_{50} = 2.7818 mm

w = 0.7872 ft/s (from figure 5.8 for temperature between 0 and 20 C degree)

V*/w = 0.6 then K_1 = 0.64

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	10/13/2020
CHECKED BY	AGF	DATE	10/13/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 5 General Scour
Live-Bed Equation
50 YEAR DESIGN FLOW RATE

Live Bed Contraction Scour calculations:

$$y_2/y_1 = (Q_2/Q_1)^{6/7}(W_1/W_2)^{k1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:
y_1= Average depth in the upstream main channel (ft)
y_2= Average depth in the contracted section (ft)
y_0= Existing depth in the contracted section before scour (ft)
Q_1= Flow in the upstream channel transporting sediment (ft^3/s)
Q_2= Flow in the contracted channel (ft^3/s)
W_1= Bottom width of the upstream main channel that is transporting bed material (ft)
W_2= Bottom width of the main channel in the contracted section less pier width(s) (ft)
K_1= Exponent determined below

V*/w	K_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

For D_{50} = 2.7818 mm

y_1 =	y_0	Q_1	Q_2	W_1	W_2	K_1	y_2	y_s	
3.67	3.65	360	280	144	104	0.64	3.64	**-0.01**	*NO SCOUR*

Where,

$$V^* = (t/q)^{1/2} = (gy_1s_1)^{1/2}$$

s_1	Slope of energy grade line of main channel (ft/ft)
y_1	Average depth in the upstream main channel (ft)
g	Acceleration of Gravity(32.2 ft/s^2)
w	Fall velocity of bed material based on D_{50}, m/s (figure 5.8, HEC-18) (for velocity in english units (ft/s), multiply w in m/s by 3.28
t	Shear stress on the bed, Pa (N/m^2) (lb/ft^2)
q	Density of water (1000 Kg/m^3) (1.94 $slug/ft^3$)

Then for s_1 = 0.0034

V* = 0.63 ft/s

And for D_{50} = 2.7818 mm

w = 0.7872 ft/s (from figure 5.8 for temperature between 0 and 20 C degree)

V*/w = 0.8 then K_1 = 0.64

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

25 YR Proposed Scour at Abutments

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft (m)
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft (m)
y_0 = Flow depth prior to scour, ft (m)

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.009
v_2= 6.25
d_2= 1.21
K_u= 11.17
q_{2f}= 7.56
y_c= 2.75
v_1= 2.15
d_1= 1.23
q_1= 2.64
q_2/q_1= 2.860
α_A= 1.15
y_{max}= 3.16
y_0= 1.21

Y_s = 1.95 ft

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

50 YR Proposed Scour at Abutments

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft
y_0 = Flow depth prior to scour, ft

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.009
v_2= 6.59
d_2= 1.35
K_u= 11.17
q_{2f}= 8.90
y_c= 3.16
v_1= 2.38
d_1= 1.35
q_1= 3.21
q_2/q_1= 2.769
α_A= 1.15
y_{max}= 3.63
y_0= 1.35

Y_s = 2.28 ft

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/17/2021
CHECKED BY	AGF	DATE	2/17/2021
DESCRIPTION			
SCALE			

Using NCHRP 24-20 Abutment Scour Approach from Evaluating Scour at Bridges, Fifth Edition, Chapter 8.6.3

25 YR Proposed Scour at Abutments with Scour Protection

$$y_{max} = \alpha_A y_c \text{ or } y_{max} = \alpha_B y_c$$

$$y_s = y_{max} - y_0$$

Where:

y_{max}= Maximum flow depth resulting from abutment scour, ft (m)
K_2= Coefficient for angle of embankment to flow, = $(\Theta/90)^{0.13}$
α_A = Amplification factor for live-bed conditions
y_s = Abutment scour depth, ft (m)
y_0 = Flow depth prior to scour, ft (m)

The contraction scour equation:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7}$$

Where:

y_c = Flow depth including clear-water contraction scour, ft
q_{2f} = Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft^2/s
K_u = 11.17 English units
D_{50} = Particle size with 50 percent finer, ft
q_1=upstream unit discharge, ft^2/s

Left Abutment

D_{50}= 0.500
v_2= 6.25
d_2= 1.21
K_u= 11.17
q_{2f}= 7.56
y_c= 0.87
v_1= 2.15
d_1= 1.23
q_1= 2.64
q_2/q_1= 2.860
α_A= 1.15
y_{max}= 1.00
y_0= 1.21

Y_s = -0.21 ft

Ys < 0. Say 0 ft scour

GREEN INTERNATIONAL AFFILIATES, INC.
Consulting Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	2/18/2021
CHECKED BY	AGF	DATE	2/18/2021
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 7 Determination of Local Scour at Piers

25 YR PROPOSED

Live Bed Contraction Scour calculations:

$$y_s/y_1 = 2.0*K_1*K_2*K_3*K_4(a/y_1)^{0.65}Fr_1^{0.43}$$

$$y_s/a = 2.0*K_1*K_2*K_3*K_4(y_1/a)^{0.35}Fr_1^{0.43}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:

y_s= Scour depth (ft)
y_1= Flow depth directly upstream of the pier (ft)
K_1= Correction factor for pier nose shape from Figure 6.3 and Table 6.1
K_2= Correction factor for angle of attack of flow from Table 6.2 or Equation 6.4
K_3= Correction factor for bed condition from Table 6.3
K_4= Correction factor for armoring by bed material size from Equation 6.5
a= Pier width (ft)
L= Length of pier (ft)
Fr_1= Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$
V_1= Mean velocity of flow directly upstream of the pier (ft/s)
g= Acceleration of gravity (32.2 ft/s^2)

Table 6.1. Correction Factor, K_1, for Pier Nose Shape.

Shape of Pier Nose	K_1
(a) Square nose	1.1
(b) Round nose	1.0
(c) Circular cylinder	1.0
(d) Group of cylinders	1.0
(e) Sharp nose	0.9

Table 6.2. Correction Factor, K_2, for Angle of Attack, Θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.0	1.0	1.0
15	1.5	2.0	2.5
30	2.0	2.8	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5.0
Angle = skew angle of flow			
L = length of pier, m			

Table 6.3. Increase in Equilibrium Pier Scour Depths, K_3, for Bed Condition.

Bed Condition	Dune Height (m)	K_3
Clear-Water Scour	N/A	1.1
Plane bed and Antidune flow	N/A	1.1
Small Dunes	3> H ≥ 0.6	1.1
Medium Dunes	9> H ≥ 3	1.2 to 1.1
Large Dunes	H ≥ 9	1.3

D_{50}=	0.009	ft
D_{95}=	0.033	ft
K_1=	1.0	(group of cylinders)
K_2=	1.0	(0 degree angle of attack for circular pier)
K_3=	1.1	(Clear-Water Scour and Plane Bed)
y_1=	1.46	ft
a=	0.33	ft
V_1=	6.25	ft/sec

$Fr_1 = V_1/(gy_1)^{1/2}$ Fr_1= 0.91

y_s = 1.17 ft

GREEN INTERNATIONAL AFFILIATES, INC.
Consulting Engineers
239 Littleton Road Suite 3
WESTFORD, MA 01886

JOB	17118 Peabody Bikeway		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	11/17/2020
CHECKED BY	AGF	DATE	11/17/2020
DESCRIPTION			
SCALE			

Using HEC-18 Evaluation of Scour at Bridges
Chapter 7 Determination of Local Scour at Piers

50 YR PROPOSED

Live Bed Contraction Scour calculations:

$$y_s/y_1 = 2.0*K_1*K_2*K_3*K_4(a/y_1)^{0.65}Fr_1^{0.43}$$

$$y_s/a = 2.0*K_1*K_2*K_3*K_4(y_1/a)^{0.35}Fr_1^{0.43}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:

y_s= Scour depth (ft)
y_1= Flow depth directly upstream of the pier (ft)
K_1= Correction factor for pier nose shape from Figure 6.3 and Table 6.1
K_2= Correction factor for angle of attack of flow from Table 6.2 or Equation 6.4
K_3= Correction factor for bed condition from Table 6.3
K_4= Correction factor for armoring by bed material size from Equation 6.5
a= Pier width (ft)
L= Length of pier (ft)
Fr_1= Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$
V_1= Mean velocity of flow directly upstream of the pier (ft/s)
g= Acceleration of gravity (32.2 ft/s^2)

Table 6.1. Correction Factor, K_1, for Pier Nose Shape.

Shape of Pier Nose	K_1
(a) Square nose	1.1
(b) Round nose	1.0
(c) Circular cylinder	1.0
(d) Group of cylinders	1.0
(e) Sharp nose	0.9

Table 6.2. Correction Factor, K_2, for Angle of Attack, Θ, of the Flow.

Angle	L/a=4	L/a=8	L/a=12
0	1.0	1.0	1.0
15	1.5	2.0	2.5
30	2.0	2.8	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5.0
Angle = skew angle of flow			
L = length of pier, m			

Table 6.3. Increase in Equilibrium Pier Scour Depths, K_3, for Bed Condition.

Bed Condition	Dune Height (m)	K_3
Clear-Water Scour	N/A	1.1
Plane bed and Antidune flow	N/A	1.1
Small Dunes	3> H ≥ 0.6	1.1
Medium Dunes	9> H ≥ 3	1.2 to 1.1
Large Dunes	H ≥ 9	1.3

D_{50}=	0.009	ft
D_{95}=	0.033	ft
K_1=	1.0	(group of cylinders)
K_2=	1.0	(0 degree angle of attack for circular pier)
K_3=	1.1	(Clear-Water Scour and Plane Bed)
y_1=	1.66	ft
a=	0.33	ft
V_1=	6.59	ft/sec

$Fr_1 = V_1/(gy_1)^{1/2}$ Fr_1= 0.90

***y_s* = 1.22 ft**

March 19, 2025

To:	Heidi M. Davis, MassDEP Wetlands Program (heidi.davis@mass.gov) Ryan Hale, MassDEP Wetlands Program (ryan.hale@mass.gov)
Cc:	Curt Bellavance, City of Peabody (curt.bellavance@peabody-ma.gov) Melissa Lenker, MassDOT (melissa.lenker@dot.state.ma.us) Erica Larner, MassDOT (erica.n.larner@dot.state.ma.us) Stephanie Upson, MassDOT (stephanie.upson@dot.state.ma.us) Stephanie Regan, MassDOT (stephanie.m.regan@dot.state.ma.us) Sandhya Potana, MassDOT (Sandhya.Potana@dot.state.ma.us) Dennis Vertiyev, Green International Affiliates, Inc. (dvertiyev@greenintl.com)
From:	Oxana Fartushnaya, Green International Affiliates, Inc. (ofartushnaya@greenintl.com)
Date:	March 19, 2025
Project Name:	Independence Greenway Extension, Peabody, MA
Project Number:	Green No. 17118
Subject:	**401 Water Quality Certification - MassDEP 24-WW26-0034-APP (Fill and Dredge) Independence Greenway Extension from Essex Center Drive to Endicott Street, Peabody, MA MassDOT Project #609211**

Dear Ms. Davis:

This Request is being submitted to MassDEP Wetlands Program by Green Internation al Affiliates, Inc. on behalf of the Applicant, the City of Peabody, for the issued 401 Water Quality Certification (WQC) Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge).

The Applicant and MassDOT have reviewed the 401 Water Quality Certification issued for the Independence Greenway Extension project in Peabody, MA and respectfully request that MassDEP review the following clarifications and requested changes to the issued 401 Water Quality Certification, Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge):

Condition 31: *"All sediment management activities authorized by this WQC shall be conducted under the supervision of a Licensed Site Professional (LSP). Prior to the Pre-Construction Meeting required in Condition 5, the applicant shall provide MassDEP with the name and contact information of the LSP."*

> **Comments:** "Management" in this context is vague. Clarification on the scope of "management" is necessary to ensure compliance and avoid potential misinterpretations. The Contractor's LSP typically determines the activities that require monitoring, as well as the amount of monitoring needed, based on the known/suspected nature of the materials being excavated and the project conditions. Requiring an LSP to oversee all sediment management activities seems overly burdensome and may not provide significant value.

Recommended Language: MassDOT requests that management activities be better defined in this special condition to ensure compliance with this Special Condition.

Condition #32*: "A Health & Safety Plan shall be required for handling of sediment which has been characterized as exceeding MCP RCS-1 criteria. A copy shall be provided to MassDEP within six weeks of the effective of this WQC or two weeks prior to the commencement of the dredging operation, whichever comes first."*

Comments:

1. The Contractor is responsible for preparing an Environmental Health and Safety Plan that protects workers from any exposure to known/suspect contaminants present in environmental media (including sediment) within the project limits. We expect that an all-encompassing safety plan will be adequate and that a separate plan specifically for sediment will not be required. Please confirm.
2. Please confirm that the plan needs to be submitted for MassDEP records only.
3. There needs to be flexibility in the submission deadline to accommodate unforeseen delays.

Recommended Language: "An Environmental Health & Safety Plan shall be required for the protection of workers from any exposure to known/suspect contaminants present in environmental media (including sediment) within the project limits. A copy shall be provided to MassDEP for records at least two weeks prior to the commencement of the dredging operation."

Condition #33: *"Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. MassDEP will review the data to determine if the sediment will require offsite disposal. Under no circumstances shall the material be transported until MassDEP has reviewed the data and approved disposal methods."*

Comments: Facilitating the efficient movement of soil from the project site to the disposal site is crucial for maintaining the construction schedule and avoiding logistical constraints within limited Right of Way construction projects. MassDOT proposes a system where the Contractor will share the electronic test results with MassDEP at the earliest opportunity, and MassDEP will render a formal approval within seven business days to ensure efficient construction operations and prevent costly delay claims from the contractor.

In addition to the comment above, the meaning of "determining whether the material requires offsite disposal" as stated by MassDEP is not entirely clear. This requires further clarification. Does this imply that the sediment exceeds the COMM 97 criteria for reuse as daily cover, thereby potentially necessitating disposal at an out-of-state facility?

Recommended Language: "Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC

data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. MassDEP will review the data to determine if the sediment exceeds these criteria and requires disposal, at an out-of-state facility, within seven calendar days to ensure efficient construction operations. Under no circumstances shall the material be transported until MassDEP has reviewed the data and approved disposal methods as consistent with the aforementioned timeframes."

Condition #34: *"Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined and securely covered with wind tear resistance tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down. Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted daily and more frequently immediately before, during and after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner."*

Comments:

1. It is generally not mandatory to bottom line stockpiles if they are placed on a paved surface, as the paved surface can serve as an adequate barrier to prevent contamination and runoff.
2. The requirement to place stockpiles at least 10 feet away from temporary construction access roads can be challenging, especially in confined project sites and laydown yards.
3. The requirement for immediate inspection and correction of deficiencies during and after storm events is impractical, especially during severe weather.

Recommended Language: "Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined if not placed on paved surfaces, and securely covered with wind tear resistance tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down. Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls whenever possible. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted in line with the frequency stated in Special Condition 20. Any observed deficiency shall be corrected or repaired in a timely manner."

Condition #36: *"Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation."*

Comments: The 90-day limit on stockpiling may be restrictive, particularly if there are delays in transportation or approval from disposal facilities or facility shutdowns. Extension provisions should be included to account for such delays.

Recommended Language: "Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation. Extensions can be requested to accommodate unforeseen delays."

Condition #43: *"BMPs shall be implemented during transportation of the dredged material to the licensed receiving facility. At a minimum, when transported upon public roadways, all dredged material shall have no free liquid as determined by the Paint Filter Test or other suitably analogous methodology acceptable to MassDEP, and a tarpaulin or other means shall be used to cover the dredged material during transport."*

Comments: Visual observation is sufficient to determine whether the dredged material contains any free liquids prior to shipment. The receiving facilities have physical acceptance criteria, ensuring that no material containing free liquids is accepted. The Contractor ensures that the material does not contain any liquids, but typically testing is not required as the determination is based on visual observation. Requiring additional testing is redundant and burdensome, given that visual assessment has proven reliable and effective in these situations.

Recommended Language: MassDOT requests that visual observation and receiving facility criteria be sufficient to facilitate transport of dredged material without any free liquids.

If you have any questions or would like to discuss further, please contact me at (978) 843-5276 or by email at ofartushnaya@greenintl.com.

Sincerely,

Oxana Fartushnaya
Client Manager II |Water Resources Group
Green International Affiliates, Inc.

Attached: 401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge), dated August 5, 2024

\\Egnytedrive\Greenintl\Shared\Engineering\Projects\2017\17118\Documents\ENV\WQC\DEP 401 WQC Amendment Request\Peabody 609211 401 WQC Amendment Request_24-WW26-0034-APP.Docx

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 5, 2024

City of Peabody
24 Lowell Street
Peabody, MA 01960
ATTN: Brendan Callahan, Assistant Director of Planning

RE: 401 WATER QUALITY CERTIFICATION
BRP WW 10, Major Fill Project
BRP WW 08, Minor Dredge Project
Independence Greenway Extension
Peabody, MA

401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge)
USACE Application No. NAE-2024-01390
MassDOT File Number: 609211

Dear Mr. Callahan:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed your application for a Water Quality Certification (WQC), as referenced above; this application was deemed complete on June 11, 2024. In accordance with the provisions of MGL Ch. 21, §§26-53 and Section 401 of the Federal Clean Water Act as amended (33 U.S.C. §1251 et seq.), it has been determined there is reasonable assurance the proposed project will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law.

The City of Peabody, in coordination with the Massachusetts Department of Transportation (MassDOT), proposes to extend the existing Independence Greenway rail trail from Essex Center Drive to Endicott Street along an existing former railroad right-of-way owned and maintained by the City of Peabody (the Project). The Project includes construction of a paved shared-use pathway (SUP) along the existing abandoned railroad right-of-way; construction of a light duty timber boardwalk structure supported on helical piles over Proctor Brook and associated wetlands; replacement of culverts that convey Proctor Brook and its tributaries beneath the railroad bed; stormwater infrastructure improvements; construction of a compensatory flood storage area; and modifications required for connections to the existing paths at either end including sidewalk reconstruction and drainage improvements. The Project purpose is to provide a continuation and connection of the existing rail trail facilities to be utilized by pedestrians and bicyclists.

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

Existing Conditions

The proposed SUP alignment generally extends in an east/west orientation along an existing abandoned and elevated railroad bed in a forested area. At the west end, a portion of the SUP will also extend along Essex Center Drive and Northshore Road to connect the alignment from the existing terminus of the Independence Greenway to the railroad bed. Essex Center Drive is classified as a local roadway with two 15-foot-wide lanes, a typical pavement width of 30 feet and five-foot-wide paved and concrete sidewalks on each side. Where Essex Center Drive extends under Route 128, it is 23 feet wide with 11-foot-wide and 12-foot-wide lanes, a 9.5-foot-wide raised median, and 3.5-foot-wide paved sidewalks on each side. Northshore Road is classified as a local roadway with two 11-foot-wide lanes, a pavement width of 23 feet, and a 4.5-foot-wide paved sidewalk on the west side.

Proctor Brook, a perennial stream, meanders west to east generally parallel to the railroad bed, crossing it in three locations. The bankfull width of Proctor Brook varies between 19 and 35 feet within the Project area. Two crossings at Stations 329+85 and 346+20 consist of culverts that are obstructed and/or washed out and are no longer functioning. Twin 42-inch culverts are present at Station 329+85 and the crossing at Station 346+20 was formerly a four-foot-high by approximately six-foot-wide concrete culvert that washed out. The third Proctor Brook crossing at Station 351+50 consists of a former railroad bridge that also washed out and is largely no longer present.

Two existing intermittent streams also flow north under the railroad bed at Stations 340+10 and 358+51 via a 30-inch corrugated metal pipe (CMP) and 15-inch ductile iron pipe (DIP), respectively. A 24-inch CMP at Station 342+20 provides a hydrologic connection between Bordering Vegetated Wetlands (BVWs) on either side of the railroad bed. Extensive BVWs are present along Proctor Brook and the railroad bed throughout the corridor.

On Essex Center Drive, Northshore Road, and Endicott Street, stormwater flows to a combination of country drainage and closed drainage systems. The Project will occur within a Federal Emergency Management Agency 1% annual chance of flooding zone (Zone AE) and Regulatory Floodway with a Base Flood Elevation ranging from 47.1 feet at the west end to 39.6 feet at the east end.

Project Description

The Project is approximately 1.3 miles in length. The SUP path will be 10 feet wide carrying two five-foot-wide travel lanes, one in each direction. Two-foot-wide stone dust shoulders will be present on either side along the railroad bed. Portions of Essex Center Drive will be fully reconstructed and/or repaved but will not be widened. Intersection improvements will also occur along Essex Center Drive, Northshore Road, and Endicott Street, and two compensatory flood storage areas will also be constructed along the SUP.

A 56-span light-duty timber boardwalk structure supported on helical piles will replace the previous railroad bridge that washed away. The boardwalk will be approximately 438 feet long and a total of 13 feet wide. It will carry two five-foot-wide travel lanes, one in each direction, with one-foot-wide shoulders on each side. Riprap scour protection will be placed along the abutment at the west end.

A four-foot-high by eight-foot-wide precast concrete box culvert will be installed at each of the Proctor Brook crossings at Stations 329+85 and 346+20. The streams within each box culvert will be restored

with 12 inches of natural streambed substrate and will match the existing invert elevations. Riprap scour protection will be installed within the channels as depicted on the plans approved herein.

The CMP at Station 340+10 will be replaced with a 36-inch DIP and the CMP at Station 342+20 will be replaced with a 24-inch DIP. Both culverts will be embedded 12 inches with a layer of natural streambed substrate and will match the existing invert elevations. The RCP at Station 358+51 will be replaced with a 16-inch DIP but due to its small diameter will not have natural stream substrate.

BVW and LUW Impacts

In total, 17,998 sf of fill impacts to BVWs and LUW are required to construct the Project; 2,344 sf of permanent and 4,681 sf of temporary BVW impacts, and 8,661 sf of permanent and 2,312 sf of temporary LUW impacts. The Project requires 1,491 cubic yards of dredging. Impacts are required to construct the boardwalk, replace the culverts, and install associated scour protection.

Alternatives Analysis

Several alternative alignments and cross sections were evaluated for the SUP. Constructing the SUP along Warren Street Extension rather than constructing the boardwalk over Proctor Brook and associated BVWs was considered but rejected due to safety concerns. The SUP and shoulders are the minimum width required and the side slopes have been narrowed to the extent practicable to avoid and minimize impacts to adjacent BVWs and LUW. Riprap scour protection in BVW and LUW at the culvert replacements is the minimum amount required based on Federal Highway Administration standards. A concrete deck was considered for the boardwalk but would require a more substantial substructure in BVWs and LUW, including the potential need for a pier and foundation. It would also require the use of larger equipment and potentially more temporary impacts. A timber boardwalk allows for the use of helical piles to support the structure, which results in less impacts to BVWs and LUW.

BVW and LUW Replication and Restoration

Permanent BVW impacts will be mitigated through construction of a 2,500 sf BVW replication area under the supervision of a qualified Wetland Scientist. The replication area will be located at the end of Gilmore Terrace along BVWs associated with Proctor Brook. Wetland soil will be installed to a depth of 18 inches to match the existing adjacent BVW elevation, the area will be planted with native trees and shrubs, and a native wetland seed mix will be applied.

Temporary BVW impacts will be restored in place under the supervision of a qualified Wetland Scientist. Where riprap scour protection will be placed in BVWs at the culvert replacements, a layer of compost will be placed over the riprap, native live stakes will be installed, and a native wetland seed mix will be applied. Twelve inches of natural streambed substrate will be placed over the riprap scour protection in LUW at the culvert replacements.

Stormwater Management Standards

The Project will increase impervious surface by 1.1 acres (46,907 sf). The roadway reconstruction portion of the Project qualifies as a redevelopment as defined at 314 CMR 9.02. Per Volume 1, Chapter

1 of the Massachusetts Stormwater Management Standards, the Standards only apply to the SUP portion of the Project to the maximum extent practicable.

Through the installation of deep sump catch basins, an infiltration trench, and a rock-lined drainage swale, the Project will meet Stormwater Management Standards 2, 3, and the structural stormwater best management practice requirements of Standard 4 to the maximum extent practicable. Two-foot-wide stone dust shoulders over eight inches of subbase gravel borrow will also be installed along each side of the SUP to capture and treat stormwater, which will improve existing conditions. A complete evaluation concluded additional Stormwater Control Measures are not practicable within the Project area.

Stream Crossing Standards

The Project will meet the Massachusetts Stream Crossing Standards to the maximum extent practicable in accordance with 314 CMR 9.06(2)(b)4. The boardwalk will meet all Stream Crossing Standards and all stream crossing culvert sizes will be increased from existing conditions. Except for the boardwalk, spans are not practicable for the other stream crossings and would require footings resulting in more impacts to adjacent BVWs and LUW. Both Proctor Brook culverts will exceed the openness ratio Standard. Twelve inches of natural streambed material will be placed within three of the replacement culverts which is the maximum practicable given the constraints. Improved water depths and velocities more consistent with natural conditions are anticipated due to the crossing improvements.

Sediment Chemistry

Sediment sample analytical results were compared to the Reportable Concentration (RC) S-1 criteria of the Massachusetts Contingency Plan (MCP). Results of the sediment samples analyzed indicated the presence of lead in Sample SS-3 in concentrations above the RC S-1 criteria. As conditioned herein, the City of Peabody is required to determine if dredged sediments are suitable for reuse or required to be handled and disposed of at an offsite facility in accordance with all applicable regulations. If required, all materials will be limited to specific pre-approved disposal facilities. MassDEP is to be notified, in writing, of the name and location of the licensed facility accepting the dredged material for disposal or reuse as daily cover material.

Invasive Species

Invasive species will be managed in accordance with an Invasive Plant Management Strategy (IPMS) to be approved by MassDEP.

Based on a review of information provided by the applicant, MassDEP finds that this project complies with the standards described under 314 CMR 9.06 and 9.07. Public notice was provided in the Peabody Weekly News on May 23, 2024, and in the MEPA Environmental Monitor on June 7, 2024. No comment letters were received during the public comment period.

Therefore, based on information currently in the record, MassDEP grants a WQC for this project subject to the following conditions to maintain water quality, to minimize impact on waters and wetlands, and to ensure compliance with appropriate state law. The Department further certifies in accordance with 314 CMR 9.00 that there is reasonable assurance the project or activity will be conducted in a manner

which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law. Finally, the Department has determined that upon satisfying the conditions and mitigation requirements of this approval, the project provides a level of water quality necessary to protect existing uses and accordingly finds that the project to be implemented satisfies the Surface Water Quality Standards at 314 CMR 4.00.

Pursuant to 314 CMR 9.09(1)(d); 314 CMR 9.06(6)(a); 310 CMR 9.06(2); 314 CMR 9.07; 314 CMR 9.07(1); 314 CMR 9.09(7)(5)(c); 314 CMR 9.11; and 314 CMR 9.09(1)(e), the following Special Conditions are necessary to ensure that construction practices and stormwater controls are implemented in such a manner as to prevent degradation to wetlands and waters; ensure that practicable steps have been taken which will avoid and minimize impacts to wetlands and waters; minimize turbidity and sediment caused by construction activities; ensure that water quality is not degraded, and that biology of the waters are not negatively impacted by potential discharges; and/or maintain a record of the dredged material for reference and to ensure accountability in its transportation.

Those Special Conditions that require direct submittals to MassDEP for either review, or review and approval, are denoted by the following notation (Submittal) at the end of the condition and are summarized in Attachment A. In addition, those conditions with the (Submittal) designation shall be included in the Special Provisions and, as applicable, reviewed at the Pre-Construction Meeting.

1. All work shall be performed in accordance with the following documents and plans:

    - Application for Water Quality Certification. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody, with cover letter and attachments. Dated May 15, 2024. 401 WQC Filing Number: 24-WW26-0034-APP.
    - Plans entitled: “Massachusetts Department of Transportation Highway Division Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the City of Peabody, Essex County. PS&E Submittal.” Last revised April 19, 2024.
    - MassDEP Administrative Completeness and Technical Deficiency Review. 401 WQC Transmittal No: 24-WW26-0034-APP (Fill and Dredge). Dated June 5, 2024.
    - Response to MassDEP Administrative Completeness and Technical Deficiency Review letter for 401 WQC Transmittal No: 24-WW26-0034-APP, including attachments. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody. Dated June 11, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Expanded Environmental Notification Form and Proposed Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated January 29, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated May 24, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Final Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated August 5, 2024.

- Order of Conditions issued by the Peabody Conservation Commission. MassDEP File #: 055-0939. Issued July 3, 2024.
- MassDEP Notice of Appeal. MassDEP File #055-0939. Issued July 15, 2024.

Pre-Construction

2. A qualified **Wetland Scientist** (WS) with a minimum of five years of relevant professional experience with wetland and stream replacement and restoration projects shall be employed to oversee all BVW and LUW replacement and restoration activities, including but not limited to grading, placement of substrate, seeding, vegetation plantings, and placement of wildlife habitat features. The name, contact information, and qualifications of the WS shall be provided to MassDEP for approval prior to the Pre-Construction Meeting required in Condition 4. The name and contact information of the approved WS shall be provided to the Peabody Conservation Commission prior to the start of work. **(Submittal)**

3. Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the Resident Engineer (RE) responsible for ensuring that all work complies with the conditions of this WQC. **(Submittal)**

4. A minimum of 21 days prior to the start of work, MassDOT shall contact MassDEP to schedule an onsite Pre-Construction Meeting to review the approved plans and terms and conditions of this WQC. The RE, the Construction Contractor (Contractor), the WS, and a representative from the MassDOT Environmental Section and/or the District Environmental Engineer shall attend the Pre-Construction Meeting.

5. MassDEP shall be copied on applicable submittals to the U.S. Army Corps of Engineers (USACE). These include but are not limited to: Self-Verification Notification Form (SVNF); Pre-Construction Notification (PCN); Work-Start Notification Form; Mitigation Work-Start Notification Form; and Compliance Certification Form. The Work-Start Notification Form shall be submitted at least 14 days before the anticipated start of work and the Compliance Certification Form shall be submitted within 30 days following the completion of the authorized work. **(Submittal)**

6. A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CP/PP) shall be developed and implemented as required by 314 CMR 9.06(6)(a)8. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit the CP/PP for review and approval. If the U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) applies, the Stormwater Pollution Prevention Plan (SWPPP) may serve as the CP/PP, providing it includes the measures required to be in the CP/PP per these Special Conditions, in addition to the measures specifically required by the CGP. Any subsequent changes to the Final CP/PP (defined herein as including the construction period SWPPP if applicable) must be approved by MassDEP. **(Submittal)**

7. Training regarding erosion and sedimentation controls is required. The RE, CP/PP Inspector, and any other relevant personnel responsible for erosion and sedimentation controls shall complete the EPA CGP Inspector Training, or other training that meets the CGP requirements, as well as

complete a comprehensive review of the Final CP/PP. Verification of proof of completion of the training shall be submitted to MassDEP prior to the start of work. **(Submittal)**

8. The CP/PP shall identify, but shall not be limited to, staging and laydown areas in relation to BVWs and LUW, proposed dewatering locations, proposed stockpile locations and their proximity to catch basins or other drainage conveyances that discharge to wetland resource areas, and the location of construction-period erosion and sedimentation controls.

9. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit a Water Management Plan for review and approval. The Plan shall include proposed methods to manage construction-period water including but not limited to dewatering methods and locations, specifications for any water bypass systems, and dredge and debris material dewatering prior to shipment off site, as applicable. The plan shall meet requirements of the CP/PP and be specific to the Project. Dewatering and water bypasses shall be conducted under the supervision of the RE and comply with the applicable conditions identified herein. **(Submittal)**

10. Prior to the start of work, approved erosion and sedimentation control measures shall be installed per the approved CP/PP and as applicable, the manufacturer specifications. Erosion and sedimentation control measures may consist of, but are not limited to, silt fence, staked straw bales, silt/turbidity curtains, compost filter tubes, etc.

11. Prior to the Pre-Construction Meeting, the boundaries of BVWs and LUW shall be re-flagged where they are within 50 feet of the limits of work. In the event BVWs and LUW boundaries overlap, the outermost boundary (i.e., closest to the proposed work) shall be flagged. All boundary markers, once in place, shall remain in place throughout construction until all disturbed surfaces have been permanently stabilized. Boundary markers shall be fully evaluated annually and refreshed where needed. Implementation of and compliance with this requirement shall be documented by the WS. All construction personnel shall be made aware of these markers.

12. A Flood Contingency Plan shall be submitted to MassDEP for review and approval that addresses areas that fall within the 1% annual chance of flooding zone within project limits. The Plan shall address the potential need for temporary relocation of construction and auxiliary equipment during flood events to designated upland locations above the Base Flood Elevation. The Plan shall be approved by MassDEP prior to any work within the 1% annual chance of flooding zone, including mobilization or storage of equipment and materials. **(Submittal)**

13. The applicant shall develop an Invasive Plant Management Strategy (IPMS) to be submitted to MassDEP for review and approval prior to the Pre-Construction Meeting. The IPMS shall be implemented as approved. **(Submittal)**

14. If needed, use of herbicides to control invasive species shall be implemented in accordance with the approved IPMS and with the following requirements:

    a. Herbicides can only be applied by a Licensed Applicator;

b. Applicant must provide MassDEP Material Safety Data Sheets (MSDS) of the product being used and must also keep MSDS sheets on site;

c. Product registration in MA with Massachusetts Pesticide Product Registration Number must be confirmed with Massachusetts Department of Agricultural Resources Pesticide Division;

d. EPA Registration Number for the product must be identified;

e. Product label restricted use provisions must be followed; and

f. Applicant must contact MassDEP Division of Watershed Planning to determine if a BRP WM 04 herbicide permit is required.

15. Final Construction Plans (the plans provided to the Contractor) shall be submitted for review at least 30 days prior to the Pre-Construction Meeting. Sufficient supporting information, explanation, and documentation shall be provided to MassDEP and the Peabody Conservation Commission for any changes, and MassDEP may at its discretion require additional supporting documentation as a condition of review. Once MassDEP provides written approval, the updated set of plans shall become the "Final Plan of Record." The Plan shall be prepared and signed by a Professional Engineer in the Commonwealth of Massachusetts and shall incorporate all revisions and additions to the original plans that have been approved as discussed herein. **(Submittal)**

Construction Period

16. No more than **2,344 sf** of permanent and **4,681 sf** of temporary impacts to BVWs shall occur. No more than **8,661 sf** of permanent and **2,312 sf** of temporary impacts to LUW shall occur. No more than **1,491 cy** of dredging in LUW shall occur. All work shall avoid unapproved impacts to BVW and LUW.

17. CP/PP inspections shall occur at least once every seven calendar days and within 24 hours of a storm event that produces 0.5 inches or more of rain within a 24-hour period, or at a more stringent frequency if the CP/PP requires.

18. Copies of CP/PP Inspection and Maintenance Log Forms shall be submitted to MassDEP within 14 days upon request.

19. Inspection and maintenance of erosion and sediment controls in active work areas shall be the responsibility of both the Contractor and RE. The project team shall include an individual with at least three years of experience with construction period erosion and sedimentation controls. The RE shall be ultimately responsible for inspection and maintenance of site controls. The RE and/or Contractor shall immediately notify MassDEP and the Peabody Conservation Commission if any unauthorized discharges to BVWs or LUW occur.

20. Disturbed areas shall be stabilized immediately after activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. The installation of stabilization measures

shall be implemented as soon as practicable, but no later than 14 calendar days after stabilization has been initiated.

21. Work within LUW shall be conducted in low or no-flow conditions to the extent practicable. Notice shall be provided to MassDEP and the Peabody Conservation Commission within 24 hours prior to the commencement of dewatering. Dewatering methods and location(s) shall be approved by the RE prior to use, and shall be documented in the CP/PP. There shall be no discharge of untreated dewatered stormwater or groundwater to BVWs or LUW. Any discharges shall be visibly free of sediment.

22. Additional erosion and sedimentation control materials shall be stored on-site at all times for emergency and routine replacement. Materials shall be kept covered, dry, and accessible at all times. The RE shall be responsible for anticipating the need for and installation of additional erosion and sedimentation controls and shall have the authority to require additional erosion control measures to protect wetland resource areas beyond what is shown on the plans if field conditions or professional judgment dictate that additional protection is necessary.

23. The RE shall monitor the National Weather Service forecast for updates, and upon issuance of a flood watch for the 1% annual chance of flooding zone, shall implement the flood contingency plan referenced in Condition 12.

24. Any storm drains with potential to receive discharge from stockpiled materials or construction operations shall be managed to inhibit the inflow of sediment while not increasing the likelihood of roadway flooding during periods of precipitation. Stockpiles shall be located no less than 50 feet from BVWs, LUW, catch basins, or other drainage conveyances that discharge to BVWs or LUW. The CP/PP shall specify measures to implement this. Filter fabric stretched under storm drain inlet grates are not acceptable for this purpose.

25. The contractor shall have designated washout areas for concrete equipment that will be comprised of impermeable material and sized to contain project concrete wastes and wash water. Concrete wash out areas shall be located no less than 50 feet from BVWs, LUW, and catch basins or other drainage conveyances that discharge directly or indirectly to BVWs, or LUW.

26. Refueling, washing, and cleaning of vehicles and other construction equipment shall not take place within 50 feet of BVWs or LUW and any wash water shall be contained such that it does not drain toward BVWs or LUW. MassDEP shall explicitly approve in writing any deviation to this condition for oversized stationary vehicles.

27. The contractor shall have spill containment kits on site. In the event of a release of fuels and/or oils, the local fire department and MassDEP shall be notified.

28. Construction vehicles or other vehicles or heavy equipment are prohibited from traversing over the proposed infiltration Stormwater Control Measures (SCMs) to avoid compaction of soils during construction. These areas shall be demarcated by silt fence with signage, or high visibility fencing. If access through the location of an infiltration SCM is unavoidable, the City of Peabody

or its Contractor shall request written approval from MassDEP to use low ground pressure equipment to complete the work. Following completion of the work, subsoils shall be tilled to a minimum depth of 18 inches prior to placement of final surface dressing materials required by the approved plans. Tilling shall only be conducted when the subsoils are in a friable condition and dry enough so that a clump cannot be formed into a ball shape by hand. No vehicles or heavy equipment shall be permitted within the infiltration SCM following placement of the final materials without written approval from MassDEP. Proposed infiltration SCMs shall remain offline until final stabilization is achieved, unless written approval is obtained from MassDEP.

29. If sheet piles are required, they shall be fully removed from wetland resource areas upon stabilization of the area as required. No portion of sheet piles shall remain unless approved by MassDEP in writing prior to installation. A request to leave sheet piles shall include, but not be limited to, demonstration that full removal of the sheet piles is not feasible or practicable, and an alternatives analysis demonstrating alternative methods to isolate the work area(s) are not feasible or practicable.

Dredging

30. No later than 21 days prior to commencement of dredging activity, a Dredged Material Dewatering Plan shall be submitted to MassDEP for review and approval. At a minimum, the Plan shall include but not be limited to the type of containment, method of dewatering (i.e. mechanical or by gravity), method of collecting the dewatered effluent and method of disposal. **(Submittal)**

31. All sediment management activities authorized by this WQC shall be conducted under the supervision of a Licensed Site Professional (LSP). Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the LSP. **(Submittal)**

32. A Health & Safety Plan shall be required for handling of sediment which has been characterized as exceeding MCP RCS-1 criteria. A copy shall be provided to MassDEP within six weeks of the effective of this WQC or two weeks prior to the commencement of the dredging operation, whichever comes first.

33. Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. MassDEP will review the data to determine if the sediment will require offsite disposal. Under no circumstances shall the material be transported until MassDEP has reviewed the data and approved disposal methods. **(Submittal)**

34. Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined and securely covered with wind tear resistance

tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down. Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted daily and more frequently immediately before, during and after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner.

35. In the event of a precipitation or storm event, the site shall be secured beforehand in such a way as to protect resource areas and waters on site and downstream of the site, including covering of stockpiles of dredged material. Sediment stockpile areas shall be inspected immediately prior to, during and immediately after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner to prevent discharge from the stockpiled material. If stormwater runoff and erosion is observed from stockpiled dredged material, additional erosion and/or damage prevention controls measures shall be implemented.

36. Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation.

37. Measures shall be in place to prevent turbid waters, due to dredging, demolition, or debris removal activities, from extending past the limits of work into Proctor Brook and its tributaries. These measures can be items such as turbidity curtains and/or sheet piles.

38. MassDEP shall be notified one week prior to the start of dredging so that staff may inspect the work for compliance throughout the project.

39. If visual turbidity escapes the controls in place, work shall stop immediately and MassDEP shall be notified within 24 hours. Work shall not resume until the issue is corrected and MassDEP to the satisfaction of MassDEP.

40. All turbidity controls shall be inspected daily by the RE. If any damage is observed the controls in place will be replaced or repaired immediately.

41. MassDEP shall be notified in writing of the name and location of the upland licensed facilities accepting the dredged material for disposal or reuse for review and approval. If the licensed facility is located out of state, documentation shall be provided to MassDEP that the dredged material disposal/reuse has been approved and will be accepted by the receiving state. The dredged material shall not be transported to the facility without concurrence of MassDEP.

42. Transportation and disposal of the dredged material shall be overseen by the LSP of record. A Bill-of-Lading (BOL) or a Material Shipping Record (MSR) shall be used to track the dredged material to the proposed intermediate (stockpiling /dewatering) facility. A fully executed copy of the BOL or MSR shall be provided to MassDEP within 30 days of final shipment to the reused location or facility.

43. BMPs shall be implemented during transportation of the dredged material to the licensed receiving facility. At a minimum, when transported upon public roadways, all dredged material shall have no free liquid as determined by the Paint Filter Test or other suitably analogous methodology acceptable to MassDEP, and a tarpaulin or other means shall be used to cover the dredged material during transport.

Wetland Mitigation

44. A minimum of 2,500 sf of wetland replication shall be completed in coordination with an approved WS. The WS shall oversee all BVW replication and restoration, including final grading, seeding, and planting. The WS shall confirm that constructed BVW replication and restoration areas have adequate soils and hydrology to promote wetland plant species prior to seeding and installation of plantings and shall recommend measures to amend soils and promote wetland hydrology as needed.

45. Planting and seeding shall not take place between November 15th and April 15th, except as allowed by MassDEP in writing. The WS shall inspect trees and shrubs to ensure they are healthy prior to planting. Trees and shrubs deemed unhealthy in the professional judgment of the WS shall be replaced. Plantings and seed mixes shall consist of native and non-invasive species. Species may be substituted at the recommendation of the WS, and review and approval by MassDEP.

46. At least 75% of the surface area of the BVW replication and restoration areas shall be vegetated with indigenous wetland plant species within two growing seasons, or the period required by the Section 404 permit, whichever is longer. Additionally, evidence of hydrology, including hydric soil formation shall be submitted at the same time. Annual monitoring reports shall be submitted by the WS no later than January 15th each year. Monitoring reports shall include an assessment based on the approved success criteria, representative photos, and recommended corrective actions as needed. **(Submittal)**

47. MassDEP reserves the right to determine the success or failure of the BVW replication and restoration areas, and reserves the right to require additional plantings, regrading, or other measures deemed necessary to promote success.

Stream Mitigation

48. The WS shall oversee all LUW replication and restoration. Placement of streambed materials shall take place in no- or low-flow conditions. The Water Management Plan required in Condition 9 shall include measures to create no-flow conditions for this work such as a pump bypass system or other dewatering method, if needed. Placement of streambed materials during greater than low-flow conditions shall require a placement plan, with a narrative describing turbidity control measures, submitted to MassDEP for review and approval.

49. Water shall be slowly introduced back into the restored and dewatered LUW work areas as to not cause erosion and sedimentation. This work shall be overseen by the WS.

50. MassDEP reserves the right to determine the success or failure of the LUW replication and restoration areas and reserves the right to require additional measures deemed necessary to promote success.

Post-Construction

51. All temporary erosion controls shall be removed at the conclusion of work once the surrounding area has achieved final stabilization.

General Conditions

52. Any proposed alterations, minor plan changes, or amendment requests, as well as any required submittals shall be sent by email for review and approval to heidi.davis@mass.gov and ryan.hale@mass.gov. **(Submittal)**

53. This WQC remains in effect for the same duration as the Section 404 permit that requires it.

54. No Special Condition set forth herein shall be construed or operate to prohibit MassDEP from taking enforcement against the City of Peabody or its contractors for any failure to comply with the terms and requirements of this WQC.

55. No activity authorized by this WQC may begin prior to expiration of the 21-day appeal period, or until a final decision is issued by MassDEP in the event of an appeal.

Failure to comply with this Certification is grounds for enforcement, including civil and criminal penalties, under MGL Ch. 21 §42, MGL Ch. 21A §16, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This Certification does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations.

NOTICE OF APPEAL RIGHTS

a.) Appeal Rights and Time Limits

Certain persons shall have a right to request an adjudicatory hearing concerning certifications by MassDEP when an application is required: (a) the applicant or property owner; (b) any person aggrieved by the decision who has submitted written comments during the public comment period; (c) any ten (10) persons of the Commonwealth pursuant to M.G.L. c.30A where a group member has submitted written comments during the public comment period; or (d) any governmental body or private organization with a mandate to protect the environment which has submitted written comments during the public comment period. Any person aggrieved, any ten (10) persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c.30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or

hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within twenty-one (21) days from the date of issuance of this Certificate, and addressed to:

Case Administrator
Department of Environmental Protection
100 Cambridge Street, 9th Floor
Boston, MA 02114

A copy of the request shall at the same time be sent by certified mail or hand delivery to the Department of Environmental Protection at:

Department of Environmental Protection
Commissioner's Office
100 Cambridge Street, Suite 900
Boston, MA 02114

b.) Contents of Hearing Request

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

3. the 401 Certification Transmittal Number;
4. the complete name of the applicant and address of the project;
5. the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
6. if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
7. a clear and concise statement that an adjudicatory hearing is being requested;
8. a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this Certificate, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief sought through the adjudicatory hearing, including specifically the changes desired in the final written Certification; and
9. a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Conservation and Recreation (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

c.) Filing Fee and Address

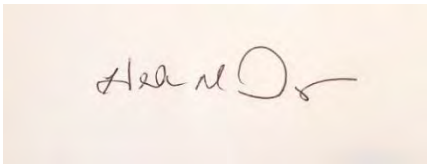
The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

Should you have any questions relative to this permit, please contact myself or Ryan Hale at heidi.davis@mass.gov and ryan.hale@mass.gov.

Very truly yours,



Heidi M. Davis
Highway Unit Supervisor

Ecc: DEP NERO – Jill Provencal
USACE – Dan Vasconcelos
MassDOT – Melissa Lenker
MassDOT – Erica Larner
MassDOT – Corinna Beckwith
Green International Affiliates, Inc. – Oxana Fartushnaya
Green International Affiliates, Inc – Danielle Spicer
Peabody Conservation Commission – Lucia DelNegro, Conservation Agent

ATTACHMENT A
PRE-CONSTRUCTION SUBMITTAL CHECKLIST

Independence Greenway Extension
Peabody, MA

THIS CHECKLIST MUST BE COMPLETED PRIOR TO THE START OF WORK. NOTE THAT SOME CONDITIONS REQUIRE THAT INFORMATION BE SUBMITTED A SPECIFIC NUMBER OF DAYS PRIOR TO THE START OF WORK OR THE PRE-CONSTRUCTION MEETING.

Condition	Required Submittal	Due Date	Date Submitted	Date Approved
PRE-CONSTRUCTION SUBMITTAL REQUIREMENTS				
2	Name, contact information, and qualifications of the WS, including specific experience and years to meet requirement	Prior to Pre-Construction Meeting		
3	Name and contact information of the RE	Prior to Pre-Construction Meeting		
5	USACE Work-Start Notification Form	14 days prior to work start		
6	CP/PP	14 days prior to work start		
7	EM Verification of SWPPP Training	Prior to work start		
9	Water Management Plan	14 days prior to work start		
12	Flood Contingency Plan	Prior to any work within 1% annual chance of flooding zone		
13	Invasive Plant Management Strategy	Prior to Pre-Construction Meeting		
15	Final Construction Plans	30 days prior to Pre-Construction Meeting		

重要 महत्वपूर्ण σημαντικός Important կարեւոր quan trọng مهم

Communication for Non-English-Speaking Parties

This document is important and should be translated immediately.

If you need this document translated, please contact MassDEP's Director of Environmental Justice at the telephone number listed below.

Español Spanish

Este documento es importante y debe ser traducido inmediatamente. Si necesita traducir este documento, póngase en contacto con el Director de Justicia Ambiental de MassDEP (*MassDEP's Director of Environmental Justice*) en el número de teléfono que figura más abajo.

Português Portuguese

Este documento é importante e deve ser traduzido imediatamente. Se você precisar traduzir este documento, entre em contato com o Diretor de Justiça Ambiental do MassDEP no número de telefone listado abaixo.

繁體中文 Chinese Traditional

本文檔很重要，需要即刻進行翻譯。
如需對本文檔進行翻譯，請透過如下列示電話號碼與 MassDEP 的環境司法總監聯絡。

简体中文 Chinese Simplified

这份文件非常重要，需要立即翻译。
如果您需要翻译这份文件，请通过下方电话与 MassDEP 环境司法主任联系。

Ayisyen Kreyòl Haitian Creole

Dokiman sa a enpòtan epi yo ta dwe tradui l imedyatman. Si w bezwen tradui dokiman sa a, tanpri kontakte Direktè. Jistis Anviwònmantal MassDEP a nan nimewo telefòn ki endike anba a.

Việt Vietnamese

Tài liệu này và quan trọng và phải được dịch ngay. Nếu quý vị cần bản dịch của tài liệu này, vui lòng liên hệ với Giám Đốc Phòng Công Lý Môi Trường của MassDEP theo số điện thoại được liệt kê bên dưới.

ប្រទេសកម្ពុជា Khmer/Cambodian

ឯកសារនេះមានសារៈសំខាន់
ហើយគប្បីត្រូវបានបកប្រែភ្លាមៗ.
ប្រសិនបើអ្នកត្រូវការអោយឯកសារនេះបកប្រែ
សូមទាក់ទងនាយកផ្នែកយុត្តិធម៌បរិស្ថានរបស់
MassDEPតាមរយៈលេខទូរស័ព្ទដែលបានរាយដូចខាងក្រោម។

Kriolu Kabuverdianu Cape Verdean

Es dokumentu sta important i tenki ser tradusidu immediatamenti. Se nho ta presisa ke es dokumentu sta tradisidu, por favor kontata O Diretor di Justisia di Environman di DEP ku es numero di telifoni menxionadu di baixo.

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Русский Russian

Это чрезвычайно важный документ, и он должен быть немедленно переведен. Если вам нужен перевод этого документа, обратитесь к директору Департамента экологического правосудия MassDEP (MassDEP's Director of Environmental Justice) по телефону, указанному ниже.

العربية Arabic

هذه الوثيقة مهمة وتجب ترجمتها على الفور.

إذا كنت بحاجة إلى ترجمة هذه الوثيقة، فيرجى الاتصال بمدير العدالة البيئية في MassDEP على رقم الهاتف المذكور أدناه.

한국어 Korean

이 문서는 중대하므로 즉시 번역되어야 합니다.
본 문서 번역이 필요하신 경우, 매사추세츠 환경보호부의 "환경정의" 담당자 분께 문의하십시오. 전화번호는 아래와 같습니다.

հայերեն Armenian

Այս փաստաթուղթը կարևոր է, և պետք է անհապաղ թարգմանել այն:
Եթե Ձեզ անհրաժեշտ է թարգմանել այս փաստաթուղթը, դիմեք Մասաչուսեթսի շրջակա միջավայրի պահպանության նախարարության (MassDEP) Բնապահպանական հարցերով արդարադատության ղեկավարին (Director of Environmental Justice)՝ ստորև նշված հեռախոսահամարով

فارسی Farsi Persian

این نوشتار بسیار مهمی است و باید فوراً ترجمه شود.
اگر نیاز به ترجمه این نوشتار دارید لطفاً با مدیر عدالت محیط زیستی MassDEP در شماره تلفن ذکر شده زیر تماس بگیرید.

Français French

Ce document est important et doit être traduit immédiatement. Si vous avez besoin d'une traduction de ce document, veuillez contacter le directeur de la justice environnementale du MassDEP au numéro de téléphone indiqué ci-dessous.

Deutsch German

Dieses Dokument ist wichtig und muss sofort übersetzt werden. Wenn Sie eine Übersetzung dieses Dokuments benötigen, wenden Sie sich bitte an MassDEP's Director of Environmental Justice *(Direktor für Umweltgerechtigkeit in Massachusetts)* unter der unten angegebenen Telefonnummer.

Ελληνική Greek

Το έγγραφο αυτό είναι πολύ σημαντικό και πρέπει να μεταφραστεί αμέσως. Αν χρειάζεστε μετάφραση του εγγράφου αυτού, παρακαλώ επικοινωνήστε με τον Διευθυντή του Τμήματος Περιβαλλοντικής Δικαιοσύνης της Μασαχουσέτης στον αριθμό τηλεφώνου που αναγράφεται παρακάτω

Italiano Italian

Questo documento è importante e deve essere tradotto immediatamente. Se hai bisogno di tradurre questo documento, contatta il Direttore della Giustizia Ambientale di MassDEP al numero di telefono sotto indicato.

Język Polski Polish

Ten dokument jest ważny i powinien zostać niezwłocznie przetłumaczony. Jeśli potrzebne jest tłumaczenie tego dokumentu, należy skontaktować się z dyrektorem ds. sprawiedliwości środowiskowej MassDEP pod numerem telefonu podanym poniżej.

हिन्दी Hindi

यह दस्तावेज महत्वपूर्ण है और इसका अनुवाद तुरंत किया जाना चाहिए। यदि आपको इस दस्तावेज का अनुवाद कराने की जरूरत है, तो कृपया नीचे दिए गए टेलीफोन नंबर पर MassDEP के पर्यावरणीय न्याय निदेशक से संपर्क करें।

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00841

MASSACHUSETTS
Department of Environmental Protection

Water Quality Certificate

THIS PAGE IS INTENTIONALLY LEFT BLANK

MassDEP
Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs
Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 5, 2024

City of Peabody
24 Lowell Street
Peabody, MA 01960
ATTN: Brendan Callahan, Assistant Director of Planning

RE: 401 WATER QUALITY CERTIFICATION
BRP WW 10, Major Fill Project
BRP WW 08, Minor Dredge Project
Independence Greenway Extension
Peabody, MA

401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge)
USACE Application No. NAE-2024-01390
MassDOT File Number: 609211

Dear Mr. Callahan:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed your application for a Water Quality Certification (WQC), as referenced above; this application was deemed complete on June 11, 2024. In accordance with the provisions of MGL Ch. 21, §§26-53 and Section 401 of the Federal Clean Water Act as amended (33 U.S.C. §1251 et seq.), it has been determined there is reasonable assurance the proposed project will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law.

The City of Peabody, in coordination with the Massachusetts Department of Transportation (MassDOT), proposes to extend the existing Independence Greenway rail trail from Essex Center Drive to Endicott Street along an existing former railroad right-of-way owned and maintained by the City of Peabody (the Project). The Project includes construction of a paved shared-use pathway (SUP) along the existing abandoned railroad right-of-way; construction of a light duty timber boardwalk structure supported on helical piles over Proctor Brook and associated wetlands; replacement of culverts that convey Proctor Brook and its tributaries beneath the railroad bed; stormwater infrastructure improvements; construction of a compensatory flood storage area; and modifications required for connections to the existing paths at either end including sidewalk reconstruction and drainage improvements. The Project purpose is to provide a continuation and connection of the existing rail trail facilities to be utilized by pedestrians and bicyclists.

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

Existing Conditions

The proposed SUP alignment generally extends in an east/west orientation along an existing abandoned and elevated railroad bed in a forested area. At the west end, a portion of the SUP will also extend along Essex Center Drive and Northshore Road to connect the alignment from the existing terminus of the Independence Greenway to the railroad bed. Essex Center Drive is classified as a local roadway with two 15-foot-wide lanes, a typical pavement width of 30 feet and five-foot-wide paved and concrete sidewalks on each side. Where Essex Center Drive extends under Route 128, it is 23 feet wide with 11-foot-wide and 12-foot-wide lanes, a 9.5-foot-wide raised median, and 3.5-foot-wide paved sidewalks on each side. Northshore Road is classified as a local roadway with two 11-foot-wide lanes, a pavement width of 23 feet, and a 4.5-foot-wide paved sidewalk on the west side.

Proctor Brook, a perennial stream, meanders west to east generally parallel to the railroad bed, crossing it in three locations. The bankfull width of Proctor Brook varies between 19 and 35 feet within the Project area. Two crossings at Stations 329+85 and 346+20 consist of culverts that are obstructed and/or washed out and are no longer functioning. Twin 42-inch culverts are present at Station 329+85 and the crossing at Station 346+20 was formerly a four-foot-high by approximately six-foot-wide concrete culvert that washed out. The third Proctor Brook crossing at Station 351+50 consists of a former railroad bridge that also washed out and is largely no longer present.

Two existing intermittent streams also flow north under the railroad bed at Stations 340+10 and 358+51 via a 30-inch corrugated metal pipe (CMP) and 15-inch ductile iron pipe (DIP), respectively. A 24-inch CMP at Station 342+20 provides a hydrologic connection between Bordering Vegetated Wetlands (BVWs) on either side of the railroad bed. Extensive BVWs are present along Proctor Brook and the railroad bed throughout the corridor.

On Essex Center Drive, Northshore Road, and Endicott Street, stormwater flows to a combination of country drainage and closed drainage systems. The Project will occur within a Federal Emergency Management Agency 1% annual chance of flooding zone (Zone AE) and Regulatory Floodway with a Base Flood Elevation ranging from 47.1 feet at the west end to 39.6 feet at the east end.

Project Description

The Project is approximately 1.3 miles in length. The SUP path will be 10 feet wide carrying two five-foot-wide travel lanes, one in each direction. Two-foot-wide stone dust shoulders will be present on either side along the railroad bed. Portions of Essex Center Drive will be fully reconstructed and/or repaved but will not be widened. Intersection improvements will also occur along Essex Center Drive, Northshore Road, and Endicott Street, and two compensatory flood storage areas will also be constructed along the SUP.

A 56-span light-duty timber boardwalk structure supported on helical piles will replace the previous railroad bridge that washed away. The boardwalk will be approximately 438 feet long and a total of 13 feet wide. It will carry two five-foot-wide travel lanes, one in each direction, with one-foot-wide shoulders on each side. Riprap scour protection will be placed along the abutment at the west end.

A four-foot-high by eight-foot-wide precast concrete box culvert will be installed at each of the Proctor Brook crossings at Stations 329+85 and 346+20. The streams within each box culvert will be restored

with 12 inches of natural streambed substrate and will match the existing invert elevations. Riprap scour protection will be installed within the channels as depicted on the plans approved herein.

The CMP at Station 340+10 will be replaced with a 36-inch DIP and the CMP at Station 342+20 will be replaced with a 24-inch DIP. Both culverts will be embedded 12 inches with a layer of natural streambed substrate and will match the existing invert elevations. The RCP at Station 358+51 will be replaced with a 16-inch DIP but due to its small diameter will not have natural stream substrate.

BVW and LUW Impacts

In total, 17,998 sf of fill impacts to BVWs and LUW are required to construct the Project; 2,344 sf of permanent and 4,681 sf of temporary BVW impacts, and 8,661 sf of permanent and 2,312 sf of temporary LUW impacts. The Project requires 1,491 cubic yards of dredging. Impacts are required to construct the boardwalk, replace the culverts, and install associated scour protection.

Alternatives Analysis

Several alternative alignments and cross sections were evaluated for the SUP. Constructing the SUP along Warren Street Extension rather than constructing the boardwalk over Proctor Brook and associated BVWs was considered but rejected due to safety concerns. The SUP and shoulders are the minimum width required and the side slopes have been narrowed to the extent practicable to avoid and minimize impacts to adjacent BVWs and LUW. Riprap scour protection in BVW and LUW at the culvert replacements is the minimum amount required based on Federal Highway Administration standards. A concrete deck was considered for the boardwalk but would require a more substantial substructure in BVWs and LUW, including the potential need for a pier and foundation. It would also require the use of larger equipment and potentially more temporary impacts. A timber boardwalk allows for the use of helical piles to support the structure, which results in less impacts to BVWs and LUW.

BVW and LUW Replication and Restoration

Permanent BVW impacts will be mitigated through construction of a 2,500 sf BVW replication area under the supervision of a qualified Wetland Scientist. The replication area will be located at the end of Gilmore Terrace along BVWs associated with Proctor Brook. Wetland soil will be installed to a depth of 18 inches to match the existing adjacent BVW elevation, the area will be planted with native trees and shrubs, and a native wetland seed mix will be applied.

Temporary BVW impacts will be restored in place under the supervision of a qualified Wetland Scientist. Where riprap scour protection will be placed in BVWs at the culvert replacements, a layer of compost will be placed over the riprap, native live stakes will be installed, and a native wetland seed mix will be applied. Twelve inches of natural streambed substrate will be placed over the riprap scour protection in LUW at the culvert replacements.

Stormwater Management Standards

The Project will increase impervious surface by 1.1 acres (46,907 sf). The roadway reconstruction portion of the Project qualifies as a redevelopment as defined at 314 CMR 9.02. Per Volume 1, Chapter

1 of the Massachusetts Stormwater Management Standards, the Standards only apply to the SUP portion of the Project to the maximum extent practicable.

Through the installation of deep sump catch basins, an infiltration trench, and a rock-lined drainage swale, the Project will meet Stormwater Management Standards 2, 3, and the structural stormwater best management practice requirements of Standard 4 to the maximum extent practicable. Two-foot-wide stone dust shoulders over eight inches of subbase gravel borrow will also be installed along each side of the SUP to capture and treat stormwater, which will improve existing conditions. A complete evaluation concluded additional Stormwater Control Measures are not practicable within the Project area.

Stream Crossing Standards

The Project will meet the Massachusetts Stream Crossing Standards to the maximum extent practicable in accordance with 314 CMR 9.06(2)(b)4. The boardwalk will meet all Stream Crossing Standards and all stream crossing culvert sizes will be increased from existing conditions. Except for the boardwalk, spans are not practicable for the other stream crossings and would require footings resulting in more impacts to adjacent BVWs and LUW. Both Proctor Brook culverts will exceed the openness ratio Standard. Twelve inches of natural streambed material will be placed within three of the replacement culverts which is the maximum practicable given the constraints. Improved water depths and velocities more consistent with natural conditions are anticipated due to the crossing improvements.

Sediment Chemistry

Sediment sample analytical results were compared to the Reportable Concentration (RC) S-1 criteria of the Massachusetts Contingency Plan (MCP). Results of the sediment samples analyzed indicated the presence of lead in Sample SS-3 in concentrations above the RC S-1 criteria. As conditioned herein, the City of Peabody is required to determine if dredged sediments are suitable for reuse or required to be handled and disposed of at an offsite facility in accordance with all applicable regulations. If required, all materials will be limited to specific pre-approved disposal facilities. MassDEP is to be notified, in writing, of the name and location of the licensed facility accepting the dredged material for disposal or reuse as daily cover material.

Invasive Species

Invasive species will be managed in accordance with an Invasive Plant Management Strategy (IPMS) to be approved by MassDEP.

Based on a review of information provided by the applicant, MassDEP finds that this project complies with the standards described under 314 CMR 9.06 and 9.07. Public notice was provided in the Peabody Weekly News on May 23, 2024, and in the MEPA Environmental Monitor on June 7, 2024. No comment letters were received during the public comment period.

Therefore, based on information currently in the record, MassDEP grants a WQC for this project subject to the following conditions to maintain water quality, to minimize impact on waters and wetlands, and to ensure compliance with appropriate state law. The Department further certifies in accordance with 314 CMR 9.00 that there is reasonable assurance the project or activity will be conducted in a manner

which will not violate applicable water quality standards (314 CMR 4.00) and other applicable requirements of state law. Finally, the Department has determined that upon satisfying the conditions and mitigation requirements of this approval, the project provides a level of water quality necessary to protect existing uses and accordingly finds that the project to be implemented satisfies the Surface Water Quality Standards at 314 CMR 4.00.

Pursuant to 314 CMR 9.09(1)(d); 314 CMR 9.06(6)(a); 310 CMR 9.06(2); 314 CMR 9.07; 314 CMR 9.07(1); 314 CMR 9.09(7)(5)(c); 314 CMR 9.11; and 314 CMR 9.09(1)(e), the following Special Conditions are necessary to ensure that construction practices and stormwater controls are implemented in such a manner as to prevent degradation to wetlands and waters; ensure that practicable steps have been taken which will avoid and minimize impacts to wetlands and waters; minimize turbidity and sediment caused by construction activities; ensure that water quality is not degraded, and that biology of the waters are not negatively impacted by potential discharges; and/or maintain a record of the dredged material for reference and to ensure accountability in its transportation.

Those Special Conditions that require direct submittals to MassDEP for either review, or review and approval, are denoted by the following notation (Submittal) at the end of the condition and are summarized in Attachment A. In addition, those conditions with the (Submittal) designation shall be included in the Special Provisions and, as applicable, reviewed at the Pre-Construction Meeting.

1. All work shall be performed in accordance with the following documents and plans:

    - Application for Water Quality Certification. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody, with cover letter and attachments. Dated May 15, 2024. 401 WQC Filing Number: 24-WW26-0034-APP.
    - Plans entitled: “Massachusetts Department of Transportation Highway Division Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the City of Peabody, Essex County. PS&E Submittal.” Last revised April 19, 2024.
    - MassDEP Administrative Completeness and Technical Deficiency Review. 401 WQC Transmittal No: 24-WW26-0034-APP (Fill and Dredge). Dated June 5, 2024.
    - Response to MassDEP Administrative Completeness and Technical Deficiency Review letter for 401 WQC Transmittal No: 24-WW26-0034-APP, including attachments. Prepared by Green International Affiliates, Inc. on behalf of the City of Peabody. Dated June 11, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Expanded Environmental Notification Form and Proposed Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated January 29, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated May 24, 2024.
    - Certificate of the Secretary of Energy and Environmental Affairs on the Final Environmental Impact Report. Independence Greenway Extension. EEA Number 16778. Dated August 5, 2024.

- Order of Conditions issued by the Peabody Conservation Commission. MassDEP File #: 055-0939. Issued July 3, 2024.
- MassDEP Notice of Appeal. MassDEP File #055-0939. Issued July 15, 2024.

Pre-Construction

2. A qualified **Wetland Scientist** (WS) with a minimum of five years of relevant professional experience with wetland and stream replacement and restoration projects shall be employed to oversee all BVW and LUW replacement and restoration activities, including but not limited to grading, placement of substrate, seeding, vegetation plantings, and placement of wildlife habitat features. The name, contact information, and qualifications of the WS shall be provided to MassDEP for approval prior to the Pre-Construction Meeting required in Condition 4. The name and contact information of the approved WS shall be provided to the Peabody Conservation Commission prior to the start of work. **(Submittal)**

3. Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the Resident Engineer (RE) responsible for ensuring that all work complies with the conditions of this WQC. **(Submittal)**

4. A minimum of 21 days prior to the start of work, MassDOT shall contact MassDEP to schedule an onsite Pre-Construction Meeting to review the approved plans and terms and conditions of this WQC. The RE, the Construction Contractor (Contractor), the WS, and a representative from the MassDOT Environmental Section and/or the District Environmental Engineer shall attend the Pre-Construction Meeting.

5. MassDEP shall be copied on applicable submittals to the U.S. Army Corps of Engineers (USACE). These include but are not limited to: Self-Verification Notification Form (SVNF); Pre-Construction Notification (PCN); Work-Start Notification Form; Mitigation Work-Start Notification Form; and Compliance Certification Form. The Work-Start Notification Form shall be submitted at least 14 days before the anticipated start of work and the Compliance Certification Form shall be submitted within 30 days following the completion of the authorized work. **(Submittal)**

6. A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CP/PP) shall be developed and implemented as required by 314 CMR 9.06(6)(a)8. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit the CP/PP for review and approval. If the U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) applies, the Stormwater Pollution Prevention Plan (SWPPP) may serve as the CP/PP, providing it includes the measures required to be in the CP/PP per these Special Conditions, in addition to the measures specifically required by the CGP. Any subsequent changes to the Final CP/PP (defined herein as including the construction period SWPPP if applicable) must be approved by MassDEP. **(Submittal)**

7. Training regarding erosion and sedimentation controls is required. The RE, CP/PP Inspector, and any other relevant personnel responsible for erosion and sedimentation controls shall complete the EPA CGP Inspector Training, or other training that meets the CGP requirements, as well as

complete a comprehensive review of the Final CP/PP. Verification of proof of completion of the training shall be submitted to MassDEP prior to the start of work. **(Submittal)**

8. The CP/PP shall identify, but shall not be limited to, staging and laydown areas in relation to BVWs and LUW, proposed dewatering locations, proposed stockpile locations and their proximity to catch basins or other drainage conveyances that discharge to wetland resource areas, and the location of construction-period erosion and sedimentation controls.

9. A minimum of 14 days prior to the start of work, the City of Peabody or its Contractor shall submit a Water Management Plan for review and approval. The Plan shall include proposed methods to manage construction-period water including but not limited to dewatering methods and locations, specifications for any water bypass systems, and dredge and debris material dewatering prior to shipment off site, as applicable. The plan shall meet requirements of the CP/PP and be specific to the Project. Dewatering and water bypasses shall be conducted under the supervision of the RE and comply with the applicable conditions identified herein. **(Submittal)**

10. Prior to the start of work, approved erosion and sedimentation control measures shall be installed per the approved CP/PP and as applicable, the manufacturer specifications. Erosion and sedimentation control measures may consist of, but are not limited to, silt fence, staked straw bales, silt/turbidity curtains, compost filter tubes, etc.

11. Prior to the Pre-Construction Meeting, the boundaries of BVWs and LUW shall be re-flagged where they are within 50 feet of the limits of work. In the event BVWs and LUW boundaries overlap, the outermost boundary (i.e., closest to the proposed work) shall be flagged. All boundary markers, once in place, shall remain in place throughout construction until all disturbed surfaces have been permanently stabilized. Boundary markers shall be fully evaluated annually and refreshed where needed. Implementation of and compliance with this requirement shall be documented by the WS. All construction personnel shall be made aware of these markers.

12. A Flood Contingency Plan shall be submitted to MassDEP for review and approval that addresses areas that fall within the 1% annual chance of flooding zone within project limits. The Plan shall address the potential need for temporary relocation of construction and auxiliary equipment during flood events to designated upland locations above the Base Flood Elevation. The Plan shall be approved by MassDEP prior to any work within the 1% annual chance of flooding zone, including mobilization or storage of equipment and materials. **(Submittal)**

13. The applicant shall develop an Invasive Plant Management Strategy (IPMS) to be submitted to MassDEP for review and approval prior to the Pre-Construction Meeting. The IPMS shall be implemented as approved. **(Submittal)**

14. If needed, use of herbicides to control invasive species shall be implemented in accordance with the approved IPMS and with the following requirements:

    a. Herbicides can only be applied by a Licensed Applicator;

b. Applicant must provide MassDEP Material Safety Data Sheets (MSDS) of the product being used and must also keep MSDS sheets on site;

c. Product registration in MA with Massachusetts Pesticide Product Registration Number must be confirmed with Massachusetts Department of Agricultural Resources Pesticide Division;

d. EPA Registration Number for the product must be identified;

e. Product label restricted use provisions must be followed; and

f. Applicant must contact MassDEP Division of Watershed Planning to determine if a BRP WM 04 herbicide permit is required.

15. Final Construction Plans (the plans provided to the Contractor) shall be submitted for review at least 30 days prior to the Pre-Construction Meeting. Sufficient supporting information, explanation, and documentation shall be provided to MassDEP and the Peabody Conservation Commission for any changes, and MassDEP may at its discretion require additional supporting documentation as a condition of review. Once MassDEP provides written approval, the updated set of plans shall become the "Final Plan of Record." The Plan shall be prepared and signed by a Professional Engineer in the Commonwealth of Massachusetts and shall incorporate all revisions and additions to the original plans that have been approved as discussed herein. **(Submittal)**

Construction Period

16. No more than **2,344 sf** of permanent and **4,681 sf** of temporary impacts to BVWs shall occur. No more than **8,661 sf** of permanent and **2,312 sf** of temporary impacts to LUW shall occur. No more than **1,491 cy** of dredging in LUW shall occur. All work shall avoid unapproved impacts to BVW and LUW.

17. CP/PP inspections shall occur at least once every seven calendar days and within 24 hours of a storm event that produces 0.5 inches or more of rain within a 24-hour period, or at a more stringent frequency if the CP/PP requires.

18. Copies of CP/PP Inspection and Maintenance Log Forms shall be submitted to MassDEP within 14 days upon request.

19. Inspection and maintenance of erosion and sediment controls in active work areas shall be the responsibility of both the Contractor and RE. The project team shall include an individual with at least three years of experience with construction period erosion and sedimentation controls. The RE shall be ultimately responsible for inspection and maintenance of site controls. The RE and/or Contractor shall immediately notify MassDEP and the Peabody Conservation Commission if any unauthorized discharges to BVWs or LUW occur.

20. Disturbed areas shall be stabilized immediately after activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. The installation of stabilization measures

shall be implemented as soon as practicable, but no later than 14 calendar days after stabilization has been initiated.

21. Work within LUW shall be conducted in low or no-flow conditions to the extent practicable. Notice shall be provided to MassDEP and the Peabody Conservation Commission within 24 hours prior to the commencement of dewatering. Dewatering methods and location(s) shall be approved by the RE prior to use, and shall be documented in the CP/PP. There shall be no discharge of untreated dewatered stormwater or groundwater to BVWs or LUW. Any discharges shall be visibly free of sediment.

22. Additional erosion and sedimentation control materials shall be stored on-site at all times for emergency and routine replacement. Materials shall be kept covered, dry, and accessible at all times. The RE shall be responsible for anticipating the need for and installation of additional erosion and sedimentation controls and shall have the authority to require additional erosion control measures to protect wetland resource areas beyond what is shown on the plans if field conditions or professional judgment dictate that additional protection is necessary.

23. The RE shall monitor the National Weather Service forecast for updates, and upon issuance of a flood watch for the 1% annual chance of flooding zone, shall implement the flood contingency plan referenced in Condition 12.

24. Any storm drains with potential to receive discharge from stockpiled materials or construction operations shall be managed to inhibit the inflow of sediment while not increasing the likelihood of roadway flooding during periods of precipitation. Stockpiles shall be located no less than 50 feet from BVWs, LUW, catch basins, or other drainage conveyances that discharge to BVWs or LUW. The CP/PP shall specify measures to implement this. Filter fabric stretched under storm drain inlet grates are not acceptable for this purpose.

25. The contractor shall have designated washout areas for concrete equipment that will be comprised of impermeable material and sized to contain project concrete wastes and wash water. Concrete wash out areas shall be located no less than 50 feet from BVWs, LUW, and catch basins or other drainage conveyances that discharge directly or indirectly to BVWs, or LUW.

26. Refueling, washing, and cleaning of vehicles and other construction equipment shall not take place within 50 feet of BVWs or LUW and any wash water shall be contained such that it does not drain toward BVWs or LUW. MassDEP shall explicitly approve in writing any deviation to this condition for oversized stationary vehicles.

27. The contractor shall have spill containment kits on site. In the event of a release of fuels and/or oils, the local fire department and MassDEP shall be notified.

28. Construction vehicles or other vehicles or heavy equipment are prohibited from traversing over the proposed infiltration Stormwater Control Measures (SCMs) to avoid compaction of soils during construction. These areas shall be demarcated by silt fence with signage, or high visibility fencing. If access through the location of an infiltration SCM is unavoidable, the City of Peabody

or its Contractor shall request written approval from MassDEP to use low ground pressure equipment to complete the work. Following completion of the work, subsoils shall be tilled to a minimum depth of 18 inches prior to placement of final surface dressing materials required by the approved plans. Tilling shall only be conducted when the subsoils are in a friable condition and dry enough so that a clump cannot be formed into a ball shape by hand. No vehicles or heavy equipment shall be permitted within the infiltration SCM following placement of the final materials without written approval from MassDEP. Proposed infiltration SCMs shall remain offline until final stabilization is achieved, unless written approval is obtained from MassDEP.

29. If sheet piles are required, they shall be fully removed from wetland resource areas upon stabilization of the area as required. No portion of sheet piles shall remain unless approved by MassDEP in writing prior to installation. A request to leave sheet piles shall include, but not be limited to, demonstration that full removal of the sheet piles is not feasible or practicable, and an alternatives analysis demonstrating alternative methods to isolate the work area(s) are not feasible or practicable.

Dredging

30. No later than 21 days prior to commencement of dredging activity, a Dredged Material Dewatering Plan shall be submitted to MassDEP for review and approval. At a minimum, the Plan shall include but not be limited to the type of containment, method of dewatering (i.e. mechanical or by gravity), method of collecting the dewatered effluent and method of disposal. **(Submittal)**

31. All sediment management activities authorized by this WQC shall be conducted under the supervision of a Licensed Site Professional (LSP). Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name and contact information of the LSP. **(Submittal)**

32. A Health & Safety Plan shall be required for handling of sediment which has been characterized as exceeding MCP RCS-1 criteria. A copy shall be provided to MassDEP within six weeks of the effective of this WQC or two weeks prior to the commencement of the dredging operation, whichever comes first.

33. Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. MassDEP will review the data to determine if the sediment will require offsite disposal. Under no circumstances shall the material be transported until MassDEP has reviewed the data and approved disposal methods. **(Submittal)**

34. Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined and securely covered with wind tear resistance

tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down. Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted daily and more frequently immediately before, during and after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner.

35. In the event of a precipitation or storm event, the site shall be secured beforehand in such a way as to protect resource areas and waters on site and downstream of the site, including covering of stockpiles of dredged material. Sediment stockpile areas shall be inspected immediately prior to, during and immediately after all precipitation and storm events. Any observed deficiency shall be corrected or repaired in a timely manner to prevent discharge from the stockpiled material. If stormwater runoff and erosion is observed from stockpiled dredged material, additional erosion and/or damage prevention controls measures shall be implemented.

36. Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation.

37. Measures shall be in place to prevent turbid waters, due to dredging, demolition, or debris removal activities, from extending past the limits of work into Proctor Brook and its tributaries. These measures can be items such as turbidity curtains and/or sheet piles.

38. MassDEP shall be notified one week prior to the start of dredging so that staff may inspect the work for compliance throughout the project.

39. If visual turbidity escapes the controls in place, work shall stop immediately and MassDEP shall be notified within 24 hours. Work shall not resume until the issue is corrected and MassDEP to the satisfaction of MassDEP.

40. All turbidity controls shall be inspected daily by the RE. If any damage is observed the controls in place will be replaced or repaired immediately.

41. MassDEP shall be notified in writing of the name and location of the upland licensed facilities accepting the dredged material for disposal or reuse for review and approval. If the licensed facility is located out of state, documentation shall be provided to MassDEP that the dredged material disposal/reuse has been approved and will be accepted by the receiving state. The dredged material shall not be transported to the facility without concurrence of MassDEP.

42. Transportation and disposal of the dredged material shall be overseen by the LSP of record. A Bill-of-Lading (BOL) or a Material Shipping Record (MSR) shall be used to track the dredged material to the proposed intermediate (stockpiling /dewatering) facility. A fully executed copy of the BOL or MSR shall be provided to MassDEP within 30 days of final shipment to the reused location or facility.

43. BMPs shall be implemented during transportation of the dredged material to the licensed receiving facility. At a minimum, when transported upon public roadways, all dredged material shall have no free liquid as determined by the Paint Filter Test or other suitably analogous methodology acceptable to MassDEP, and a tarpaulin or other means shall be used to cover the dredged material during transport.

Wetland Mitigation

44. A minimum of 2,500 sf of wetland replication shall be completed in coordination with an approved WS. The WS shall oversee all BVW replication and restoration, including final grading, seeding, and planting. The WS shall confirm that constructed BVW replication and restoration areas have adequate soils and hydrology to promote wetland plant species prior to seeding and installation of plantings and shall recommend measures to amend soils and promote wetland hydrology as needed.

45. Planting and seeding shall not take place between November 15th and April 15th, except as allowed by MassDEP in writing. The WS shall inspect trees and shrubs to ensure they are healthy prior to planting. Trees and shrubs deemed unhealthy in the professional judgment of the WS shall be replaced. Plantings and seed mixes shall consist of native and non-invasive species. Species may be substituted at the recommendation of the WS, and review and approval by MassDEP.

46. At least 75% of the surface area of the BVW replication and restoration areas shall be vegetated with indigenous wetland plant species within two growing seasons, or the period required by the Section 404 permit, whichever is longer. Additionally, evidence of hydrology, including hydric soil formation shall be submitted at the same time. Annual monitoring reports shall be submitted by the WS no later than January 15th each year. Monitoring reports shall include an assessment based on the approved success criteria, representative photos, and recommended corrective actions as needed. **(Submittal)**

47. MassDEP reserves the right to determine the success or failure of the BVW replication and restoration areas, and reserves the right to require additional plantings, regrading, or other measures deemed necessary to promote success.

Stream Mitigation

48. The WS shall oversee all LUW replication and restoration. Placement of streambed materials shall take place in no- or low-flow conditions. The Water Management Plan required in Condition 9 shall include measures to create no-flow conditions for this work such as a pump bypass system or other dewatering method, if needed. Placement of streambed materials during greater than low-flow conditions shall require a placement plan, with a narrative describing turbidity control measures, submitted to MassDEP for review and approval.

49. Water shall be slowly introduced back into the restored and dewatered LUW work areas as to not cause erosion and sedimentation. This work shall be overseen by the WS.

50. MassDEP reserves the right to determine the success or failure of the LUW replication and restoration areas and reserves the right to require additional measures deemed necessary to promote success.

Post-Construction

51. All temporary erosion controls shall be removed at the conclusion of work once the surrounding area has achieved final stabilization.

General Conditions

52. Any proposed alterations, minor plan changes, or amendment requests, as well as any required submittals shall be sent by email for review and approval to heidi.davis@mass.gov and ryan.hale@mass.gov. **(Submittal)**

53. This WQC remains in effect for the same duration as the Section 404 permit that requires it.

54. No Special Condition set forth herein shall be construed or operate to prohibit MassDEP from taking enforcement against the City of Peabody or its contractors for any failure to comply with the terms and requirements of this WQC.

55. No activity authorized by this WQC may begin prior to expiration of the 21-day appeal period, or until a final decision is issued by MassDEP in the event of an appeal.

Failure to comply with this Certification is grounds for enforcement, including civil and criminal penalties, under MGL Ch. 21 §42, MGL Ch. 21A §16, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This Certification does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations.

NOTICE OF APPEAL RIGHTS

a.) Appeal Rights and Time Limits

Certain persons shall have a right to request an adjudicatory hearing concerning certifications by MassDEP when an application is required: (a) the applicant or property owner; (b) any person aggrieved by the decision who has submitted written comments during the public comment period; (c) any ten (10) persons of the Commonwealth pursuant to M.G.L. c.30A where a group member has submitted written comments during the public comment period; or (d) any governmental body or private organization with a mandate to protect the environment which has submitted written comments during the public comment period. Any person aggrieved, any ten (10) persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c.30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or

hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within twenty-one (21) days from the date of issuance of this Certificate, and addressed to:

Case Administrator
Department of Environmental Protection
100 Cambridge Street, 9th Floor
Boston, MA 02114

A copy of the request shall at the same time be sent by certified mail or hand delivery to the Department of Environmental Protection at:

Department of Environmental Protection
Commissioner's Office
100 Cambridge Street, Suite 900
Boston, MA 02114

b.) Contents of Hearing Request

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

3. the 401 Certification Transmittal Number;
4. the complete name of the applicant and address of the project;
5. the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
6. if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
7. a clear and concise statement that an adjudicatory hearing is being requested;
8. a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this Certificate, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief sought through the adjudicatory hearing, including specifically the changes desired in the final written Certification; and
9. a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Conservation and Recreation (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

c.) Filing Fee and Address

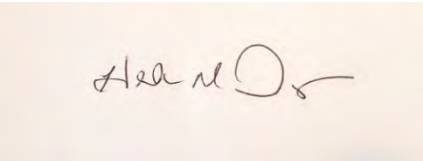
The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

Should you have any questions relative to this permit, please contact myself or Ryan Hale at heidi.davis@mass.gov and ryan.hale@mass.gov.

Very truly yours,



Heidi M. Davis
Highway Unit Supervisor

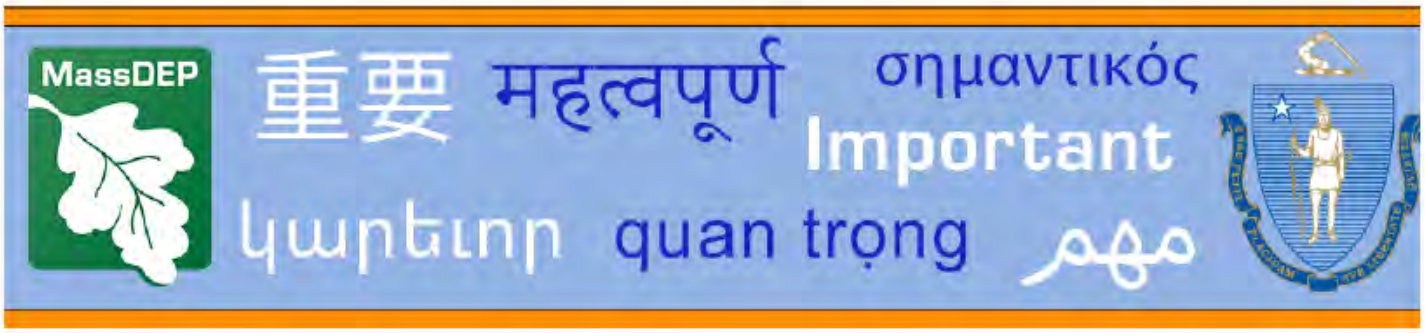
Ecc: DEP NERO – Jill Provencal
USACE – Dan Vasconcelos
MassDOT – Melissa Lenker
MassDOT – Erica Larner
MassDOT – Corinna Beckwith
Green International Affiliates, Inc. – Oxana Fartushnaya
Green International Affiliates, Inc – Danielle Spicer
Peabody Conservation Commission – Lucia DelNegro, Conservation Agent

ATTACHMENT A
PRE-CONSTRUCTION SUBMITTAL CHECKLIST

Independence Greenway Extension
Peabody, MA

THIS CHECKLIST MUST BE COMPLETED PRIOR TO THE START OF WORK. NOTE THAT SOME CONDITIONS REQUIRE THAT INFORMATION BE SUBMITTED A SPECIFIC NUMBER OF DAYS PRIOR TO THE START OF WORK OR THE PRE-CONSTRUCTION MEETING.

Condition	Required Submittal	Due Date	Date Submitted	Date Approved
PRE-CONSTRUCTION SUBMITTAL REQUIREMENTS				
2	Name, contact information, and qualifications of the WS, including specific experience and years to meet requirement	Prior to Pre-Construction Meeting		
3	Name and contact information of the RE	Prior to Pre-Construction Meeting		
5	USACE Work-Start Notification Form	14 days prior to work start		
6	CP/PP	14 days prior to work start		
7	EM Verification of SWPPP Training	Prior to work start		
9	Water Management Plan	14 days prior to work start		
12	Flood Contingency Plan	Prior to any work within 1% annual chance of flooding zone		
13	Invasive Plant Management Strategy	Prior to Pre-Construction Meeting		
15	Final Construction Plans	30 days prior to Pre-Construction Meeting		



Communication for Non-English-Speaking Parties

This document is important and should be translated immediately.

If you need this document translated, please contact MassDEP's Director of Environmental Justice at the telephone number listed below.

Español Spanish

Este documento es importante y debe ser traducido inmediatamente. Si necesita traducir este documento, póngase en contacto con el Director de Justicia Ambiental de MassDEP (*MassDEP's Director of Environmental Justice*) en el número de teléfono que figura más abajo.

Português Portuguese

Este documento é importante e deve ser traduzido imediatamente. Se você precisar traduzir este documento, entre em contato com o Diretor de Justiça Ambiental do MassDEP no número de telefone listado abaixo.

繁體中文 Chinese Traditional

本文檔很重要，需要即刻進行翻譯。
如需對本文檔進行翻譯，請透過如下列示電話號碼與 MassDEP 的環境司法總監聯絡。

简体中文 Chinese Simplified

这份文件非常重要，需要立即翻译。
如果您需要翻译这份文件，请通过下方电话与 MassDEP 环境司法主任联系。

Ayisyen Kreyòl Haitian Creole

Dokiman sa a enpòtan epi yo ta dwe tradui l imedyatman. Si w bezwen tradui dokiman sa a, tanpri kontakte Direktè. Jistis Anviwònmantal MassDEP a nan nimewo telefòn ki endike anba a.

Việt Vietnamese

Tài liệu này và quan trọng và phải được dịch ngay. Nếu quý vị cần bản dịch của tài liệu này, vui lòng liên hệ với Giám Đốc Phòng Công Lý Môi Trường của MassDEP theo số điện thoại được liệt kê bên dưới.

ប្រទេសកម្ពុជា Khmer/Cambodian

ឯកសារនេះមានសារៈសំខាន់
ហើយគប្បីត្រូវបានបកប្រែភ្លាមៗ.
ប្រសិនបើអ្នកត្រូវការអោយឯកសារនេះបកប្រែ
សូមទាក់ទងនាយកផ្នែកយុត្តិធម៌បរិស្ថានរបស់
MassDEPតាមរយៈលេខទូរស័ព្ទដែលបានរាយដូចខាងក្រោម។

Kriolu Kabuverdianu Cape Verdean

Es dokumentu sta important i tenki ser tradusidu immediatamenti. Se nho ta presisa ke es dokumentu sta tradisidu, por favor kontata O Diretor di Justisia di Environman di DEP ku es numero di telifoni menxionadu di baixo.

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Русский Russian

Это чрезвычайно важный документ, и он должен быть немедленно переведен. Если вам нужен перевод этого документа, обратитесь к директору Департамента экологического правосудия MassDEP (MassDEP's Director of Environmental Justice) по телефону, указанному ниже.

العربية Arabic

هذه الوثيقة مهمة وتجب ترجمتها على الفور.

إذا كنت بحاجة إلى ترجمة هذه الوثيقة، فيرجى الاتصال بمدير العدالة البيئية في MassDEP على رقم الهاتف المذكور أدناه.

한국어 Korean

이 문서는 중대하므로 즉시 번역되어야 합니다.
본 문서 번역이 필요하신 경우, 매사추세츠 환경보호부의 "환경정의" 담당자 분께 문의하십시오. 전화번호는 아래와 같습니다.

հայերեն Armenian

Այս փաստաթուղթը կարևոր է, և պետք է անհապաղ թարգմանել այն:
Եթե Ձեզ անհրաժեշտ է թարգմանել այս փաստաթուղթը, դիմեք Մասաչուսեթսի շրջակա միջավայրի պահպանության նախարարության (MassDEP) Բնապահպանական հարցերով արդարադատության ղեկավարին (Director of Environmental Justice)՝ ստորև նշված հեռախոսահամարով

فارسی Farsi Persian

این نوشتار بسیار مهمی است و باید فوراً ترجمه شود.
اگر نیاز به ترجمه این نوشتار دارید لطفاً با مدیر عدالت محیط زیستی MassDEP در شماره تلفن ذکر شده زیر تماس بگیرید.

Français French

Ce document est important et doit être traduit immédiatement. Si vous avez besoin d'une traduction de ce document, veuillez contacter le directeur de la justice environnementale du MassDEP au numéro de téléphone indiqué ci-dessous.

Deutsch German

Dieses Dokument ist wichtig und muss sofort übersetzt werden. Wenn Sie eine Übersetzung dieses Dokuments benötigen, wenden Sie sich bitte an MassDEP's Director of Environmental Justice *(Direktor für Umweltgerechtigkeit in Massachusetts)* unter der unten angegebenen Telefonnummer.

Ελληνική Greek

Το έγγραφο αυτό είναι πολύ σημαντικό και πρέπει να μεταφραστεί αμέσως. Αν χρειάζεστε μετάφραση του εγγράφου αυτού, παρακαλώ επικοινωνήστε με τον Διευθυντή του Τμήματος Περιβαλλοντικής Δικαιοσύνης της Μασαχουσέτης στον αριθμό τηλεφώνου που αναγράφεται παρακάτω

Italiano Italian

Questo documento è importante e deve essere tradotto immediatamente. Se hai bisogno di tradurre questo documento, contatta il Direttore della Giustizia Ambientale di MassDEP al numero di telefono sotto indicato.

Język Polski Polish

Ten dokument jest ważny i powinien zostać niezwłocznie przetłumaczony. Jeśli potrzebne jest tłumaczenie tego dokumentu, należy skontaktować się z dyrektorem ds. sprawiedliwości środowiskowej MassDEP pod numerem telefonu podanym poniżej.

हिन्दी Hindi

यह दस्तावेज महत्वपूर्ण है और इसका अनुवाद तुरंत किया जाना चाहिए। यदि आपको इस दस्तावेज का अनुवाद कराने की जरूरत है, तो कृपया नीचे दिए गए टेलीफोन नंबर पर MassDEP के पर्यावरणीय न्याय निदेशक से संपर्क करें।

Contact Deneen Simpson 857-406-0738
Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114
TTY# MassRelay Service 1-800-439-2370 • https://www.mass.gov/environmental-justice
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
100 Cambridge Street Suite 900 Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

April 16, 2025

City of Peabody
24 Lowell Street
Peabody, MA 01960
ATTN: Brendan Callahan, Assistant Director of Planning

RE: **AMENDED** 401 WATER QUALITY CERTIFICATION
BRP WW 10, Major Fill Project
BRP WW 08, Minor Dredge Project
Independence Greenway Extension
Peabody, MA

401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge)
USACE Application No. NAE-2024-01390
MassDOT File Number: 609211

Dear Mr. Callahan:

On August 5, 2024, the Massachusetts Department of Environmental Protection (MassDEP) issued a Water Quality Certification (WQC) to the City of Peabody (the City) for extension of the existing Independence Greenway rail trail from Essex Center Drive to Endicott Street along an existing former railroad right-of-way owned and maintained by the City (the Project). The Project includes construction of a paved shared-use pathway along the existing abandoned railroad right-of-way; construction of a light duty timber boardwalk structure supported on helical piles over Proctor Brook and associated wetlands; replacement of culverts that convey Proctor Brook and its tributaries beneath the railroad bed; stormwater infrastructure improvements; construction of a compensatory flood storage area; and modifications required for connections to the existing paths at either end including sidewalk reconstruction and drainage improvements. The WQC contained 55 conditions and addressed impacts to Bordering Vegetated Wetlands and Land Under Water. On March 19, 2025, Green International Affiliates, Inc., submitted a request on behalf of the City to amend Conditions 31, 32, 33, 34, 36, and 43 of the WQC.

The City requested that Condition 31 be revised to better define sediment management activities to be conducted under the supervision of a Licensed Site Professional (LSP). MassDEP is amenable to revising Condition 31 to specify that the handling of contaminated sediment exceeding MCP RCS-1 criteria shall be conducted under the direction of an LSP.

This information is available in alternate format. Please contact MassDEP at 617-292-5500.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

The City requested that Condition 32 be revised to clarify that the Environmental Health and Safety Plan to be prepared by the Contractor will be adequate and that a separate plan specifically for sediment management will not be required. The City also requested confirmation that the plan needs to be submitted for MassDEP records only and flexibility in the submission deadline. MassDEP agrees a separate plan specifically for sediment management is not required so long as the Environmental Health and Safety Plan includes provisions to protect workers from any exposure to known/suspected contaminants. MassDEP hereby confirms the plan needs to be submitted for record keeping purposes only. However, the requirement to submit the Environmental Health and Safety Plan within two weeks prior to the commencement of the dredging operation will remain in the condition.

The City requested that Condition 33 be revised to require MassDEP to review sediment sampling test results within seven days of receipt. MassDEP is amenable to reviewing sediment sampling test results within 10 calendar days of receipt. The City also requested clarification as to what "determining whether the material requires offsite disposal" means in the condition. To clarify, the approved LSP will be required to review the sediment sampling test results to determine if the sediment exceeds the MCP RCS-1 criteria and requires disposal at an out-of-state facility.

The requested revisions to Condition 34 relate to dredged material stockpile management; specifically, the requirement to bottom line stockpiles on paved surfaces, place them at least 10 feet away from temporary construction roads, and inspect and correct deficiencies during and after storm events. MassDEP is amenable to removing the requirement to bottom line stockpiles so long as they are on paved surfaces and properly secured, and also removing the requirement to place stockpiles at least 10 feet from temporary construction roads so long as a DEP-approved barrier is provided. Inspection of stockpiles shall still occur daily, but MassDEP understands the safety concerns associated with inspection and correcting deficiencies during storm events, especially severe weather. As such, inspections will be required within 24 hours of a storm event that produces 0.5 inches or more of rain within a 24-hour period. Deficiencies shall be corrected in accordance with the timelines specified in the approved Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CP/PP).

The City requested that Condition 36 be revised to explicitly allow for stockpiles of sediment exceeding the RCS-1 criteria to be stored onsite longer than 90 days in extenuating circumstances. MassDEP is amenable to extensions of this deadline to accommodate unforeseen delays subject to MassDEP approval.

The conditions of this amended WQC will serve as a replacement to Conditions 31, 32, 33, 34, and 36.

MassDEP declines to revise Condition 43 by replacing the requirement to use the Paint Filter Test with visual observation as the means to ensure dredged material shall have no free liquid during transport as MassDEP does not believe that visual observation is an analogous methodology as required by 314 CMR 9.07(5)(a).

In accordance with the provisions of MGL c. 21, s. 26-53 and Section 401 of the Federal Clean Water Act as amended (33 U.S.C. s. 1251 et seq.), MassDEP has reviewed this project change request and has

determined that there is reasonable assurance that the project change will not violate applicable water quality standards. MassDEP hereby approves of the above-mentioned project changes and amends the WQC dated August 5, 2024, by referencing the following documents and subject to the following Special Conditions:

Reference Documents:

1) 401 Water Quality Certification. Independence Greenway Extension. 401 WQC Filing Number: 24-WW26-0034-APP (Combined Fill/Dredge). Issued August 5, 2024.

2) 401 Water Quality Certification Amendment Request. Independence Greenway Extension, Peabody, MA. MassDOT Project #609211. Prepared by Green International Affiliates, Inc. Dated March 19, 2025.

Revised Special Conditions

31. All handling of contaminated sediment exceeding MCP RCS-1 criteria and authorized by this WQC shall be conducted under the direction of a Licensed Site Professional (LSP). Prior to the Pre-Construction Meeting required in Condition 4, the applicant shall provide MassDEP with the name, qualifications, and contact information of the LSP. **(Submittal)**

32. An Environmental Health & Safety Plan shall be required for the protection of workers from any exposure to known/suspected contaminants present in environmental media (including sediment which has been characterized as exceeding MCP RCS-1 criteria). A copy shall be provided to MassDEP within two weeks prior to the commencement of the dredging operation. **(Submittal)**

33. Dredged sediment shall be sampled to determine the suitability for reuse or if offsite disposal is required. Sampling data including sampling methods and laboratory QA/QC data shall be provided to MassDEP within 48 hours once available from the analytical laboratory for review. Results of the chemical analysis shall be compared to the reuse levels in Policy COMM-97-001-Reuse and Disposal of Contaminated Soil at Massachusetts Landfills for reuse as landfill daily cover and to the Massachusetts Contingency Plan (MCP) RCS-1 criteria. The approved LSP required by Condition 31 will review the data to determine if the sediment exceeds these criteria and requires disposal at an out-of-state facility within ten calendar days. The data and LSP determination shall be submitted to MassDEP prior to transportation of this material. **(Submittal)**

34. Best Management Practices (BMPs) shall be employed by the contractor to protect resource areas located adjacent to the proposed staging/temporary dredged material stockpiling and dewatering areas. Sediment stockpiles shall be constructed in accordance with the MassDEP approved project plans, stabilized, bottom-lined if not placed on paved surfaces and securely covered with wind tear resistance tarpaulin, polyethylene sheeting or similar impermeable material at all times, and properly labeled. Stockpile covers shall be securely weighed down.

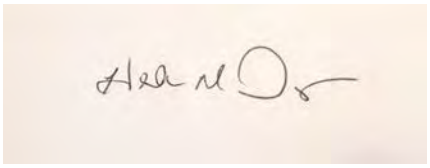
Stockpiles shall also be secured to restrict access by the public and shall be set back at least 10 feet from temporary construction access roads or other areas and activities which could disturb the stockpiles and associated erosion controls; if the 10-foot setback cannot be met, then a MassDEP-approved barrier shall be provided. Inspection of the sediment containment and dewatering location and associated erosion controls shall be conducted daily and within 24 hours of a storm that produces 0.5 inches or more of rain. Any observed deficiency shall be corrected or repaired in a timely manner. Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation. Extensions may be requested to accommodate unforeseen delays subject to MassDEP approval.

36. Dredging, stockpiling of dredged material, and offsite transport of dredged material shall be sequenced and conducted in a manner to limit stockpiling time. Sediment characterized as having concentrations exceeding the RCS-1 criteria shall not be stockpiled at the site longer than 90 days from the date of generation. Extensions may be requested to accommodate unforeseen delays subject to MassDEP approval.

All other WQC Special Condition remain in effect as applicable.

Should you have any questions relative to this permit, please contact me at heidi.davis@mass.gov or Ryan Hale at ryan.hale@mass.gov.

Very truly yours,



Heidi M. Davis
Highway Unit Supervisor

Ecc: DEP NERO – Jill Provencal
USACE – Dan Vasconcelos
MassDOT – Stephanie Regan
MassDOT – Sandhya Potana
Green International Affiliates, Inc. – Oxana Fartushnaya
Green International Affiliates, Inc – Dennis Vertiyev
Peabody Conservation Commission – Lucia DelNegro, Conservation Agent

Failure to comply with this amended certification is grounds for enforcement, including civil and criminal penalties, under MGL Ch. 21 §42, MGL Ch. 21A §16, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This amended certification does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations.

NOTICE OF APPEAL RIGHTS

A) Appeal Rights and Time Limits

Certain persons shall have a right to request an adjudicatory hearing concerning certifications by MassDEP when an application is required: (a) the applicant or property owner; (b) any person aggrieved by the decision who has submitted written comments during the public comment period; (c) any ten (10) persons of the Commonwealth pursuant to M.G.L. c.30A where a group member has submitted written comments during the public comment period; or (d) any governmental body or private organization with a mandate to protect the environment which has submitted written comments during the public comment period. Any person aggrieved, any ten (10) persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c.30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within twenty-one (21) days from the date of issuance of this Certificate, and addressed to:

Case Administrator
Department of Environmental Protection
100 Cambridge Street, Suite 900
Boston, MA 02108

A copy of the request shall at the same time be sent by certified mail or hand delivery to the Department of Environmental Protection at:

Department of Environmental Protection
Commissioner's Office
100 Cambridge Street, Suite 900
Boston, MA 02108

B) Contents of Hearing Request

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

a.) the 401 Certification Transmittal Number;
b.) the complete name of the applicant and address of the project;
c.) the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
d.) if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
e.) a clear and concise statement that an adjudicatory hearing is being requested;

f.) a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this Certificate, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief sought through the adjudicatory hearing, including specifically the changes desired in the final written Certification; and

g.) a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Environmental Management (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

C) Filing Fee and Address

The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

DOCUMENT A00844

U.S. FISH AND WILDLIFE SERVICE

NLAA CONCURRENCE VERIFICATION LETTER

THIS PAGE INTENTIONALLY LEFT BLANK

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: June 21, 2023
Project code: 2023-0058208
Project Name: 609211-PEABODY- INDEPENDENCE GREENWAY EXTENSION

Subject: Consistency letter for the '609211-PEABODY- INDEPENDENCE GREENWAY EXTENSION' project under the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (NLEB).

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated June 21, 2023 to verify that the **609211-PEABODY- INDEPENDENCE GREENWAY EXTENSION** (Proposed Action) may rely on the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action will have no effect on the endangered Indiana bat (*Myotis sodalis*) or the endangered northern long-eared bat (*Myotis septentrionalis*). If the Proposed Action is not modified, **no consultation is required for these two species.** If the Proposed Action is modified, or new information reveals that it may affect the Indiana bat and/or northern long-eared bat in a manner or to an extent not considered in the PBO, further review to conclude the requirements of ESA section 7(a)(2) may be required.

For Proposed Actions that include bridge/culvert or structure removal, replacement, and/or maintenance activities: If your initial bridge/culvert or structure assessments failed to detect Indiana bats and/or NLEB use or occupancy, yet later detected prior to, or during construction, please submit the Post Assessment Discovery of Bats at Bridge/Culvert or Structure Form (User Guide Appendix E) to this Service Office within 2 working days of the incident. In these instances, potential incidental take of Indiana bats and/or NLEBs may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species and/or designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please advise the lead Federal action agency accordingly.

The following species may occur in your project area and **are not** covered by this determination:

- Monarch Butterfly *Danaus plexippus* Candidate

PROJECT DESCRIPTION

The following project name and description was collected in IPaC as part of the endangered species review process.

NAME

609211-PEABODY- INDEPENDENCE GREENWAY EXTENSION

DESCRIPTION

609211-PEABODY- INDEPENDENCE GREENWAY EXTENSION

The proposed Independence Greenway Extension is intended to continue the existing Greenway further eastwards from its present eastern terminus at the North Shore Mall to the Warren Street Extension/Endicott Street intersection in central Peabody. This will extend the Greenway by 7000 feet (1.3 miles). The Greenway Extension will mostly be constructed on an abandoned Boston and Maine Railroad right-of-way along Proctor Brook. The only location where there will be an at-grade crossing of a public road is on the North Shore Road, either at its intersection with the North Shore Mall Driveway, or at the former railroad right-of-way across the road. The existing driveway/North Shore Road intersection signal will be adjusted to accommodate bicycle/pedestrian crossings. The proposed path will provide a 10’- 0” wide two-lane two-way bikeway with 2’- 0” wide shoulders on each side. Where the proposed Greenway Extension runs along Proctor Brook, the waterway’s meandering course crosses under the former track centerline at three locations. New concrete box culverts will be installed at two of these locations, while at bridge crossing for the trail will be needed at the easternmost brook crossing near the City powerplant facility. The bridge will be approximately 80 feet long and will carry a 10’- 0” wide two lane two-way bikeway with 1’- 0” wide shoulders on each side. All stream crossings will meet the Massachusetts Stream Crossing Standards to the best extent practicable.

Monarch Butterfly: Candidate Species only, no conservation measures at this time.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.5341401,-70.94305632766583,14z

DETERMINATION KEY RESULT

Based on the information you provided, you have determined that the Proposed Action will have no effect on the endangered Indiana bat and/or the endangered northern long-eared bat. Therefore, no consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required for these two species.

QUALIFICATION INTERVIEW

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No

2. Is the project within the range of the northern long-eared bat[1]?

   [1] See northern long-eared bat species profile

   Automatically answered
   Yes

3. [Semantic] Does your proposed action intersect an area where Indiana bats and northern long-eared bats are not likely to occur?

   Automatically answered
   Yes

DETERMINATION KEY DESCRIPTION: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

This key was last updated in IPaC on June 14, 2023. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which may require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the endangered **northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

IPAC USER CONTACT INFORMATION

Agency: Massachusetts Department of Transportation
Name: Trevor Burns
Address: 10 Park Plaza
City: Boston
State: MA
Zip: 02116
Email trevor.b.burns@dot.state.ma.us
Phone: 8573010759

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00860

MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

NOTICE OF INTENT

THIS PAGE INTENTIONALLY LEEFT BLANK

NOTICE OF INTENT

Independence Greenway Extension
Peabody, Massachusetts

MassDOT Contract No. 609211

Prepared for

City of Peabody

April 10, 2024

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.

Building Strong Client Relationships Through Engineering Excellence

April 10, 2024

Lucia DelNegro, Conservation Agent
Peabody Conservation Commission
Peabody City Hall
24 Lowell Street
Peabody, MA 01960
(978)-538-5900

Subject: **Independence Greenway Extension**
Peabody, MA
MassDOT File No. 609211
Notice of Intent Submittal

Dear Ms. DelNegro:

On behalf of the City of Peabody, with construction funding from the Massachusetts Department of Transportation (MassDOT) Highway Division, Green International Affiliates, Inc. is pleased to submit the enclosed Notice of Intent (NOI) to the Peabody Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (WPA) and 310 CMR 10.00, which is administered by the Peabody Conservation Commission. This NOI Application has been prepared for the Independence Greenway Extension transportation improvement project in the City of Peabody.

This Notice of Intent (NOI) is being submitted to the Peabody Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (WPA) Regulations and its implementing regulations 310 CMR 10.00 for work within the Bordering Vegetated Wetland (BVW), the Land Under Water (LUW), the 100-foot Buffer Zone, the Bordering Land Subject to Flooding (BLSF), Bank, and within the Riverfront Area and pursuant to the City of Peabody local Wetlands and Rivers Protection Regulations.

The proposed project activities associated with the proposed work taking place within WPA jurisdiction will occur within BLSF to Proctor Brook, which flows along the project corridor and has various 100-year flood elevations which drop from 47.1 feet near the western project limit to 39.6 feet at the eastern project limit (NAVD 88).

In addition to the WPA buffers, the Peabody Local Wetlands Bylaw also regulates a “No Disturb Zone” in which the Commission may require that the applicant maintain a strip or buffer of continuous, undisturbed vegetative cover within 200 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (I), and within 100 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (A-H). However, since this project is a public project proposed by the City of Peabody, which also includes replacement of water dependent structures, it falls under the circumstances where limited wetland alteration necessary to accomplish the goals of the project may be permitted under the provisions of

Section 32-36 of the local ordinance. Section 8.1 of this Application demonstrates that acceptable mitigation has been provided to foster the values and interests protected by this ordinance.

The NOI is being submitted for the purpose of receiving an Order of Conditions under the Massachusetts WPA for the proposed work within these resource areas. The project can be categorized as a "Redevelopment" project under the Massachusetts Stormwater Management Standards and meets the Stormwater Standards to the maximum extent practicable.

A majority of the proposed project falls under the following Limited Project Provisions listed under 310 CMR 10.53, which are also depicted on Figure 2 in Appendix C:

- 310 CMR 10.53(6)*: the construction, rehabilitation, and maintenance of footpaths, bike paths, and other pedestrian or nonmotorized vehicle access to or along riverfront areas but outside other resource area.*
- 310 CMR 10.53(3)(i): *The maintenance, repair and improvement (but not substantial enlargement except when necessary to meet the Massachusetts Stream Crossing Standards) of structures, including dams and reservoirs and appurtenant works to such dams and reservoirs, buildings, piers, towers, headwalls, bridges, and culverts.*
- 310 CMR 10.53(3)(j): *The construction and maintenance of catwalks, footbridges, wharves, docks, piers, boathouses, boat shelters, duck blinds, skeet and trap shooting decks and observation decks; provided, however, that such structures are constructed on pilings or posts so as to permit the reasonably unobstructed flowage of water and adequate light to maintain vegetation.*
- 310 CMR 10.53(3)(f): *Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving inadequate drainage systems.*

The proposed project will result in permanent and temporary impacts to Bordering Vegetated Wetlands (BVW), Land Under Water Bodies and Waterways (LUW), Bank, Bordering Land Subject to Flooding (BLSF), Riverfront Area, and the 100-foot Buffer Zone. These impacts to resources areas will be mitigated through the construction of a wetland replication area, wetland restoration, a compensatory flood storage area, and removal of invasive species to restore degraded Riverfront area.

Enclosed are the following items included with this submission:

- 2 hard copies of the NOI Report (includes Stormwater Report)
- 2 full size (24x36) plan set of NOI drawings

An electronic copy of this submittal is also being sent to Lucia.DelNegro@peabody-ma.gov.

As required by regulation, one (1) copy of the above submittal is being provided concurrently to the MassDEP Northeast Regional Office located at 150 Presidential Way, Woburn, MA 01801.

We respectfully request that this project be placed on the Conservation Commission agenda for the hearing scheduled on May 8, 2024. Should you have any questions regarding this submittal, please do not hesitate to contact me.

Very Truly Yours,
Green International Affiliates, Inc.

Danielle H. Spicer, P.E.
Senior Project Manager

CC: DEP – Northeast Region
Project File: 17118

\\Egnytedrive\Greenintl\Shared\Engineering\Projects\2017\17118\Documents\ENV\NOI\NOI Submittal Letter.Docx

TABLE OF CONTENTS

NOTICE OF INTENT FORMS 3

1.0 PROJECT DESCRIPTION 5

1.1 EXISTING CONDITIONS 7

1.2 PROPOSED CONDITIONS 9

1.3 CONSTRUCTION PHASING 10

1.4 PROJECT PLAN LIST 11

2.0 PROJECT IMPACTS 12

2.1 WETLAND RESOURCE AREAS 12

2.1.1 Bordering Vegetated Wetlands (BVW) 13
2.1.2 Land Under Water Bodies and Waterways (LUW) 13
2.1.3 Bank 13
2.1.4 Bordering Land Subject to Flooding (BLSF) 13
2.1.5 Riverfront Area 14
2.1.6 Buffer Zone 14

2.2 REGULATORY COMPLIANCE 14

2.2.1 Limited Project Status 14
2.2.2 Resource Areas Impacts 15
2.2.3 Compliance with Massachusetts River and Stream Crossing Standards 29
2.2.4 Stormwater Management 33
2.2.5 Rare Species 34
2.2.6 Water Quality 34
2.2.7 Area of Critical Environmental Concern 34

2.3 AVOIDANCE, MINIMIZATION AND MITIGATION MEASURES 34

2.3.1 Alternatives Analysis 35
2.3.2 Construction Mitigation Measures 41
2.3.3 Wetland Mitigation 42
2.3.4 Flood Storage Compensation 42

APPENDICES 43

APPENDIX A - WETLANDS DELINEATION MEMO WITH DATA FORMS 44

APPENDIX B – PHOTOS 45

APPENDIX C – FIGURES 46

APPENDIX D – WILDLIFE HABITAT EVALUATION 47

APPENDIX E – ABUTTER INFORMATION 48

APPENDIX F – STORMWATER MANAGEMENT REPORT (BOUND SEPARATELY) 49

APPENDIX G – NOI PLAN SET (BOUND SEPARATELY) 50

NOTICE OF INTENT FORMS

(This page is left blank for double sided printing)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Former B & M Railroad Easement, Northshore Road, Essex Center Drive, Endicott Street
a. Street Address

Peabody
b. City/Town

01960
c. Zip Code

Latitude and Longitude:
42°32'08"N-42°31'51"N
71°56'54"W-71°56'02"W

N/A
f. Assessors Map/Plat Number

N/A
g. Parcel /Lot Number

2. Applicant:

Brendan
a. First Name

Callahan
b. Last Name

City of Peabody
c. Organization

24 Lowell Street
d. Street Address

Peabody
e. City/Town

MA
f. State

01960
g. Zip Code

978-538-5780
h. Phone Number

i. Fax Number

brendan.callahan@peabody-ma.gov
j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name

b. Last Name

City of Peabody
c. Organization

24 Lowell Street
d. Street Address

Peabody
e. City/Town

MA
f. State

01960
g. Zip Code

h. Phone Number

i. Fax Number

j. Email address

4. Representative (if any):

Danielle
a. First Name

Spicer
b. Last Name

Green International Affiliates, Inc.
c. Company

100 Ames Pond Drive Suite 200
d. Street Address

Tewksbury
e. City/Town

MA
f. State

01876
g. Zip Code

978-923-0400
h. Phone Number

i. Fax Number

dspicer@greenintl.com
j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

exempt
a. Total Fee Paid

exempt
b. State Fee Paid

exempt
c. City/Town Fee Paid

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

A. General Information (continued)

6. General Project Description:

The project proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, MA for a total project length of approximately 1.3 miles. The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody. (see Project Narrative for more details).

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☒ Transportation
9. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☒ Yes ☐ No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

310 CMR 10.52 (6), 310 CMR 10.53(3)(i), and 310 CMR 10.53(3)(f)
(see Project Narrative for more details).

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

a. County	b. Certificate # (if registered land)
Peabody	
c. Book	d. Page Number
N/A	N/A

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☒ Bank	618 (P); 201 (T) — 1. linear feet	618 will be restored — 2. linear feet
b. ☒ Bordering Vegetated Wetland	2,225 (P); 4,641 (T) — 1. square feet	2,500 will be replaced — 2. square feet
c. ☒ Land Under Waterbodies and Waterways	10,343 (P); 2,082 (T) — 1. square feet 1,142 — 3. cubic yards dredged	4,271 - natural stream bottom will be restored

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	69,340 (includes fill and cut) — 1. square feet 2,982 — 3. cubic feet of flood storage lost	1,630 (comp.flood storage) — 2. square feet 3,472 — 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☒ Riverfront Area	Proctor Brook (inland) — 1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☒ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 294,400 square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.
103,288	77,465	25,823

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☒ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☒ Project Involves Stream Crossings

0
a. number of new stream crossings

6
b. number of replacement stream crossings

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

   a. ☐ Yes ☒ No

   If yes, include proof of mailing or hand delivery of NOI to:

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   1 Rabbit Hill Road
   Westborough, MA 01581

   August 1, 2021
   b. Date of map

   If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

   c. Submit Supplemental Information for Endangered Species Review*

      1. ☐ Percentage/acreage of property to be altered:

         (a) within wetland Resource Area _____ percentage/acreage

         (b) outside Resource Area _____ percentage/acreage

      2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

   (a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

   (b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. a. NHESP Tracking # b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

c. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☒ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☐ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

NOI PROJECT PLAN SET - INDEPENDENCE GREENWAY EXTENSION
a. Plan Title

Green International Affiliates, Inc.
b. Prepared By

04/08/2024
c. Signed and Stamped by

d. Final Revision Date

As shown on each plan
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

Brendan Callahan	04/09/24
1. Signature of Applicant	2. Date
3. Signature of Property Owner (if different)	4. Date
	4/09/2024
5. Signature of Representative (if any) Danielle Spicer	6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the “yes” box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Applicant Information

1. Location of Project:

Former B & M Railroad Easement, Northshore Road, EsseX Center Drive, Endicott Street	Peabody
a. Check number	b. City/Town
exempt	exempt
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Brendan		Callahan
a. First Name		b. Last Name
City of Peabody		
c. Organization		
24 Lowell Street		
d. Mailing Address		
Peabody	MA	01960
e. City/Town	f. State	g. Zip Code
978-538-5780		brendan.callahan@peabody-ma.gov
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

a. First Name		b. Last Name
City of Peabody		
c. Organization		
24 Lowell Street		
d. Mailing Address		
Peabody	MA	0160
e. City/Town	f. State	g. Zip Code
h. Phone Number	i. Fax Number	j. Email Address

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee

Step 5/Total Project Fee: _____

Step 6/Fee Payments:

Total Project Fee:	Fee Exempt a. Total Fee from Step 5
State share of filing Fee:	Fee Exempt b. 1/2 Total Fee **less $**12.50
City/Town share of filling Fee:	Fee Exempt c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

1.0 PROJECT DESCRIPTION

This Notice of Intent Application has been prepared on behalf of the City of Peabody for the Independence Greenway Extension transportation improvement project in the City of Peabody. The City of Peabody with construction funding from the Massachusetts Department of Transportation, Highway Division (MassDOT) proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, Massachusetts for a total project length of approximately 1.3 miles. The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody.

The Independence Greenway Extension project is a continuation of a rail trail facility that can be utilized by pedestrians and bicyclists for recreation or for short-range trips to businesses or other destinations along the Greenway. This project will expand the City's network of bicycle routes and provide a dedicated bike trail between the busy Northshore Mall and residential/commercial areas adjacent to downtown Peabody.

The project will consist of the following improvements:

- Modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared use path;
- Construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street;
- Construction of a light duty timber boardwalk structure supported on helical piles;
- Various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and
- Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements.

This project transforms the former railroad bed into a shared use pedestrian pathway. As the proposed project is a pathway for pedestrian and/or nonmotorized vehicle access, it is therefore categorized as a "Redevelopment Project" under the Massachusetts Stormwater Management Standards. The project is therefore designed to meet the Standards to the maximum extent practicable. A stormwater report is attached in Appendix F to this Application demonstrating the compliance of the project with the ten state stormwater standards.

The proposed work within Waters of the United States requires a Section 401 Water Quality Certification for Minor Fill and Excavation Projects pursuant to 314 CMR 9.04(1) since the project will result in more than 5,000 square feet cumulatively of temporary and permanent impacts to Bordering Vegetated Wetland and Land Under Water, areas subject to 310 CMR 10.00: Wetlands Protection which is also subject to 33 U.S.C. §1251 et seq. (1972), The Clean Water Act (CWA). The proposed work within Waters of the United States requires a Section 401 Water Quality Certification pursuant to 314 CMR 9.04(1) since the project will result in dredging of more than 100 CY of material and placement of minor fill within Land Under Water. Therefore, a Combined Minor Fill/Dredging Water Quality Certification application package will be submitted to the Department of Environmental Protection (DEP) in association with this project. A filing of a Pre-Construction Notification (PCN) Form in accordance with Section 404 with the U.S. Army Corps of Engineers under GP 7, 17, 23, and 24 will also occur concurrently with the Section 401 WQC filing.

The MassDEP Waterways Program evaluated the site conditions within the limits of the proposed work areas (i.e., culvert crossings and boardwalk crossing), and has identified that Proctor Brook is not practicably navigable within the boundaries of the project footprint due to the bottom topography and shallow water depths. As a result, the portions of the proposed project located in/on/over/under Proctor Brook as identified on the plans do not require authorization pursuant to M.G.L. Chapter 91 or the Waterways Regulations at 310 CMR 9.00.

In addition, the proposed work exceeds the activity thresholds described in 301 CMR 11.03 (3)(b)(1)(f) for alteration of ½ or more acres of any other wetland, 301 CMR 11.03(3)(b)1(d) for alteration of 5,000 or more sf of bordering or isolated vegetated wetlands; and 301 CMR 11.03(3)(b)1(b) for alteration of 500 or more linear feet of inland bank; consequently, an Expanded Environmental Notification Form (EENF) was filed to initiate project review under MEPA by the Executive Office of Energy and Environmental Affairs (EEA). An EENF Certificate for the EEA File No. 16778 was issued on January 29, 2024, determining that the project required the submission of an Environmental Impact Report (EIR). The Draft Environmental Impact Report addressing the comments and scope received in the EENF Certificate was filed with the MEPA Office on April 1, 2024.

This Notice of Intent (NOI) is being submitted to the Peabody Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (WPA) Regulations and its implementing regulations 310 CMR 10.00 for work within the Bordering Vegetated Wetland (BVW), the Land Under Water (LUW), the 100-foot Buffer Zone, the Bordering Land Subject to Flooding (BLSF), Bank and within the Riverfront Area and pursuant to the City of Peabody local Wetlands and Rivers Protection Regulations.

Local Ordinance Provisions

The City of Peabody Wetlands and Rivers Protection Regulations (Chapter 32 of the City of Peabody Code of Ordinances) also established "No Disturb Zones" in the size of the applicable buffer zones (100 - 200 feet), where no grading, planting, site work, construction, or storage of materials is allowed. Vegetation in the No Disturb Zone shall not be cut or trimmed in any manner. However, pursuant to Section 32-36 of the local ordinance, public projects and replacement of water dependent structures fall under circumstances where the Conservation Commission may permit limited wetland alteration if they find that "*…there is no feasible alternative to the proposed project, that the amount of wetland alteration is the minimum necessary to accomplish the goals of the project, and that acceptable mitigation has been provided to foster the values and interests protected by this ordinance*." As this is a Municipal project with construction funding from MassDOT Highway Division, the project is subject to local wetlands bylaw and abutters notification is required.

Limited Project Provisions

A majority of the proposed project falls under the Limited Project Provisions listed under 310 CMR 10.53 (See Figure 2 in Appendix C). The majority of the project within the existing railroad right-of-way falls under 310 CMR 10.53(6): *the construction, rehabilitation, and maintenance of footpaths, bike paths, and other pedestrian or nonmotorized vehicle access to or along riverfront areas but outside other resource areas, provided that adverse impacts from the work are minimized and that the design specifications are commensurate with the projected use and are compatible with the character of the riverfront area.* Culvert replacement components of this project fall under 310 CMR 10.53(3)(i): *The maintenance, repair and improvement (but not substantial enlargement except when necessary to meet the Massachusetts Stream Crossing Standards) of structures, including dams and reservoirs and appurtenant works to such dams and reservoirs, buildings, piers, towers, headwalls, bridges, and culverts which existed on the effective date of 310 CMR 10.51 through 10.60 (April 1, 1983)*. The boardwalk portion of the project qualifies for 310 CMR

10.53(3)(j): *The construction and maintenance of catwalks, footbridges, wharves, docks, piers, boathouses, boat shelters, duck blinds, skeet and trap shooting decks and observation decks; provided, however, that such structures are constructed on pilings or posts so as to permit the reasonably unobstructed flowage of water and adequate light to maintain vegetation.* Lastly, the roadway work along Northshore Road and Essex Center Drive at the western project limit falls under 310 CMR 10.53(3)(f): *Maintenance and improvement of existing public roadways, but limited to widening less than a single lane, adding shoulders, correcting substandard intersections, and improving inadequate drainage systems* (See Figure 2 in Appendix C for the locations of each limited project provision).

1.1 EXISTING CONDITIONS

The existing Independence Greenway was built in 2008 and is functionally classified as a Bike Path, being an exclusive pedestrian/bicycle facility open year-round from dusk until dawn. It currently consists of two discontinuous segments separated by Interstate 95 and Route 1. The overall length of the west section is 2.9 miles, and it starts between Russell Street and the Ipswich River, and the section ends at the Lt. Ross Park. The east section starts from Peabody Road near Proctor Brook and runs for 1.7 miles to end at the Essex Center Drive behind the Northshore Mall. The trail was built on the route of the former Boston and Maine Railroad right-of-way north of Lowell Street. The existing Greenway is owned and maintained by the City of Peabody.

The existing west and east sections of the Independence Greenway provide a 14’-0” wide pavement carrying two-way traffic on two 5’-0” wide travel lanes and two 2’-0” wide shoulders. The present eastern terminus of the Independence Greenway is located at the Essex Center Drive behind the Northshore Mall. The allowed uses on the Greenway include walking/running, bicycling, inline/roller skating, snowshoeing and cross-country skiing. No motorized vehicles, snow mobiles, or horseback riding is allowed on the trail.

Essex Center Drive is classified as a Local Roadway maintained under the private jurisdiction of the Northshore Mall. It serves mostly as a circulating road for the Northshore Mall and its adjacent office and commercial buildings, including Lahey Medical Center. Essex Center Drive is a two-lane, two-way road with a typical pavement width of 30 feet. The travel lanes, separated by a double yellow centerline, are approximately 15 feet wide. There is a consistent 5-foot bituminous sidewalk along the east side of the road and a cement concrete sidewalk on the west side of the road in front of Lahey Medical Center.

The second segment of the Essex Center Drive runs through an underpass under Route 128, connecting the rest of the Essex Center Drive and the mall driveway to the Northshore Road and from Route 128 North. This segment is under the jurisdiction of MassDOT as part of Route 128 above. The roadway is 23 feet wide, with an 11-foot right turn lane and a 12-foot right turn lane in the eastbound direction, with a 9.5-foot-wide raised median between the directions, which contain support columns for the bridge above. There are 3.5-foot-wide sidewalks in the underpass, which do not allow ADA accessible path of travel. In addition, the sidewalks are too narrow for cyclists to comfortably ride on or even walk with a bicycle to pass someone walking in the other direction without one person having to walk in the roadway.

Northshore Road is a local roadway under the City of Peabody jurisdiction south of the Route 128 underpass, and under the jurisdiction of MassDOT north of the underpass. Northshore Road connects the Northshore Mall south entrance with Lowell Street and Route 114, as well as ramps to the Route 128 North. Northshore Road is 23 feet wide with 11-foot-wide lanes separated by a double yellow centerline. There is a 4.5-foot-wide bituminous sidewalk on the west side of the street. The posted speed limit on Northshore Road is 25 mph in both directions.

The former B&M railroad-owned easement between Northshore Road and Endicott Street is currently wooded and is roughly parallel to, and overlaps with, Proctor Brook, which generally flows west to east till its confluence with Goldthwaite Brook near Peabody Square to form the North River, which eventually empties downstream into Salem harbor. There are currently no existing trails, roadways, or railroad tracks at this location.

The project corridor contains a former bridge structure, oriented west to east, that used to carry railroad tracks over Proctor Brook. There are presently granite stone blocks extending across Proctor Brook and granite stone abutments, which remain intact along the Proctor Brook's western bank with remnants of stone wingwalls splayed along the sides of the abutments.

The wetlands and waterbodies exist directly adjacent to the former railroad right-of-way on both sides along the project corridor (see section 2.1 of this report for detailed description of each protected resource area). There are several existing stream crossings and hydrologic connections beneath the former railroad track bed within the project limits:

- The existing twin culverts consisting of 42-inch diameter Reinforced Concrete Pipes (RCPs) at Sta. 329+85 convey Proctor Brook which flows south-to-north at this location. Due to the existing 42-inch twin culverts being obstructed with sediment and debris, the pipes are not able to pass the sufficient flow during larger storm events and the bank overtime became eroded and expanded west of the existing culverts at this location.
- The existing 30-inch diameter Corrugated Metal Pipe (CMP) at Sta. 340+10 conveys an intermittent stream flowing into Proctor Brook on the north side of the former railroad bed. The existing culvert is corroded.
- The existing 24-inch diameter CMP at Sta. 342+20 conveys hydrological connection of Proctor Brook with wetland V-series on the south side of the former railroad tracks. The existing culvert is corroded.
- The former 4'H x 6.4'W concrete culvert at Sta. 346+20 used to convey Proctor Brook beneath discontinued railroad bed; Proctor Brook flows in the north-to-south direction at this location. The culvert was washed out after the railroad was discontinued and the tracks were removed; there are remains of the former culvert in the existing channel at this location.
- The existing remains of the former railroad bridge crossing over Proctor Brook at Sta. 351+50, which crosses the former railroad right-of-way in the south-to-north direction at this location. The bridge was washed out after the railroad was discontinued and track were removed.
- The existing 15-inch RCP culvert conveying intermittent stream at Sta. 358+51 near the eastern limit of the project at Endicott Street. There are no known deficiencies with the existing culvert.

Surface runoff on Essex Center Drive, its Route 128 underpass, Northshore Road and Endicott Street is mainly distributed by "country drainage", where runoff sheet flows into the pervious shoulder, roadside ditches, wetlands, or private front yards. Additionally, there are separate closed drainage systems spread throughout the project, servicing existing watershed areas via catch basin curb inlets and at low points. Where stormwater does not sheet flow off the roadway via country drainage, it travels via curb along the roadway into these closed drainage systems. The existing site can be analyzed as ten (10) watershed areas that contribute runoff to ten (10) discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. There are several culverts that convey Proctor Brook and intermittent streams that provide hydrological connections beneath the existing railroad track bed as described in detail above. The wetland resource areas within and adjacent to the project corridor can be seen on Figure 3, Protected Resource Areas Map.

Per MassGIS online data mapping, there are no stormwater "critical areas" as defined in MassDEP's wetland regulations as Outstanding Resource Waters (ORW), Special Resource Waters, recharge areas for public water supplies or cold-water fisheries either crossing or located adjacent to the project area. There are also no Areas of Critical Environmental Concern (ACECs) within or adjacent to the project area (see Figure 3).

1.2 PROPOSED CONDITIONS

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is approximately 1.3 miles.

The proposed project is located along the former railroad right-of-way that has not seen any improvements since the rails were removed. The proposed bituminous shared-use trail pavement will match the dimensions of the existing discontinued railroad structure. This will include 10'-0" wide hot mix asphalt pavement carrying two 5'-0" wide travel lanes, one in each direction, and two 2'-0" wide stone dust shoulders on both sides.

To make the former railroad right-of-way usable for a bicycle/pedestrian path, and to avoid filling protected wetland resources areas and FEMA-designated 100-year floodplain associated with Proctor Brook, a light duty timber boardwalk structure supported on helical piles is proposed to replace the previous railroad bridge that was washed away.

The proposed 56-span light duty timber boardwalk structure will be approximately 437'- 9" long with an out-to-out width of 13'-00" and will provide a clear width of 12'- 1" to accommodate two 5'- 0" wide travel lanes, one in each direction, and two 1'-0" shoulders on each side to provide service to bikers, pedestrians and and/or nonmotorized vehicle access. The shared use path will support emergency vehicles, but the boardwalk section will not.

The proposed shared-use trail will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (Fourth Edition, 2012) and the MassDOT Separated Bike Lane Planning & Design Guide 2015. The proposed bridge will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges and the most recent supplemental Specifications, Standard Nomenclature and Engineering Directives.

The project will result in approximately 2.5 acres of clearing and grubbing along the former railroad right-of-way between Northshore Road and Endicott Street.

The project includes drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. The proposed drainage design will add catch basins to replace existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. The proposed catch basins will have deep sumps to provide additional stormwater

treatment. A stormwater BMP (infiltration trench) is proposed to be installed in the eastern end of the project to help with peak rate attenuation and improve water quality. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge. There are no new untreated point source discharges created as a result of this project (see Stormwater Report in Appendix F for details).

Drainage and structural improvements to the following stream crossings and hydrologic connections are proposed as part of this project:

- The existing 42-inch twin culverts crossing at Sta. 329+85 is proposed to be replaced with a 4'H x 8'W precast reinforced concrete box culvert with a natural stream bottom and will match existing invert elevations.
- The existing corroded 30-inch diameter CMP culvert at Sta. 340+10 is proposed to be replaced with 36-inch DIP and will be embedded 12-inches and will have a layer of natural streambed material to match the existing surface elevations. The Hydraulic opening of this culvert will be maintained. A 12-inch layer of natural streambed material will also be placed on top of stone at the pipe ends on each side of the culvert to restore natural substrate.
- The existing 24-inch diameter CMP at Sta. 342+20 is proposed to be replaced with 24-inch DIP with placement of the riprap at pipe ends for scour protection. A 12-inch layer of natural streambed material will also be placed on top of stone at the pipe ends at the outlet of this culvert within Proctor Brook to restore natural substrate.
- The former 4'H x 6.4'W concrete culvert at Sta. 346+20 is proposed to be replaced with a 4'H x 8'W precast reinforced concrete box culvert with a natural stream bottom and will match existing invert elevations.
- As described above, the proposed light duty timber boardwalk structure will replace the former washed out railroad bridge crossing over Proctor Brook at Sta. 351+50.
- The existing 15-inch RCP culvert conveying the intermittent stream at Sta. 358+51 is proposed to be replaced with a 16-inch DIP to be able to support the H-20 vehicle loading with a shallow depth of cover.

Compliance of the proposed culvert replacements with the Massachusetts River and Stream Crossing Standards are discussed in Section 2.2.2 of this Application.

The proposed drainage will overall maintain historic drainage patterns, distributing runoff to the existing discharge points. All work will be done in a manner that will limit the impacts to adjacent protected wetland resource areas.

1.3 CONSTRUCTION PHASING

Construction phasing will ultimately be determined by the project contractor. The construction phasing is assumed to generally include the following items:

1. Installation of sediment and erosion control measures.
2. Clearing and rough grading of the former railroad right-of-way between Northshore Road and Endicott Street.
3. Construction of wetland replication area.
4. Construction of flood storage compensation area.
5. Reconstruction of existing culverts and other drainage improvements sections along the project corridor.

6. Construction of light duty timber boardwalk structure supported on helical piles.
7. Construction of proposed bituminous shared-use trail along the project corridor.
8. Construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements.
9. Construction of modifications at the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared-use path.
10. Completing shared-use path construction, upgrading signage and pavement markings.
11. Installation of landscaping and grassed areas.
12. Maintaining wetland replication area: checking for plantings that are damaged or failing to thrive and adjusting/replacing plantings as recommended by Wetland Specialist.
13. Removal of sediment and erosion control measures and dispose of same.

Equipment that is likely to be utilized for this project includes dump trucks, flatbed trucks, front-end loader(s), backhoe(s), skid steer(s), excavator, hoe rams, drilling rigs, concrete pumpers, boom trucks, air hammers, air compressor(s), and a crane. Equipment can be parked on roadway pavements off-limits for construction staging purposes. Staging equipment in Vegetated Wetland or Waterway resource areas shall be prohibited.

1.4 PROJECT PLAN LIST

The following plan sheets are included with this Notice of Intent in Appendix G:

Sheet	Title	Prepared by	Date
1	Title Sheet & Index	Green International Affiliates, Inc	04/08/2024
2	Legend & Abbreviations	Green International Affiliates, Inc	04/08/2024
3	General Notes	Green International Affiliates, Inc	04/08/2024
4	Key Plan	Green International Affiliates, Inc	04/08/2024
7-8	Typical Sections & Details 1-2	Green International Affiliates, Inc	04/08/2024
9-16	Construction Plans & Profiles	Green International Affiliates, Inc	04/08/2024
17-20	Curb Tie & Grading Plans	Green International Affiliates, Inc	04/08/2024
21-24	Drainage and Utility Plans	Green International Affiliates, Inc	04/08/2024
25-31	Pavement Markings and Signing Plans	Green International Affiliates, Inc	04/08/2024
32	Compensatory Flood Storage Plan	Green International Affiliates, Inc	04/08/2024
33	Wetland Replication Plan	Green International Affiliates, Inc	04/08/2024
35-40	Culvert Plans	Green International Affiliates, Inc	04/08/2024
40-45	Construction Details	Green International Affiliates, Inc	04/08/2024
45-51	Landscape Plans	Green International Affiliates, Inc	04/08/2024
52-56	Temporary Traffic Control Plans	Green International Affiliates, Inc	04/08/2024
57-73	Bridge Plans	Green International Affiliates, Inc	04/08/2024
74-123	Cross Sections	Green International Affiliates, Inc	04/08/2024

2.0 PROJECT IMPACTS

2.1 WETLAND RESOURCE AREAS

The Wetland Resource Areas on the Project Site are regulated under Federal, State and Local regulatory programs including:

- Section 404 of the Clean Water Act (CWA) which is administered by the U.S. Army Corps of Engineers (ACOE)
- Section 401 of the CWA which is overseen by the Massachusetts Department of Environmental Protection (DEP)
- Massachusetts Environmental Policy Act (MEPA) and 301 CMR 11.00 which is administered by the Executive Office of Energy and Environmental Affairs (EEA)
- Massachusetts Wetlands Protection Act (WPA) and 310 CMR 10.00 which is administered by the Peabody Conservation Commission or (upon appeal) by DEP
- The City of Peabody has its own local Wetlands and Rivers Protection Regulations Wetlands Ordinance (Chapter 32 of the City of Peabody Code of Ordinances), hereinafter referred to as the local ordinance.

The wetlands and waterbodies exist directly adjacent to the former railroad right-of-way on both sides along the project corridor. These areas are identified on the attached Figure 3, Protected Resource Area Map (see Appendix C - Figures).

The Wetlands Protection Act (Massachusetts General Laws (MGL) Chapter 131, Section 40 protects wetlands and the public interests they serve, including protection of public and private water supply and ground water supply, flood control, prevention of storm damage and pollution, land containing shellfish, fisheries, and wildlife habitat.

In addition to the WPA buffers, the Peabody Local Wetlands Bylaw also regulates a “No Disturb Zone” in which the Commission may require that the applicant maintain a strip or buffer of continuous, undisturbed vegetative cover within 200 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (I), and within 100 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (A-H). However, since this project is a public project proposed by the City of Peabody, which also includes replacement of water dependent structures, it falls under the circumstances where limited wetland alteration necessary to accomplish the goals of the project may be permitted under the provisions of Section 32-36 of the local ordinance. Section 2.2.1 of this Application demonstrates that acceptable mitigation has been provided to foster the values and interests protected by this ordinance.

The following sections describe jurisdictional areas associated with the project:

2.1.1 Bordering Vegetated Wetlands (BVW)

Per 310 CMR 10.55(1), Bordering Vegetated Wetlands (BVWs) are likely to be significant to public or private water supply, to ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to the protection of fisheries and to wildlife habitat.

A delineation of the wetland boundaries in the vicinity of the project site was originally completed by Green in February 2018 in accordance with the methodology outlined in the Regulations at 310 CMR 10.55 and the DEP handbook *Delineating Bordering Vegetated Wetlands Under Massachusetts Wetlands Protection Act*. Hydrophytic vegetation was based upon the *US Fish and Wildlife Service National List of Plant Species That Occur in Wetlands*, as well as all plant species listed in the Act. Wetland hydrology includes hydric soils, which were determined based upon the interagency document *Field Indicators for Identifying Hydric Soils in New England*. This methodology is consistent with the three-parameter approach required for the delineation of federal wetlands as outlined in the Corps of Engineers *Wetland Delineation Manual*. The site was reflagged, and the wetland boundaries were reconfirmed on October 5, 2022. The wetlands are identified in further detail in Appendix A and are depicted on Figure 3, Protected Resource Area Map in Appendix C.

2.1.2 Land Under Water Bodies and Waterways (LUW)

Land under Water Bodies and Waterways (under any Creek, River, Stream, Pond or Lake), established through 310 CMR 10.56, is likely to be significant to public and private water supply, to ground water supply, to flood control, to storm damage prevention, to prevention of pollution and to protection of fisheries and wildlife habitat. The main perennial stream present on the project site is Proctor Brook, which is a perennial stream traveling in the west-to-east direction; it has a LUW associated with it. Proctor Brook crosses the project corridor at three (3) locations: at approximate Sta. 329+85, Sta. 346+20 and Sta. 351+50.

2.1.3 Bank

Per 310 CMR 10.54(1), Banks are likely to be significant to public or private water supply, to ground water supply, to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat.

There is one (1) perennial stream and two (2) intermittent streams within the project limit, which have an associated Bank.

2.1.4 Bordering Land Subject to Flooding (BLSF)

Per 310 CMR 10.57(1), Bordering Lands Subject to Flooding (BLSF) are likely to be significant to flood control and storm damage prevention, by providing a temporary storage area for flood water which has overtopped the bank of the main channel of a creek, river or stream or the basin of a pond or lake. Certain portions of Bordering Land Subject to Flooding, including those located within 100 feet of the bank or bordering vegetated wetland, are also likely to be significant to the protection of wildlife habitat.

Over time, incremental filling of these areas causes increases in the extent and level of flooding by eliminating flood storage volume or by restricting flows, thereby causing increases in damage to public and private properties.

Per the Flood Insurance Rate Maps (FIRM) for the City of Peabody, Massachusetts, Essex County, Panel 25009C0412F, dated 07/03/2012, and Panels 25009C0416G, 25009C0418G, dated 07/16/2014, portions of the project in the vicinity of Proctor Brook are located within the 100-year floodplain. The floodplain areas are shown on Figure 4 – FEMA Map. The Flood Insurance Study, by the Federal Management Agency and last revised on July 16, 2014, includes a detailed study of the project area, showing the 100-year floodplain elevations in the project vicinity. Sections of Proctor Brook flowing along the project corridor have various 100-year flood elevations which drop from 47.1 feet near the western project limit to 39.6 feet at the eastern project limit (NAVD 88). See Figure 7A-7H in Appendix C for details and exact locations of the FEMA 100-year flood lines and elevations.

2.1.5 Riverfront Area

Per 310 CMR 10.58(1), Riverfront areas are likely to be significant to protect the private or public water supply, to protect groundwater, to provide flood control, to prevent storm damage, to prevent pollution, to protect land containing shellfish, to protect wildlife habitat and fisheries.

Proctor Brook is a perennial stream within the project limits, which has a 200-foot Riverfront Area associated with it.

2.1.6 Buffer Zone

The 100-foot Buffer Zone (established through 310 CMR 10.02) is a 100-foot offset from the BVW line, the inland bank of intermittent streams, lakes and ponds. The Buffer Zones within the project area consist of existing abandoned railroad track bed and some wooded areas surrounding it. Portions of the project are located within the Buffer Zones associated with BVWs and the Bank of intermittent streams. No buildings are proposed as part of this project, but the proposed bituminous shared-use trail with typical pavement width of thirteen (12) feet with two 5-foot travel lanes and 1-foot-wide shoulders in each direction will result in the limit of the pavement being closer to the wetland under proposed conditions.

In addition to the WPA buffers, the Peabody Local Wetlands Bylaw also regulates a “No Disturb Zone” in which the Commission may require that the applicant maintain a strip or buffer of continuous, undisturbed vegetative cover within 200 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (I), and within 100 feet of resource areas defined in Sec. 32-2 Definitions Resource Area (A-H). However, since this project is a public project proposed by the City of Peabody, which also includes replacement of water dependent structures, it falls under the circumstances where limited wetland alteration necessary to accomplish the goals of the project may be permitted under the provisions of Section 32-36 of the local ordinance. Section 2.2.1 of this Application demonstrates that acceptable mitigation has been provided to foster the values and interests protected by this ordinance.

2.2 REGULATORY COMPLIANCE

Pursuant to 310 CMR 10.53(3), the project has been designed to avoid wetland resource area impacts to the maximum extent practicable and will mitigate unavoidable resource area impacts in accordance with state regulations.

2.2.1 Limited Project Status

Since majority of the proposed project qualifies as a limited project, it is required to meet the performance standards for each resource area to the maximum extent practicable. While some portions of the project that are located within BLSF do not fall under limited provisions, as a whole the project is meeting the

performance standards for BVW, LUW, Bank, BLSF and RFA. Mitigation of impacts, replication and restoration of the impacted resource areas are provided under the scope of this project to contribute to the protection of the interests identified in M.G.L. c. 131, § 40. Mitigation areas will be constructed to meet the requirements of permits and certifications including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40) and U.S. Army Corps of Engineers.

2.2.2 Resource Areas Impacts

There are direct impacts to wetland resource areas associated with the project. These impacts are associated with construction activities necessary to achieve the project purpose of constructing an extension of a shared-use path in the location of the former B&M railroad right-of-way. The activities within the resource areas and their buffer zones include clearing and rough grading of the former railroad right-of-way between Northshore Road and Endicott Street; construction of the proposed shared-use path, replacement of stream crossings, landscape improvements, as well as construction of the wetland and floodplain impact mitigation measures. Replication of the impacted wetland resource areas is discussed in detail below. In an effort to minimize the impact to the wetland area buffer zones, proper erosion and sediment controls will be installed during construction.

In addition to the minimum control measures included in the plan set, a Stormwater Pollution Prevention Plan (SWPPP) for construction activities will be prepared by the Contractor for the site in compliance with the EPA's Construction General Permit. It will include measures to minimize exposed soil areas through sequencing and temporary stabilization and establish a permanent vegetative cover or other forms of stabilization as soon as practicable.

Bordering Vegetated Wetlands (BVWs)

There are BVW areas within and adjacent to the project limits. The project results in permanent and temporary impacts to the following wetland areas along the project corridor, as described in Table 1 below.

Table 1: BVW Impacts

Wetland Area Series (STA. #)	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)
Z (STA. 329+85)	264	245
Y (STA. 329+85)	447	58
V (STA. 340+10)	168	88
V (STA. 342+20)	183	435
V (STA. 346+20)	914	216
E (STA. 346+20)	126	72
E (STA. 346+90)	117	66
X (STA. 352+00)	6	3,461
Total	**2,225**	**4,641**

*see Figure 6A – 6H in Appendix C

The direct impacts to BVWs were minimized to the maximum extent feasible but cannot be avoided in order to achieve the project goals. The majority of permanent BVW impacts are associated with the proposed bank protection and stabilization countermeasures near the proposed culverts; other BVW impacts are associated with the adjacent areas of slope stabilization and regrading. The proposed extension on the

Independence Greenway and stream crossing replacements necessary to achieve the project purpose are expected to result in an overall improvement of the existing wetland resource areas and the area in general, which are currently degraded, overgrown with invasives and brush, and contain a lot of debris and garbage. The project will not impact the capacity of the BVW to prevent or reduce contamination or damage to fish; and to serve as their habitat and nutrient source. There is no land containing shellfish or NHESP Estimated or Priority Habitats of Rate Wildlife located within or in close proximity to the project area, therefore the project will not negatively impact these interests of the WPA.

Temporary disturbance to BVW (4,641 square feet) will be required for installation of Erosion & Sediment Control BMPs. The 3,461 square feet of temporary impact to BVW X is caused by placement of the temporary timber matting in order to protect the BVW X from negative impacts by construction machines during installation of helical piles for the duration of its construction. Under existing conditions, the entire wetland area at the location of the proposed boardwalk area is shaded by the surrounding tree canopy. Since the entire area is completely shaded by the tree canopy, as depicted in the photo log in Appendix B, the proposed boardwalk will not result in any new shade impacts to the BVW area. After the erosion controls have been removed the BVWs will be restored to preexisting conditions in accordance with the MassDOT Specifications for Wetland Restoration. The MassDOT Specification for Item 755.45 Wetland Restoration provides further detail on the restoration of wetland areas upon completion of construction work including placement of sediment barriers if they are required for sediment control during restoration work. Additionally, this includes removal and disposal of the proposed timber matting after construction and restoration of grades to existing pre-construction elevations.

The following section describes how the proposed work within BVW meets the performance standards:

The proposed work will comply with General Performance Standards in accordance with 310 CMR 10.55 (4)(b), (d) and (e). The 310 CMR 10.55 (4)(c) Standard does not apply to this project as the impacts are more than 500 SF.

In compliance with 310 CMR 10.55 (4)(d), the proposed project will not have any "… adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.59." The project site is not located within an area designated as Priority or Estimated Habitat of Rare Species by the Natural Heritage & Endangered Species Program (NHESP) 2021 Maps. No Certified or Potential Vernal Pools are located in this area of the City (see Figure 3).

In compliance with 310 CMR 10.55 (4)(e), the proposed project is not located within an Area of Critical Environmental Concern (ACEC), therefore, proposed work will "*not destroy or otherwise impair any portion of a Bordering Vegetated Wetland that is within an Area of Critical Environmental Concern designated by the Secretary of Energy and Environmental Affairs under M.G.L. c. 21A, § 2(7) and 301 CMR 12.00: Areas of Critical Environmental Concern*."

A wetland replication of approximately 2,500 square feet is proposed and designed in accordance with 310 CMR 10.55 (4)(b) provisions and MassDOT Specification 755.35, Inland Wetland Replication Area, as summarized below. The MassDOT Specification for Item 755.35 Inland Wetland Replication Area provides further detail for the construction of the proposed replication area including the proposed sediment control barrier and erosion prevention measures, the wetland soil to be used, planting, seed mix, and other construction methods and site protection methods.

1. *Replacement areas (replication areas) must be equal in total size to lost BVW area;*

As shown on the plans (see Figure 6D and plan sheet 26), the proposed replication area on the northern side of the proposed bikeway around Sta. 327+00 adjacent to BVW Z has an area of approximately 2,500 square feet, which is slightly greater than the 2,225 square feet of permanently impacted area as required by the regulations.

2. *The surface/ground water elevations of the replacement must approximate those that characterized the lost BVW areas;*

The proposed wetland replication area around Sta. 327+00 will be connected to BVW Z and will be at the same elevation as BVW Z.

3. *Replication areas are to be configured and located, with respect to inland bank, in a similar manner as was the case for lost BVW areas;*

The overall horizontal configuration and location of the replacement area with respect to the bank are similar to the lost areas.

4. *Replication areas must have an unrestricted hydraulic connection to the same waterways and/or waterbodies as the lost areas;*

The replication area proposed around Sta. 327+00 adjacent to BVW Z is hydrologically connected to all wetlands being impacted by the proposed project.

5. *Replication areas are to be located within the same reach of waterway or general areas of waterbody, as lost BVW areas;*

The proposed replication area is located along the same waterbody and the same reach of Proctor Brook as the lost areas. Due to site constraints and limited area within the right-of-way, the replication area cannot be closer to any of the lost wetlands than the location in which it is proposed on the plans. Additional site constraints of this area include a concrete pool that is located just north of the proposed wetland replication area. The pool is located approximately 12 feet from the existing wetland edge, preventing a more linear wetland replication in this area.

6. *In the replication areas, indigenous plant species shall be used to reestablish the vegetation cover of the new BVW areas such that a 75% cover of these areas is attained within two (2) growing seasons. During the period of reestablishment, any exposed soil must be stabilized in accordance with U.S. Soil Conservation Service methods;*

Indigenous plant species are proposed to reestablish vegetation, as shown on the plans. Any exposed soil will be stabilized in accordance with U.S. Soil Conservation Service methods.

7. *General Performance Standards for BVW areas must be addressed in a manner consistent with those of other resource areas described in 310 CMR 10.*

The proposed work will comply with General Performance Standards for BVW areas.

Land Under Water Bodies and Waterways (LUW)

The main protected wetland resource area within the project area is Proctor Brook, which is a perennial stream. General Performance Standards for Land Under Water Bodies and Waterways (LUW), as presented in 310 CMR 10.56(4), allows work in LUW that will not impair the water carrying capacity of the existing channel, nor ground water and surface water quality, nor the capacity of the LUW to provide breeding

habitat, escape cover, or food for fisheries. The work also may not impair the capacity of the LUW to provide important wildlife functions. The regulations provide that the capacity of LUW to provide important wildlife functions is deemed to be unimpaired so long as less than ten (10) percent of the area of LUW significant to protection of wildlife habitat, or 5,000 square feet of LUW (whichever is less) is cumulatively altered.

The proposed Independence Greenway extension requires replacement of the existing two (2) cross culverts to allow Proctor Brook to pass beneath the proposed shared-use trail. There is also a portion of the proposed Greenway near the eastern limits where the light duty timber boardwalk structure supported on helical piles is proposed. Replacement of the culverts and construction of the timber boardwalk will result in permanent and temporary impacts to LUW, as described in Table 2 below.

Table 2: LUW Impacts

Proctor Brook (STA. #)	Permanent Impacts (ft^2)	Temporary Impacts (ft^2)
STA. 329+85	8,365	1,009
STA. 340+10	107	32
STA. 342+20	79	64
STA. 345+50	13	72
STA. 346+20	1,474	355
STA. 351+50	305	550
Total	**10,343**	**2,082**

*see Figure 6A – 6H in Appendix C

The proposed improvements under this project will result in 10,343 square feet of permanent impacts within the waterways. Permanent impacts will be caused by the replacement of the existing Proctor Brook crossings beneath the former railroad bed (proposed shared-use path), including placement of riprap at the proposed culvert inlets and outlets for scour protection and associated regrading near proposed culverts.

The extensive work within the LUW at the locations of Culvert No. 1 (Sta. 329+85) and Culvert No.2 (Sta. 346+20) is required to place riprap countermeasures, which were designed in accordance with the guidelines outlined in Hydraulic Engineering Circular No. 14, specifically Chapters 5 and 10. These guidelines were utilized to estimate scour levels at culvert outlets and to develop the design for riprap basins and aprons, respectively. In order to mitigate the impacts of the high volume of riprap at the culvert inlets and outlets of these two culverts at Sta. 329+85 and Sta. 346+20, as well as at the outlets of the smaller culverts within Proctor Brook at Sta. 340+10 and Sta. 342+20, an additional 12-inch layer of natural streambed material will be placed on top of the riprap and stone for pipe ends on each side of the culverts as shown on the plans to restore natural substrate.

Additionally, the temporary impacts of 2,082 square feet are associated with the control of water during construction and installation of erosion and sediment controls to protect the downstream waterway during the replacements of the stream crossings, installation of boardwalk. The proposed replacement of Culverts 1 and 2 at Sta. 329+85 and 346+20, respectively, may require dewatering to take place, and installation of erosion & sediment controls at the boardwalk will result in temporary LUW impacts at these locations. Dewatering for culverts within temporary cofferdams to allow for construction “in the dry” will be required for removal of groundwater from excavations for structural components and from surface water that enters the work area by precipitation or splash-over.

The Contractor will be expected to perform this work in accordance with MassDOT specifications for Control of Water (Items 991.11, 991.12 and 991.13 – Control of Water for Structures - Culvert No. 1, Culvert No.2 and Bridge Structure No. P-03-020 (CAK) respectively). The Contractor must treat dewatering discharges, prior to outletting these flows to local waterways, for removal of sediments. This will be done by use of sediment tanks, fractionalization tanks, sediment basins, or other approved means. Outlets from these treatment measures will discharge onto splash pads or other measures that will prevent concentrated flows that could erode bank soils or streambed materials en route to the receiving watercourse.

There will be no direct discharge of pumped water into any wetland, resource area, or closed drainage system.

Bank

The proposed project activities will permanently impact 618 linear feet of inland bank associated with Proctor Brook and two (2) intermittent streams within the project limits. These activities consist of the proposed replacement of culverts conveying Proctor Brook, intermittent streams and hydrological connection beneath the proposed shared-use path. Temporary disturbance to Bank (201 linear feet) will be required for installation of Erosion & Sediment Control BMPs. The permanent and temporary impacts to the Bank are summarized in Table 3 below.

Table 3: Impacts to Bank

Bank (STA. #)	Permanent Impacts (LF)	Temporary Impacts (LF)
Proctor Brook (West STA. 329+85)	117	9
Proctor Brook (East STA. 329+85)	125	39
Proctor Brook (North STA. 340+10)	10	3
Intermittent Stream (South STA. 340+00)	17	13
Proctor Brook (STA. 342+20)	15	17
Proctor Brook (West STA. 346+20)	94	4
Proctor Brook (East STA. 346+20)	78	5
Proctor Brook (West STA. 351+00)	37	4
Intermittent Stream (358+00)	125	107
Total	**618**	**201**

* see Figure 6A – 6H in Appendix C

General Performance Standards for Inland Bank, as presented in 310 CMR 10.54(4), allow work on a Bank that will not impair its physical stability, the water carrying capacity of the existing channel within the Bank, or ground water and surface water quality. Such work also must not impair the capacity of the Bank to provide breeding habitat, escape cover, or food for fisheries; nor may the work impair the capacity of the Bank to provide important wildlife functions. A Bank's capacity to provide important wildlife functions is deemed to be unimpaired so long as less than ten (10) percent of the length of the Bank, or 50 feet of the Bank (whichever is less) is cumulatively altered.

Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.

The WPA regulations require, in part, that wildlife habitat evaluations be conducted when a proposed project will alter Inland Bank, Land Under Water ("LUW"), Riverfront Area ("RFA"), or Land Subject to Flooding ("BLSF" or "ILSF") beyond the thresholds permitted under 310 CMR 10.54(4)(a)5., 10.56(4)(a)4., 10.57(4)(a)3., and 10.58(4)(d)1. The proposed work under this project will cumulatively alter more than 50 linear feet of Bank, which is beyond the threshold referenced in the Regulations thus requiring an Evaluation.

Wildlife Habitat Evaluation was performed on November 2, 2022 by the Certified Wildlife Biologist, at the locations where Bank was impacted due to project improvements in order to assess how project activities may impact the Banks' capacities to provide breeding habitat, escape cover and food for wildlife.

The Wildlife Habitat Evaluation conducted in six locations along the former railroad right-of-way between Northshore Road and Endicott Street concluded that although significant disturbance is proposed in several wetland resource area types, the existing condition in the study area being heavily disturbed with a variety of developments and former railroad infrastructure as well as the area being dominated by the invasive and/or noxious species are expected to result in a net improvement under proposed project, as designed. Not only no adverse impacts to wildlife habitat are anticipated, but the proposed project, as designed, is expected to improve the wildlife habitat and the affected resource areas' overall capacities to provide important wildlife habitat functions listed in 310 CMR 10.60(2), including food, escape cover, migratory and breeding habitat after reconstruction of stream crossings under the scope of this project is completed. While there are open water areas along the brook, which may have Important Habitat Features for winter waterfowl as well as plunge pools significant for fisheries, the disturbance to wildlife habitat required to replace the stream crossings is temporary and the natural streambed will be reestablished and the LUW area will be restored upon completion of construction. Notwithstanding the requirements of 310 CMR 10.56(4)(a)4., the impact on Land under Water Bodies and Waterways caused by the installation of a stream crossing is exempt from the requirement to perform a habitat evaluation in accordance with the procedures established under 310 CMR 10.60 (see Wildlife Habitat Evaluation in Appendix D of this Application).

The "no substantial reduction" standard is met when "important wildlife habitat functions are substantially restored" during project construction, or it is otherwise demonstrated that "the proposed alterations will have no adverse effects on wildlife habitat" because the important features identified in a particular study area are common to the overall area, and potential habitat features lost are minimal and any adverse impacts are avoided or minimized and mitigated. Therefore, the project should not result in a significant adverse effect or impair or reduce the capacity of Bank to provide important wildlife habitat functions.

The following section describes how the proposed work within the Bank meets the performance standards in accordance with 310 CMR 10.54 (4)(a):

310 CMR 10.54(4)(a)(1) Physical Stability of the Bank:

The proposed work will not impair the physical stability of the Bank. The minor impacts associated with construction activities will be mitigated by the implementation of E&S controls to minimize impacts on Bank. After completion of work, the total area of bank disturbed under proposed conditions will be replaced in accordance with the performance standards listed in 310 CMR 10.54(4).

310 CMR 10.54(4)(a)(2) Water Carrying Capacity of the Existing Channel within the Bank:

The proposed work will not impair the water carrying capacity of the existing channel within the bank. The permanent impacts to the inland bank of the streams within the project area result from the proposed water-dependent activities (replacement of culverts conveying Proctor Brook, intermittent streams and

hydrological connection beneath the proposed shared-use path). The impacted banks will be stabilized with riprap at the culvert ends and headwalls, therefore, the water carrying capacity of the existing channel within the bank will not be affected.

310 CMR 10.54(4)(a)(3) Ground Water and Surface Water Quality:

The work within the Bank will not have a negative impact on the ground water and surface water quality due to the nature of disturbance associated with water-dependent activities such as replacement of culverts conveying Proctor Brook, intermittent streams and hydrological connection beneath the proposed shared-use path. In addition, implementation of the proposed erosion and sediment control measures will help maintain water quality (ground and surface) throughout construction.

310 CMR 10.54(4)(a)(4) Capacity of the Bank to provide Breeding Habitat, Escape Cover and Food for Fisheries:

The proposed work will not have an adverse effect on the capacity of the Bank to provide breeding habitat, cover and food for fisheries. In addition, the impacts will be also offset by the proposed mitigation measures, since culvert replacements with larger openings and a natural stream bottom may actually improve animal movement along the abandoned railroad right-of-way, potentially create and/or improve the escape cover and breeding habitat.

The Wildlife Habitat Evaluation in Appendix D of this Application concluded that no important habitat features were observed at these locations, and there will be no significant adverse impacts to wildlife habitat. Therefore, the Banks' capacities to provide breeding habitat, escape cover and food for fisheries will not be impacted by the proposed work.

310 CMR 10.54(4)(a)(5) Capacity of the Bank to provide Important Wildlife Habitat Functions:

The capacity of Bank to provide important wildlife functions will not be impacted by this project since the existing characteristics of the Bank and landscape context within and adjacent to the previously developed paved project area will not be negatively affected as concluded by the Wildlife Habitat Evaluation (see Appendix D). Impacts to wildlife are expected to be negligible and are expected to be offset by the proposed mitigation measures. In addition, the proposed culvert replacements may actually improve animal movement at the locations of larger culvert openings and due to placement of a natural stream bottom at each replacement stream crossing. Furthermore, based on the conclusion of the Wildlife Habitat Evaluation, an Appendix B WHE is not needed for this project because there are no Important Habitat Features found on or even around the areas of Bank proposed for alteration.

Pursuant to 10.54(4)(b), notwithstanding the provisions of 310 CMR 10.54(4)(a), structures may be permitted in or on a Bank when required to prevent flood damage to facilities, buildings and roads constructed prior to the effective date April 1, 1983, including the renovation or reconstruction (but not substantial enlargement) of such facilities, buildings and roads, provided that the following requirements are met:

1. The proposed protective structure, renovation or reconstruction is designed and constructed using best practical measures so as to minimize adverse effects on the characteristics and functions of the resource area;

The impacts to Banks were minimized to the maximum extent practicable.

2. The applicant demonstrates that there is no reasonable method of protecting, renovating or rebuilding the facility in question other than the one proposed.

There are no reasonable alternatives that would achieve the project purpose of extending the existing Independence Greenway bikeway/share-use path network along the former B&M railroad right-of-way, as proposed. The replacement of multiple stream crossings along the project corridor are required due to the project's location near Proctor Brook; therefore, the impacts to the Bank are unavoidable, however, they were minimized to the maximum extent feasible. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings and adjacent landscape improvements, the proposed work, as deigned, is expected to result in a net improvement to wildlife habitat across the project.

In order to mitigate impacts to bank caused by the placement of riprap for scour protection and bank stabilization near the proposed culvert replacements, vegetated riprap is proposed for bank protection and stabilization. The vegetated rip rap is proposed at the inlets and outlets of Culverts 1 and 2 at Sta. 329+85 and Sta. 346+20, respectively, in the areas where rip rap is proposed within BVW. At Culvert 1 at Sta. 329+85, approximately 694 SF of vegetated rip rap is proposed. At Culvert 2 at Sta. 346+20, approximately 1,520 SF of vegetated rip rap is proposed. The selected method is to plant live vegetated stakes in the voids between the riprap area in order to further aid in slope stabilization and restoring the area to natural conditions. The proposed live stakes will integrate brush layering, pole planting, and live siltation techniques during rock placement to ensure contact with native ground and will be laid horizontally to maximize rooting in accordance with MassDOT specifications for Live Stakes. The MassDOT Special Provision for Item 799.775 Live Stakes specifies that the live stakes be a minimum of four feet in length, a minimum of three-quarter inch (3/4") in diameter, harvested locally, and have side branches removed with the bark intact. Additionally, the stakes will have at least two (2) bud scars near the top to facilitate branch development and shall be planted at 90-degrees to the slope.

Bordering Land Subject to Flooding (BLSF)

Majority of the project corridor is located along Proctor Brook which is generally flowing in the west-to-east direction which has various 100-year flood elevations which drop from 47.1 feet near the western project limit to 39.6 feet at the eastern project limit (NAVD 88).

The proposed project activities will occur within approximately 69,340 square feet of BLSF area, due to proposed shared-use path currently being located within the 100-year floodplain area associated with Proctor Brook. There are areas of cut and fill within BLSF along the project corridor, required for regrading and construction activities to make the area usable for the proposed shared-use path (see Figure 7A-7H for details).

The following section describes how the proposed work within BLSF meets the performance standards in accordance with 310 CMR 10.57 (4)(a):

10.57(4)(a)(1) Compensatory Storage:

The fill within the floodplain is proposed from approximately Sta. 352+50 to Sta. 358+50 and is associated with the proposed timber boardwalk located within a portion of the 100-year floodplain. At other areas along the project corridor between Sta. 345+50 and 352+50 minor fill is proposed due to required regrading of the existing railroad track bed located within the BLSF. The areas where the existing railroad track bed will be regraded and lowered and at the proposed culvert replacement sites, the project will result in either

no impacts or net cut within the BLSF. The project overall will result in a net fill of 2,982 cubic feet. However, compensatory flood storage of 3,472 cubic feet will be provided.

The proposed flood storage compensation area will be located near the eastern end of the project approximately 350 feet west of Endicott Street (approx. Sta. 355+50) and must comply with the General Performance Standards presented in 310 CMR 10.57 (4)(a). These call for the provision of compensatory flood storage volume for existing flood storage that will be made unavailable by the proposed work. These storage areas must be incrementally equal per foot of elevation to storage volume lost. They also must have an unrestricted hydraulic connection to the same waterway segment as the lost storage volumes. Work within BLSF cannot restrict flows in any manner that would increase flood stages or flow velocities. The proposed flood storage area is hydrologically connected to the affected floodplain and will provide flood storage compensation on a foot-by-foot basis where feasible. Due to the close proximity of wetlands at the same elevations as the proposed fill within the 100-year floodplain, the project, though resulting in overall incremental net cut, is not able to compensate fill at elevations 37-41 feet as compensation would result in additional impacts to the surrounding wetland resource areas. However, the project is able to compensate the remaining project's flood storage loss at elevations 34-37 feet. While the project is not compensating at the same incremental elevations that fill is occurring at, all of the flood storage compensation that will be provided is occurring either at or below the elevations of fill. Compensating at a lower overall elevation, and providing more storage overall, is more beneficial for mitigating and reducing flood impacts than simply compensating for lost storage on a foot-by-foot basis. The proposed flood compensation area more than compensates for the existing flood storage that will be made unavailable by the proposed work, compensates at lower overall elevations, is hydraulically connected to the same waterway segments as the lost storage volumes, and will not result in restricted flows. Additionally, although the majority of the project is eligible for limited project status, there are portions of the project within BLSF that are not eligible for limited project status. However, the proposed work within the BLSF area is being compensated at the elevations listed in Table 4 below, and the BLSF performance standards are being met. Table 4 below provides a summary of cut, fill and flood storage compensation provided:

Table 4: Cut/Fill Across the Project & Compensatory Flood Storage

Elevation (FT)	Incremental Net Cut/Fill Volume (CF)	Storage Cut Volume (CF)	Total Net Cut/Fill Volume (CF)
34-35	301	-921	-620
35-36	-159	-1,400	-1,559
36-37	2,197	-1,151	1,046
37-38	2,033	0	2,033
38-39	1,305	0	1,305
39-40	5,246	0	5,246
40-41	2,207	0	2,207
41-42	-726	0	-726
42-43	79	0	79
43-44	-4,458	0	-4,458
44-45	-1,980	0	-1,980
45-46	-1,495	0	-1,495
46-47	-1,490	0	-1,490

47-47.1	-79	0	-79
TOTAL	**2,982**	**-3,472**	**-490**

*see Figure 7A-7H in Appendix C

The project is not increasing the FEMA Base Flood Elevations. A hydraulic study of Proctor Brook was done that included the increase in peak rates due to the increase in impervious area. The proposed reconstruction of culvert No. 1 at Sta. 329+85 and culvert No. 2 at Sta 346+20 with larger box culverts to increase flows through the culverts beneath the proposed shared-use path will not result in increase to the Base Flood Elevation (BFE) or downstream flooding.

10.57(4)(a)(2) Restriction of Flows:

The proposed work will redevelop the existing previously disturbed and degraded area associated with the former B&M railroad track bed, which is currently located within BLSF. The work will include the activities associated with replacements of the cross culverts to promote unrestricted flows under the proposed shared-use path. Therefore, the proposed improvements will not restrict flows so as to cause an increase in flood stages on flow velocities, in compliance with this standard.

10.57(4)(a)(3) Shall Not Impair Wildlife Habitat:

The proposed site alterations within BLSF will not adversely impact portions of the BLSF found to be significant to the protection of wildlife habitat nor its capacity to provide wildlife habitat functions. The proposed alterations are located outside areas depicted as “priority habitat or rare species” and “estimated habitat of rare wildlife” as depicted on the 2021 Massachusetts Natural Heritage Atlas. The project area is comprised of disturbed and degraded areas associated with the former B&M railroad, which is surrounded by Proctor Brook, BVWs and adjacent intermittent streams. However, project activities will not negatively impair wildlife habitat, and, on the contrary, are expected to result in improved wildlife passage beneath the proposed path due to larger culvert openings, as well as improved wildlife habitat functions. The site is currently degraded, overgrown with invasives and brush, and contains a lot of debris and garbage. These are anticipated to be addressed by this project resulting in improved wildlife habitat functions. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings, the proposed work will only result in a net improvement to wildlife habitat. Additionally, a Wildlife Habitat Evaluation was performed and concluded that an Appendix B WHE is not required for this project because there are no Important Habitat Features found on or even around the areas of Bank proposed for alteration (see Appendix D for Wildlife Habitat Evaluation).

Riverfront Area

Riverfront Area associated with Proctor Brook extends over 294,400 square feet of the project site. The work proposed in the Riverfront Area includes construction of the Independence Greenway Extension along the former B&M railroad right-of-way, the replacement of existing stream crossings, construction of a light duty timber boardwalk structure supported on helical piles and associated work necessary to achieve the project purpose.

The railroad that formerly operated on the subject property was constructed in approximately 1848-1849 and was opened for service in 1850 as the Salem & Lowell Branch of the Lowell & Lawrence Railroad. The Salem & Lowell Branch ran between Peabody and Tewksbury, Massachusetts. Operation of the Lowell &

Lawrence Railroad was taken over by the Boston & Lowell Railroad in 1858, which operated on the subject property until the tracks were leased by the Boston & Maine Railroad in 1887. Trains using the subject property provided both passenger and freight service for several decades until passenger service was discontinued on the Salem & Lowell Branch in 1932. Freight service between Peabody and West Peabody (including the proposed project site) continued until 1962, and freight service from West Peabody to South Middleton (west of the proposed project site) continued until 1980. The entire Salem & Lowell branch was formally abandoned in 1987.

As a result of the project site's history as an abandoned railroad, the ground surface within the former railroad bed is mixed with the remains of the materials typically used for construction of railroads, such as track ballast and railroad ties. Additionally, in the years since the railroad was abandoned, the already degraded site has since been degraded even further with the presence of discarded waste, debris, trash, and overgrown invasives.

This proposed work will occur within previously degraded Riverfront Area, and therefore meets the requirements for review under Redevelopment: 10.58(5). The Riverfront Area associated with Proctor Brook in this area is located with an abandoned railroad bed and has a significant amount of debris and trash that has collected in the area over the years. Additionally, the area has had significant erosion and culverts have failed and washed out. While the area is not impervious or developed, it is significantly disturbed and degraded and therefore meets the requirements as a Redevelopment project.

In addition, a large portion of the project within the existing railroad right-of-way falls under the limited project provisions listed in 310 CMR 10.53(6) and 310 CMR 10.53(3)(i) as well as 310 CMR 10.53(3)(j) and 10.53(3)(f). See Figure 2 in Appendix C for the portions of the project that are within each of the above limited project provisions.

General Performance Standards for Riverfront Area, as set forth in 310 CMR 10.58(4), are addressed as described below:

(a) Protection of other Resource Areas: The affected Riverfront Area includes BVWs, Inland Bank, BLSF and Buffer Zones. The project will comply with the performance standards as described above in previous sections of this narrative.

(b) Protection of Rare Species: As indicated previously in this Narrative, there are no threatened or endangered species, or species of concern, in the project area.

(c) Practicable and Substantially Equivalent Economic Alternative: This project evaluated several Practicable and Substantially Equivalent Economic Alternatives to the proposed design in order to select the design that avoids, minimizes, and mitigates all wetland resource area impacts to the maximum extent practicable. A thorough Alternatives Analysis was conducted and is included in Section 4.0 of this report.

(d) No Significant Adverse Impact: The project will result in an increase in impervious area. Most of the permanent work will occur within a Riverfront Area that is previously degraded by the fill associated with the former railroad track bed and embankments. The work associated with culvert replacements may partially encroach into undeveloped portions of the Riverfront Area; however, those impacts are unavoidable due to the need to replace the existing culverts. No significant adverse impacts are anticipated, since all impacts have been minimized to the maximum extent practicable and the area will be stabilized upon completion of construction.

When work that redevelops previously developed Riverfront Areas is proposed, the following criteria from 310 CMR 10.58(5) need to be complied with:

(a) At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the Riverfront Area to protect the interests identified in M.G.L. c.131,§40. When a lot is previously developed but no portion of the Riverfront Area is degraded, the requirements of 310 CMR 10.58(4) shall be met.

This project is intended to provide the highest level of service to bikers and pedestrians that can be utilized for recreation or for short-range trips to businesses or other destinations along the Greenway. The project mostly alters previously disturbed and degraded Riverfront Area, and within the limits of the project area, minimal space is present where improvements to the Riverfront Area could be realized. Since most of the Riverfront Area within the project corridor is degraded, and as such there is no need to meet requirements of 310 CMR 10.58(4). The work within small undeveloped portions of the Riverfront Area is unavoidable due to culvert replacements, associated regrading and placement of the erosion and sediments controls to protect nearby BVWs. Where possible, disturbed areas will be loamed and seeded. Portions of the Riverfront Area within the project corridor and near the reconstructed stream crossings which are currently degraded, overgrown with invasives and brush, and contain a lot of debris and garbage will be improved as a result of this project. Mitigation for impacts to Riverfront Areas at a ratio of 1:1 was considered for this project. However, mitigation at a 1:1 ratio was determined to be infeasible due to limited space within the Right of Way and due to the fact that the area surrounding the project is primarily already developed and degraded riverfront. Local options for restoration or replication of disturbed areas outside of the project area are also not available due to the surrounding land uses consisting of mostly residential and paved areas. Herbicide treatment of invasive plants currently existing within the project limits and as directed will occur as part of this project in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33). The MassDOT Special Provisions for Invasive Plants Management specify that all herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau. Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones. Additionally, the contractor shall not spray 2 hours prior to precipitation, during rain, or during windy conditions and shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used. Item 102.33 also specifies that a written Invasive Plant Management Strategy (IPMS) proposal must be submitted for approval by the Engineer and MassDOT Landscape Architect at least thirty (30) days prior to construction activities and/or any proposed treatment.

(b) Stormwater management is provided according to Massachusetts Stormwater Management Standards, as can be seen in Appendix F to this Application.

This project provides an opportunity to improve the existing drainage system and improve the quality of stormwater runoff discharged to adjacent wetlands. This project will incorporate the installation of practical Best Management Practices (BMPs). Retrofitting of outfall locations with stone for pipe ends to provide splash pads for stormwater discharges will reduce erosion and movement of sediment into the waterbodies. Additionally, new catch basins have been proposed to replace existing catch basins where proposed roadway geometry differs from existing conditions. Sediment filters (silt sacks) will be installed at all existing and proposed drainage structures and maintained and cleaned as required to maintain their effectiveness. Catch basins, drain manholes and storm drain pipes will be cleaned of sediment and debris after the completion of construction. Sediment collected in structures will be disposed of properly and covered, if

stored on-site. A stormwater BMP (infiltration trench) will be installed to help with peak rate attenuation and improve water quality. All proposed drainage improvements will maintain historic drainage patterns, distributing runoff to the existing discharge points, and will be done in a manner that will limit the impacts to adjacent resource areas. These improvements may contribute to improved water quality and drainage characteristics; therefore, contributing to the interests of the WPA (public or private water supply, to ground water supply, to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat).

(c) Within 200-foot Riverfront Areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less, or not closer than existing conditions within 25 foot Riverfront Areas, except in accordance with 310 CMR 10.58(5)(f) or (g).

Majority of proposed work will occur as close to the river as the present limits of areas degraded by the former railroad track bed and embankments. However, due to the project's purpose to extend the existing Independence Greenway along the former B&M railroad right-of-way, the existing stream crossings beneath it require to be replaced; therefore, small portions of this work associated with stream crossing replacements may be located closer to the river than existing conditions. The limit of work has been minimized to the maximum extent practicable, and the area will be stabilized and restored to the maximum extent feasible upon completion of work.

(d) Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).

Most of the permanent work will be located within the area previously disturbed, due to the present limits of areas degraded by the former railroad track bed. Areas disturbed by culvert reconstruction and regrading within the Riverfront Area will be stabilized upon completion of construction to the maximum extent practicable.

(e) The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).

The amount of work in the Riverfront Area is 103,288 square feet of the 294,400 square feet of the total Riverfront Area within the project area. Approximately 35 percent of the Riverfront Area will be affected by the proposed work. Of the 103,288 square feet of affected Riverfront Area within the project area, most of the resource area is already degraded by the former railroad track bed. Disturbances within the Riverfront Area associated with culvert replacements and regrading have been minimized to the maximum extent practicable and the area will be stabilized upon completion of construction.

(f) When an applicant proposes restoration on-site of degraded riverfront area alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Restoration shall include:

1. removal of all debris, but retaining any trees or other mature vegetation;
2. grading to a topography which reduces runoff and increases infiltration;
3. coverage by topsoil at a depth consistent with natural conditions at the site; and

4. seeding and planting with an erosion control seed mixture followed by plantings of herbaceous and woody species appropriate to the site;

The project proposes restoration of the degraded Riverfront Area within the former railroad right-of-way. The proposed restoration within the Riverfront Area will include removal of debris and invasives, regrading, wetland restoration and replication, as well as areas of landscape improvements. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings and adjacent landscape improvements, the proposed work, as designed, is expected to result in a net improvement to wildlife habitat across the project. Existing areas that are currently degraded by the presence of invasive plants, debris, and garbage will be improved by the proposed work which will involve herbicide treatment of invasive plants currently existing within the project limits and as directed will occur as part of this project in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33) as well as the removal of debris and garbage from the project site. All areas will be stabilized upon completion of the work.

(g) When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 to 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Environmental Affairs.

The project proposes restoration of the degraded Riverfront Area within the former railroad right-of-way. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings and adjacent landscape improvements, the proposed work, as designed, is expected to result in a net improvement to wildlife habitat across the project. Existing areas that are currently degraded by the presence of invasive plants, debris, and garbage will be improved by the proposed work which will involve herbicide treatment of invasive plants currently existing within the project limits and as directed will occur as part of this project in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33) as well as the removal of debris and garbage from the project site. All areas will be stabilized upon completion of the work.

(h) The issuing authority shall include a continuing condition in the Certificate of Compliance for projects under 310 CMR 10.58(5)(f) or (g) prohibiting further alteration within the restoration or mitigation area, except as may be required to maintain the area in its restored or mitigated condition. Prior to requesting the issuance of the Certificate of Compliance, the applicant shall demonstrate the restoration or mitigation has been successfully completed for at least two growing seasons.

The project proposes restoration of the degraded Riverfront Area within the former railroad right-of-way. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings and adjacent landscape improvements, the proposed work, as designed, is expected to result in a net improvement to wildlife habitat across the project. Existing areas that are currently degraded by the presence of invasive plants, debris, and garbage will be improved by the proposed work which will involve herbicide treatment of invasive plants currently existing within the project limits and as directed will occur as part of this project in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33) as well as the removal of debris and garbage from the project site. All areas will be stabilized upon completion of the work.

Buffer Zone

The majority of the project corridor is located within the 100-foot Buffer Zone to the BVWs and Banks of the intermittent streams. The project will result in approximately 54,594 SF of Buffer Zone impacts. Erosion and sediment control Best Management Practices (BMPs) will be installed during construction to protect adjacent resource areas, which will temporarily impact the buffer zones. These BMPs ensure the land disturbance within the Buffer Zone does not negatively impact resource areas and will secure the protection of the interests of the Act they are supporting.

Local Bylaw Buffer Zones

Portions of the project corridor are located within the Local "No Disturb Zones" subject to local bylaw regulations. Since this project is a public project proposed by the City of Peabody, which also includes replacement of water dependent structures, it falls under the circumstances where limited wetland alteration necessary to accomplish the goals of the project may be permitted under the provisions of Section 32-36 of the local ordinance.

The work within these buffer zones has been designed to minimize impacts to the buffer area to the maximum extent practicable. Erosion and sediment control Best Management Practices (BMPs) will be installed during construction to protect adjacent resource areas, which will temporarily impact the buffer zones. These BMPs ensure the land disturbance within the Buffer Zone does not negatively impact resource areas.

2.2.3 Compliance with Massachusetts River and Stream Crossing Standards

The existing 24-inch diameter CMP culvert at Sta. 342+20 conveys a hydrological connection between Proctor Brook and the BVW V-series beneath the former railroad bed; therefore, the replacement of this culvert is not required to meet the MA Stream Crossing General Standards (SCGS). However, the proposed stone for pipe ends on the outlet side of the culvert in Proctor Brook will be topped with a 12-inch layer of natural streambed in order to reestablish natural substrate upon completion of construction.

The compliance of each stream crossing with the Massachusetts River and Stream Crossing Standards are summarized in Table 5 below.

Table 5: Compliance with Massachusetts River and Stream Crossing Standards

Stream Crossing (STA. #)	SCGS #1	SCGS #2	SCGS #3	SCGS #4	SCGS #5	SCGS #6
Culvert No. 1 Replacement at STA. 329+85	Not met	Partially Met	Not met	Met	Met	Met
Culvert Replacement STA. 340+10	Not met	Met	N/A	Met	Met	Not met
Culvert No. 2 Replacement at STA. 346+20	Not met	Partially Met	Met	Met	Met	Met
Prop. Timber Boardwalk at STA. 351+50	Met	N/A	Met	N/A	Met	Met
Culvert Replacement at STA. 358+51	Not met	Not met	N/A	Not met	Met	Not met

The proposed replacement concrete box culverts at Sta. 329+85 and Sta. 346+20 achieve partial compliance with the Massachusetts River and Stream Crossing Standards (revised March 2011) as discussed below and summarized in Table 5 above. SCGS #1 cannot be complied with for either culvert. An open bottom culvert requires the installation of a footing which will result in significantly more excavation and, as a result, significantly more impacts within the surrounding wetland resource areas.

The proposed timber boardwalk pedestrian bridge at Sta. 351+50 achieves compliance with the Massachusetts River and Stream Crossing Standards by conforming with the SCGS #1, #3, #5, and #6. SCGS #2 and SCGS #4 do not apply.

The proposed embedded 36-inch diameter DIP culvert at Sta. 340+10 and the proposed 16-inch DIP culvert Sta. 358+51 both convey intermittent streams under the former railroad bed. These culverts will achieve partial compliance with the MA SCGSs as discussed below and summarized in Table 5 above.

SCGS #1 posits that "*Spans (bridges, 3-sided box culverts, open-bottom culverts or arches) that preserve the natural stream channel are strongly preferred*." The project proposes the replacement of the existing undersized culverts with larger box culverts. The existing culverts are not open bottom, and replacement of the culverts with open bottom structures is not feasible in order to expeditiously complete the replacement of the culverts, without disturbing substantially more adjacent resource areas and established site hydrology. An open bottom culvert requires the installation of a footing which will result in significantly more excavation and fill within the surrounding wetland resource areas. Therefore, this standard cannot be complied with. The proposed timber boardwalk pedestrian bridge at Sta. 351+50 will preserve Proctor Brook's natural stream channel and therefore complies with SCGS #1.

SCGS #2 provides recommendations for a culverted crossing to be embedded a minimum of 2 feet for box culverts or at least 25% for round pipe culverts. When embedment material includes elements > 15 inches in diameter, embedment depths should be at least twice the D84 (particle width larger than 84 % of particles) of the embedment material.

As shown in the Plans, the proposed concrete box replacement Culverts 1 and 2 will be embedded 12 inches with a natural streambed material proposed in the bottom of Culverts 1 and 2 at the same elevations as the existing surface. Embedding of these box culverts to the depth of 2 feet is not feasible due to the need to maintain the distance between the bottom of the structures and the existing 42-inch sewer lines located below both crossings, as shown on the Culvert 1 and Culvert 2 Plan and Longitudinal Section sheets in Appendix G. Considering that the embedment depth of a minimum of 2 feet for box

culverts is recommended in order to prevent streambed washout, and ensure compliance and long-term success of the proposed replacement stream crossing, the proposed design at both culverts includes concrete baffles in the bottom of box culverts to help hold the 12-inch layer of natural streambed in place and prevent washouts.

The proposed 36-inch culvert at Sta 340+10 will be embedded 12-inches, which exceeds the recommended minimum embedment depth of 25% for the round pipe culverts. This culvert was upsized in order to be embedded to provide a layer of natural streambed to match the existing surface elevations.

The proposed 16-inch DIP conveying an intermittent stream beneath the proposed bikeway at Sta 358+51 is not being embedded due to the small diameter of the culvert under both the existing and proposed conditions; upsizing this culvert significantly to allow for embedment and placement of natural streambed within it is precluded due to the hydraulic requirements. In addition, significantly upsizing this culvert to be embedded to provide enough room for placement of the natural streambed material would result in the need to elevate the profile of the bike path at this location, resulting in more impacts to the existing Bank of the stream as well as fill within the 100-year floodplain.

SCGS #3 calls for a new span to incorporate a width that, at a minimum, equals 1.2 times bankfull width of the stream.

- Proposed Culvert 1 (Sta. 329+85) – The existing bankfull width is approximately 19', however, the existing twin culvert spans approximately 7 feet and therefore does not comply with the SCGS. The proposed span of the culvert replacement is 8 feet. Although the proposed span still does not meet the SCGS of 1.2 times bankfull width, this is an improvement upon the existing conditions and meets the standards to the maximum extent practicable. It is not feasible to replace the culvert with a span greater than 8 feet, without disturbing substantially more adjacent resources areas and the established site hydrology. The culvert was sized using hydrological calculations to ensure no potential flooding of the properties and infrastructure will occur as a result of this replacement. Overall, in order to expeditiously complete the replacement of the culvert, without disturbing substantially more adjacent resource areas and established hydrology, additional widening of the passage is precluded. Therefore, this standard is met to the MEP.

- Proposed Culvert 2 (Sta. 346+20) – The bankfull width of the stream at the location of Culvert 2 is approximately 6 feet. The proposed culvert replacement has a span of 8 feet, which approximately 1.33 times the bankfull width of the stream, and therefore meets SGS #3.

- Proposed Timber Boardwalk Pedestrian Bridge (Sta. 351+50) – The bankfull width of the stream at the location of the proposed timber boardwalk is approximately 35 feet. The span of the proposed timber boardwalk is approximately 437 feet which greatly exceeds the minimum of 1.2 times the bankfull width of the stream in order to avoid greater impacts to surrounding resource area, and therefore meets SCGS #3.

- Proposed embedded 36-inch DIP culvert (Sta. 340+10) – Per ACOE terminology, an intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow. Since this culvert conveys an intermittent stream that does not have a year-round flow, this standard is not applicable. However, the proposed design evaluated all opportunities for improvement recommended by the MA Stream Crossing standard. The approximate width of the intermittent stream during the flow

period both at the culvert inlet and outlet is approximately 9 feet. The existing 30-inch CMP is proposed to be replaced with the 36-inch DIP culvert, that will be embedded 12 inches with a layer of natural streambed material in the bottom of it to meet the existing surface elevations. Therefore, the proposed design results in an improvement upon the existing conditions at this stream crossing by embedding the culvert 12 inches and, therefore, increasing the width of the crossing at this location.

- Proposed 16-inch DIP culvert (Sta. 358+51) – As mentioned above, this standard is not applicable to intermittent streams. However, the proposed design evaluated all opportunities for improvement recommended by the MA Stream Crossing standard. The width of the intermittent stream both at the culvert inlet and outlet is approximately 9 feet. The existing 15-inch RCP is proposed to be replaced with the 16-inch DIP culvert, which is an improvement upon the existing conditions at this stream crossing. Since this culvert is conveying and an intermittent stream beneath the existing railroad bed, significant widening of the crossing is precluded due to the hydraulic requirements and to maintain a shallow for depth of cover required to avoid additional fill within the 100-year floodplain.

SCGS #4 calls for placement of natural substrate within the structure. As shown in the Plans, the proposed replacement Culverts 1 and 2 will utilize concrete box culvert span-type structures of larger dimensions than existing culverts and will accommodate 12 inches of natural streambed material in the bottom. In addition, natural streambed material will be placed on top of the riprap in the areas of scour countermeasures outside of the culverts in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction.

The proposed embedded 36-inch culvert at Sta. 340+10 and the proposed 16-inch culvert Sta. 358+51 both convey intermittent streams under the former railroad bed; placement of the stone at pipe ends is required to prevent scour. As shown on the plans, a 12-inch layer of natural streambed material will be placed on top of the stone for pipe ends at Sta 340+10 within the stream areas in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed measures will result in providing a smooth transition from upstream to downstream of the crossing upon completion of construction.

SCGS #5 calls for "… *bed forms and streambed characteristics so that water depths and velocities are comparable to those found in the natural channel at a variety of flows*." The proposed Culverts 1 and 2 have been designed to provide as much accommodation to the existing channel as possible, and natural stream bed will allow for a smooth transition from upstream to downstream of each crossing upon completion of construction. Natural streambed material will be placed on top of the riprap in the areas of scour countermeasures outside of the culverts in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed timber boardwalk pedestrian bridge will preserve Proctor Brook's existing streambed characteristics. The proposed 36-inch Culvert at Sta. 340+10 will be embedded 12-inches with a layer of natural streambed material in the bottom of the culvert to meet the existing surface elevations. In addition, natural streambed material will be placed on both ends of the culvert on top of the stone for pipe ends in order to reestablish natural substrate adjacent to the proposed structures upon completion of construction. The proposed 16-inch DIP culvert at Sta. 358+51 will also maintain the existing streambed characteristics. Due to a very small area of riprap at the inlet and outlet at the proposed 16-inch DIP culvert at Sta. 358+51, no natural streambed layer is proposed; however, due to the location and the flow of this intermittent stream in the west-to-east directed, it is expected to be naturally reestablished shortly upon completion of construction.

SCGS #6 provides a desired level of "*openness*" for stream crossings so that wildlife will utilize the crossing for passage beneath a roadway. The desired ratio of cross-sectional area of opening to passage length is a minimum value of 0.82 feet. The embedded portion of a culvert is not included in the calculation of cross-sectional area for determining openness.

- Proposed Culvert 1 (Sta. 329+85) – A cross-sectional area of 24 square feet for the proposed culvert, divided by a passage length of 24 feet, both as shown in the Plans, yields a value of 1 foot.
- Proposed Culvert 2 (Sta. 346+20) – A cross-sectional area of 24 square feet divided by a passage length of 18 feet, both as shown in the Plans, yields a value of 1.33 feet.
- Proposed Timber Boardwalk Pedestrian Bridge (351+50) – A cross-sectional area of approximately 368 feet divided by a passage length of 13 feet, both as shown in the Plans, yields a value of 28.27 feet.
- Proposed embedded 36-inch DIP culvert (Sta. 340+10) – A cross-sectional area of the existing 30-inch CMP is approximately 4.9 square feet, divided by a passage length of 20 feet, both as shown in the Plans, yields a value of 0.24 feet. As mentioned above, upsizing this culvert significantly to allow to increase a level of "openness" is precluded due to the hydraulic requirements. The proposed 36-inch embedded replacement culvert's cross-sectional area is 5 square feet, therefore, though it is an improvement over existing conditions, it is not able to meet Standard #6 by providing a minimum level of openness of 0.82 feet.
- Proposed DIP culvert (Sta. 358+51) - A cross-sectional area of the existing 15-inch culvert is approximately 2.5 square feet. The proposed cross-sectional area of the 16-inch DIP culvert is 2.6 square feet, both divided by a passage length of 25 feet yield a value of approximately 0.1 feet. Therefore, the proposed replacement culvert is not able to meet Standard #6 by providing a minimum level of openness of 0.82 feet due to the. As mentioned above, upsizing this culvert significantly to allow to increase a level of "openness" is precluded due to the hydraulic requirements and to avoid additional impact the BLSF and the Bank of the stream.

As shown above, the proposed replacement of the perennial stream culverts and the proposed timber boardwalk pedestrian bridge are all able to meet Standard #6 by providing a minimum level of openness of 0.82 feet.

2.2.4 Stormwater Management

Stormwater management for this project has been designed in compliance with the Stormwater Management Standards as outlined in 310 CMR 10.05(6)(k) through (q) and defined in detail in the DEP's Stormwater Management Handbook. The project has been designed to minimize the impacts to nearby resource areas from both the construction and operation of the proposed project.

To improve upon existing conditions, stormwater runoff contributing to one of the existing discharge points will have a portion of the catchment area routed to a treatment SCM prior to discharge. The proposed SCM is an infiltration trench located in the median adjacent to the proposed shared use path along North Shore Road, between the shared-use path and Route 128 (Northbound). While the location of this proposed infiltration trench is outside of WPA jurisdiction, the proposed infiltration trench will still help improve the quality of discharged stormwater from the overall project. Due to the close proximity of wetlands to the proposed shared-use path throughout the rest of the project, as well as the seasonal high groundwater elevation and presence of existing utilities, it is not possible to provide additional infiltration SCMs within WPA jurisdiction. Additionally, new catch basins have been proposed to replace existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New

catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. The proposed catch basins will have deep sumps and hoods to provide additional treatment. This project also includes the replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed. All proposed drainage systems will maintain the historic drainage patterns, distributing runoff to the existing discharge points. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge.

A full Stormwater Management Report documenting compliance with the DEP's Stormwater Management Standards, including required calculations and description of methodology, is attached as Appendix F to this report.

2.2.5 Rare Species

The project site is not located within an area designated as a Priority Habitat of Rare Species or Estimated Habitat of Rare Wildlife by the Natural Heritage & Endangered Species Program (NHESP) 2021 Maps. No certified vernal pools are located in proximity to the project area. The closest potential vernal pool (PVP18854) is located approximately 300 feet west of the project limit, below the current boundary of the Independence Greenway behind the North Shore Lahey Clinic. The project activities are not expected to negatively affect this vernal pool. A combination of erosion and sediment control measures will be installed as shown on the attached plan set in the vicinity of the resource areas, therefore, the above areas will not be affected during construction.

2.2.6 Water Quality

Per MassGIS online data mapping, there are no stormwater "critical areas" are defined in MassDEP's wetland regulations as Outstanding Resource Waters (ORW), Special Resource Waters, recharge areas for public water supplies or cold-water fisheries either crossing or located adjacent to the project area. (See Figure 3).

2.2.7 Area of Critical Environmental Concern

Per MassGIS online data mapping, the project site is not located within an Area of Critical Environmental Concern (ACEC). (See Figure 3).

2.3 AVOIDANCE, MINIMIZATION AND MITIGATION MEASURES

In addition to the above-described avoidance, minimization and mitigation measures, some project activities will contribute to the interests of the WPA:

- Reconstruction of the culvert crossings conveying Proctor Brook beneath the former railroad track bed with larger openings and a natural stream bottom will contribute to improved animal movement along the abandoned railroad right-of-way, potentially create and/or improve the escape cover and breeding habitat.
- As a result of this project, the presently degraded area will be cleared from the existing debris, remains of former washed out infrastructure, garbage, invasives and brush, thereby contributing to the interests of the Act. Corrective measures shall be taken to remove or treat invasive plant

species. The strategy for chemical and/or manual removal shall be in accordance with MassDOT specifications for Invasive Plants Management (Items 102.3 and 102.33).

- Construction of the proposed stream crossing replacements will contribute to the enhanced flood control and storm damage prevention.

The project will not impact the capacity of the resource areas to prevent or reduce contamination or damage to fish; and to serve as their habitat and nutrient source. There are no land containing shellfish or NHESP Estimated or Priority Habitats of Rare Wildlife habitat located within or in close proximity to the project area, therefore the project will not negatively impact these interests of the WPA.

A summary of all of the project's proposed mitigation measures, including the location and size of each measure, is included in Table 6 below.

Table 6: Summary of Mitigation Measures

Mitigation Measure	Location (STA.)	Total Area (SF)
Wetland Replication	STA. 327+00	2,500 SF
Wetland Restoration	STA. 329+85, 340+10, 342+20, 346+20, 346+90, 352+00	4,271 SF
Compensatory Flood Storage	STA. 355+50	1,690 SF / 3,472 CF
Streambed Restoration	STA. 329+85, 340+10, 342+20, 345+50, 346+20	10,343 SF
Vegetated Riprap	STA. 329+85, 346+20	2,215 SF
Infiltration Trench	STA. 310+50	1,600 SF / 1,414 CF

2.3.1 Alternatives Analysis

Several alternatives were considered and evaluated for this project throughout the design process in order to avoid, minimize, and mitigate all impacts to the maximum extent practicable. Alternatives for the project included the "No-Build Alternative". The "No-Build Alternative" would lead to the bikeway extension not being constructed. Since the intent of this project is to extend the Independence Greenway by constructing a continuous shared-use path for bikers and pedestrians in order to continue the development of the Independence Greenway for Peabody's residents and visitors and as an important community and regional greenway network, therefore, the "No-Build Alternative" will not meet the purpose and need of the project, and it was therefore dismissed from further consideration.

A variety of alternatives were evaluated during the planning stages of the project. Options such as alternative sites, alternative alignments, and typical cross sections were evaluated. The primary purpose of the project was to develop a connection from the existing Peabody Independence Greenway path to the greater Border to Boston Trail, a developing shared use path network that will stretch 70 miles between the

MA-NH state line and Boston. An alternative that involved using Warren Street extension as a segment of the path was also evaluated; however, one of the major design considerations was avoiding placing the shared use path for bicyclists and pedestrians directly adjacent to an existing high-traffic roadway in order to promote safety. Additionally, this alternative location would not keep the shared use path as a linear connection, another one of the primary design goals for the project.

Additionally, options for narrowing sections of the shared use path, when wetland resources would be impacted, were also considered in order to reduce the overall resource area impacts of the project. However, the minimum width for a shared use path is 10 feet per MassDOT PDDG Section 11.4.1.1 and the minimum shoulder width for a shared use path is 2 feet per MassDOT PDDG Section 11.4.1.2 and therefore these options were not feasible and therefore were not developed into substantial alternatives. While the path was not able to be narrowed in order to avoid wetland impacts, the grade of the proposed pathway was lowered to the maximum extent feasible to reduce floodplain impacts, the slide slopes of the path were tightened as much as possible, and a boardwalk with helical piles was proposed in lieu of traditional foundations to avoid large amount of fill within the floodplain and wetlands. The proposed depth of riprap is the minimum amount required to provide scour counter measures at the culverts in order to mitigate greater impacts to the brook while also meeting the project goals of restoring the natural streambed and preventing future scour.

Several different stormwater best management practices were also evaluated in various locations throughout the project, including environmentally sensitive site design, low impact development techniques that minimize land disturbance and impervious surfaces, structural stormwater best management practices, pollution prevention, erosion and sedimentation control, and proper operation and maintenance of stormwater best management practices. Primarily, infiltration SCMs were considered for the project in various locations; however, only one location was found to be feasible for an infiltration SCM due to limited space constraints, the seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. The only location that was found feasible for an infiltration SCM is the location of the proposed infiltration trench located adjacent to the proposed shared use path along North Shore Road, between the shared-use path and Route 128 (Northbound). While the location of this proposed infiltration SCM is outside of WPA jurisdiction, the proposed infiltration trench will still help improve the quality of discharged stormwater from the overall project. Due to the close proximity of wetlands to the proposed shared-use path throughout the rest of the project, as well as the seasonal high groundwater elevation and presence of existing utilities, it is not possible to provide additional infiltration SCMs within WPA jurisdiction. Additionally, drywells were considered for additional stormwater treatment, but these provide very little stormwater treatment volume, require 2 feet of separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another alternative that was evaluated for this project was the use of proprietary devices at each discharge point for the stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

The following alternatives detailed below reflect the alternatives that were deemed the most feasible in order to meet the objectives of the project while also minimizing the environmental impacts to the maximum extent practicable. Each of the alternatives below more thoroughly detail the proposed alternatives that were carefully evaluated, and each reflect the above-described efforts to avoid, minimize, and mitigate environmental impacts while still meeting the project's purpose.

This section describes the alternatives for the major features, broken down by segment, of the proposed Greenway Extension that were analyzed and considered during the design process.

SCOUR COUNTERMEASURES AND BANK PROTECTION ALTERNATIVES:

In addition to evaluating a variety of different alternatives for the locations and design of the pathway segments, various alternatives for the areas of riprap placed for slope stabilization in BVWs adjacent to the top of the bank associated with Proctor Brook near the proposed Culverts No. 1 (Sta. 329+85) and No. 2 (Sta. 340+10) were evaluated in order to select the alternative with the least impacts to the surrounding resource areas. The alternatives analysis that was conducted for the rip rap areas is listed in Table 6 below.

Table 6 Alternatives for Rip Rap at Culvert Inlets/Outlets

Alternative	Details/Reason for Selection/Dismissal
Riprap for Scour Protection and Bank Stabilization	Dumped riprap was originally proposed in the riverbed at the proposed culvert inlets and outlets for scour protection. These riprap countermeasures extended slightly into the adjacent BVWs affecting the existing limits of the Bank of Proctor Brook. The proposed design minimized the extent of the required riprap countermeasures at culvert ends to the maximum extent feasible to still be able to provide the required protection from future scour. However, these impacts are unavoidable. The riprap countermeasures were designed in accordance with the guidelines outlined in Hydraulic Engineering Circular No. 14, specifically Chapters 5 and 10. These guidelines were utilized to estimate scour levels at culvert outlets and to develop the design for riprap basins and aprons, respectively. This alternative was modified to address MassDEP comments received during the MEPA ENF Review.
Vegetated Bank without Riprap	Nature-based solutions and biotechnical engineering countermeasures, such as are described in FEMA's document entitled "*Engineering With Nature - Alternative Techniques to Riprap Bank Stabilization*" and FHWA "*HEC 23 - Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance Third Edition"* were also evaluated in order to minimize adverse impacts to Bank, LUW and other jurisdictional resource areas. Utilizing natural methods of slope stabilization such as coir logs, willow whips, deeply rooted bunch grasses, keyed logs, etc. is not feasible for the banks steeper than 2:1. The proposed bank is 1.5:1 and, the majority of the reviewed natural methods are not suitable for this incline. Therefore, not utilizing riprap does not achieve the goal of protecting and stabilizing the bank of Proctor Brook near the proposed replacement stream crossings beneath the bike path. It is also required to protect against scour during overtopping flow. Therefore, this alternative was dismissed from further consideration.
Vegetated Riprap for Bank Protection (Selected)	Due to the proposed slope being 1.5:1 at both stream crossing locations (Culvert No.1 and Culvert No. 2), there are limited biotechnical engineering countermeasures for bank stabilization. Most vegetative measures for bank stabilization are only recommended for up to 2:1 slopes. We reviewed the FHWA "*HEC 23 - Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance Third Edition*" and determined that one method they provide could be modified for the rip rap slope at Culvert No. 1 and Culvert No. 2. The selected method is to plant live stakes in the voids between the rip rap. Because of the size and depth of the rip rap needed to protect the bank, live stakes will need to be 4 feet in length to allow them to be installed into the granular fill and subsoil under the rip rap. A detail including the species, spacing, and quantities of the live stakes is included in the Vegetated Riprap detail on Sheet 41 of the NOI Plan Set included in Appendix G.

Natural Streambed Restoration within Riverbed (selected)	In order to mitigate the impacts to the LUW of Proctor Brook associated with the high volume of riprap required at the culvert inlets and outlets for scour protection, a 12-inch (minimum) layer of natural streambed material will be placed on top of the riprap to reestablish the natural streambed, and it will match existing invert elevations.

SEGMENT 1: ESSEX CENTER DRIVE: INDEPENDENCE GREENWAY TRAILHEAD TO UNDERPASS UNDER ROUTE 128

Alternative 1: 10-foot-wide travel lanes, five-foot striped bicycle lanes

Alternative 1 proposes to restripe Essex Center Drive with 10-foot-wide travel lanes and five-foot striped bicycle lanes. The bicycle lanes will be located on the outside of the motor vehicle lanes. Roadway widening or reconstruction is not anticipated under this alternative.

The westernmost 400 feet, passing the Lahey Medical Center parking lot from the existing trailhead, will be marked with shared lane markings and appropriate signage under this alternative. This is necessary due to the narrower width of the roadway in this area. This Alternative separates bicyclists from pedestrians, increasing the comfort of the latter relative to that of a shared-use path. However, bicyclists would need to share the roadway with motor vehicles. This represents a change in character from that of the existing bicycle route on the Greenway.

Alternative 2: 11-foot-wide travel lanes, 10-foot-wide multiuse path with buffer

Alternative 2 proposes Essex Center Drive to be reconstructed to provide 11-foot-wide vehicle travel lanes and replacing the existing sidewalk along the south side with a 10-foot-wide raised multiuse path with 5 feet of separation from the roadway. This will continue the character of the Greenway and will increase comfort for Greenway users when compared with on-street lanes. The raised multiuse path would be widened into the existing roadway and beyond the existing sidewalk, while maintaining the existing curb along the north side of Essex Center Drive. A catch basin will need to be constructed at the corner of the intersection with the mall driveway and underpass to replace the existing due to the change in curb line.

Coordination with Northshore Mall and MassDOT has occurred and approval was stated in August 2023 to reconstruct the roadway with horizontal and vertical separation from the proposed shared-use path and to have part of the shared-use path occur within state layout with the City of Peabody maintaining the path. Coordination is ongoing regarding changes to access to the existing trailhead parking area that borders the Mall-owned portion of Essex Center Drive and the Lahey Medical Center. Additionally, to accommodate the continuation of the trail, parking would be prohibited on the south side of the shared roadway section before the sidewalk and bicycle lanes begin. This being stated, separating bicycle traffic from motor vehicle traffic is the preferred alternative for comfort and safety reasons.

SEGMENT 2: UNDERPASS UNDER ROUTE 128 BETWEEN ESSEX CENTER DRIVE AND NORTHSHORE ROAD

Alternative 1: Divert trail users onto sidewalk of the underpass

Alternative 1 proposes to have trail users divert from the proposed bicycle lanes on Essex Center Drive and from the proposed separated path on Northshore Road to use the sidewalk to connect through the underpass under Route 128. Bicyclists coming from the underpass sidewalk would be alerted to walk across Essex Center Drive at a proposed mid-block crossing west of the intersection of Essex Center Drive with the mall roadway to access the proposed westbound bicycle lane on Essex Center Drive. Although this would

have minimal cost, this is not an ideal condition given that the existing sidewalk on the south side of the underpass is less than five feet wide.

Alternative 2: Sign and mark the outside lanes of the underpass as shared lanes, accommodate WB traffic with two stage left turn box and enhanced crossing markings through the Essex Center Drive intersection

Alternative 2 would stripe the outside lanes of the underpass with shared lane markings in each direction, and with appropriate signage alerting roadway users to the presence of the shared use lanes. In addition, this alternative would stripe a bicycle travel path through the intersection at the north end of the underpass to connect to Essex Center Drive. This path of travel would include a two-stage left- turn queue box which will provide bicyclists with a better opportunity to wait for a gap in opposing traffic to turn left. This alternative allows bicyclists to avoid the discomfort of dismounting and walking on the narrow sidewalk of the underpass. However, bicyclists would be requested to cross the underpass road on the roadway surface to continue towards the direction of the existing Greenway trail and thus presents bicyclist comfort and safety issues.

Alternative 3: Convert one roadway lane into 10-foot-wide multiuse path with 2 feet of buffer

As approved per discussion with the Northshore Mall and MassDOT in August 2023, the southbound underpass connecting Essex Center Drive and Northshore Road will be reduced from two to one vehicle lanes to provide a 10-foot-wide raised multiuse path with a 2-foot buffer and vertical separation from the curb abutting the roadway traffic. The roadway would be restriped to have one 11-foot travel lanes with 1.5-foot-wide shoulders. The curb along the roadway median will be maintained. This conversion will continue the character of the Greenway and will increase comfort for Greenway users when compared with on-street lanes in an unlit underpass. Review of existing and projected future traffic volumes indicates that it is not anticipated that the southbound lane reduction will result in traffic blocking Essex Center Drive. This alternative would maintain motor vehicle/bicyclist separation and thus provide the greatest level of safety and comfort amongst the underpass alternatives. A catch basin will need to be constructed to replace the existing catch basin location approximately midway along the underpass due to the change in curb line.

Alternative 4: Seasonal closure of underpass lane for use as shared-use path

A variant of Alternative 3 proposes to close the leftmost southbound underpass lane to motor vehicle traffic during warmer months to provide a shared-use path with temporary bollards separating the path from the remaining lane. The temporary bollards would be removed in colder months when the shared-use path would be less frequently used such that the underpass would maintain two motor vehicle lanes in the southbound direction and bicyclists would dismount to use the remaining sidewalk. This alternative is not recommended as dismounting compliancy may be low and that this alternative would not always provide separation from motor vehicle traffic.

The preferred alternative for the Route 128 underpass is Alternative 3. Continuing the character of the existing shared-use path is important, especially in this section where shading from the overhead roadway would reduce visibility of bicyclists. Maintaining physical separation between bicyclists and motor vehicles is important in maintaining the safety and comfort of trail users.

SEGMENT 3: NORTHSHORE ROAD FROM ESSEX CENTER DRIVER TO RAILROAD RIGHT-OF-WAY

The proposed design for the Greenway Extension along Northshore Road comprises a multiuse path along the west side of the road and parallel to Route 128. The cross section is proposed to consist of a 10-foot-

wide paved shared-use path with nine feet of separation from the path and curb along Northshore Road. On the highway side a grass drainage swale is proposed beyond the shoulder.

A road crossing is necessary to connect the path from the north side of Northshore Road to the proposed segment following the former railroad layout to the south.

Alternative 1: Install Standard W11-1 bicycle warning signage at the crossing

Alternative 1 proposes installing a standard crosswalk treatment, with W11-1 signage at the crosswalk and approximately 200' in advance of the crosswalk. This treatment will make the crossing visible to drivers and ensure the safety of trail users crossing to/from North Shore Road and the old railroad ROW.

Alternative 2: Install W11-15 with RRFB and detection

Alternative 2 Proposed at this crossing is enhanced crosswalk treatment consistent with what has been installed on the trail in West Peabody at the Russell Street crossing. This treatment would install W11-15 signage with a Rectangular Rapid-Flash Beacon (RRFB) at the crosswalk, with standard advance warning signage approximately 200' away from the crosswalk.

BRIDGE DESIGN ALTERNATIVES:

The portion of the shared-use trail in the vicinity of the washed away railroad bridge requires construction of a light duty structure in order to make the former railroad right-of-way usable for a bicycle/pedestrian path and to avoid filling protected wetland resources areas and FEMA-designated 100-year floodplain associated with Proctor Brook. This structure would then tie into the proposed timber boardwalk from the east, which was designed at this location in order to avoid filling the wetland resource areas and the FEMA 100-year floodplain.

The various proposed bridge design alternatives are detailed below. Two (2) viable structure types and four (4) viable substructure and foundation types were considered, and the recommended foundation type of helical piles spaced 8'-0" to 14'-0" center-to-center and retaining walls comprised of timber lagging at each end of the boardwalk, was used in developing the following four (4) bridge alternatives:

Alternative A: Timber Boardwalk (Preferred)

The proposed timber boardwalk alternative consists of a timber deck with a 60'-0" structure length with multiple 8'-0" equal spans for the length of the structure. The boardwalk will have an out-to-out width of 13'-0" to provide a clear width that accommodates a 10'-0" wide pedestrian/bike path with two (2) 1'-0" shoulders. The proposed timber railing is 3'-6" high with vertical timber pickets spaced less than 4" apart with a continuous top handrail and bottom rub rail. All these railing components are required to meet state and federal (OSHA) safety standards for this type of path. The proposed timber decking is comprised of 2x6 timber boards placed transverse to the centerline of the path. The deck boards have a ¼" between their edges to provide a safe continuous riding surface that also allows for minor thermal expansion and contraction. There is an average of ~4-feet between the ground and the bottom of the 2x8 stringers which are spaced ~1-ft on center and support the deck planks for the full length of the boardwalk. Below the stringers there are timber bents comprised of three (3) 2x12s spaced every ~8-feet perpendicular to the center line of the path. This alternative has simple constructure methods, minimal environmental impacts, and requires minimal maintenance, resulting in lower lifecycle costs. In addition, it would be an extension of the timber boardwalk proposed east of this crossing, eliminating the need for additional substructure components on the east side, therefore, minimizing impacts to wetland resource areas and FEMA 100-year floodplain. The proposed substructure type would provide ease of constructability, lower material cost, and

lessen the environmental impacts to adjacent sensitive areas. Timber Boardwalk on Helical Piles is the recommended alternative because it provides the most cost-effective structure with the fewest impacts to the surrounding environmentally sensitive areas. This design also has the shallowest superstructure for meeting hydraulic criteria and the simplest construction method, which uses smaller equipment that can access the site from the trail.

Alternative B: Prefabricated Steel Truss with a Concrete Deck

This proposed bridge design is 60'-0" long with an out-to-out width of 12'-0". The truss will be constructed offsite and delivered to the construction site. The installation will be quicker than traditional bridge construction and have the option for technical guidance and oversight provided by the prefabricator. The installation has minimal impact to the environment when compared to more traditional construction materials and methods, though, would result in more impacts to wetland resource areas and FEMA 100-year floodplain than the preferred alternative A due to installation to the substructure components to support the fabricated steel truss superstructure. The installation might be difficult due to site accessibility for construction equipment and vehicles.

Alternative C: Prestressed Concrete Spread Box Beams with a Composite Concrete Deck

In this proposed bridge design, four (4) S36-12 prestressed concrete spread box beams will be used. The beams will be composite with a 5" cast-in-place deck and have a 3" paved wearing surface. The beams may not be able to support a span length of 60'-0" without a pier. These prestressed concrete beams are manufactured under controlled conditions and are more resistant to corrosion and deterioration than their steel counterparts. This option is a better choice for bridges over water with high constant humidity and for areas where it is difficult to access the superstructure for maintenance work. This alternative requires minimal maintenance, resulting in lower life cycle costs; however, the constructability and component delivery may be difficult due to site accessibility. This design is also significantly heavier than the timber boardwalk or timber beam alternatives and requires large equipment to ship and erect. This alternative would result in more impacts to wetland resource areas and FEMA 100-year floodplain than both Alternatives A and B due to installation to the substructure components, including potential need for an additional pier, to support the proposed superstructure with a span length of 60'-00".

Alternative D: Timber Bridge Structure with Timber Deck

This proposed design consists of three (3) 60'-0" glulam stringers spaced 5'-0" apart. Due to the loading requirements, the minimum depth of each beam would be 36". This depth exceeds the permissible depth requirements for wetland protection and hydraulic opening requirements and would result in even more extensive wetland resource area and FEMA 100-year floodplain impacts. The constructability and delivery of beams would prove to be difficult due to site constraints. However, the timber aesthetic would match the timber of the timber boardwalk and the design would require less maintenance than a steel structure over water.

2.3.2 Construction Mitigation Measures

Erosion and Sediment Control

To protect the resource areas and interests of the WPA during construction, a combination of erosion and sediment control BMPs will be installed as shown on the attached plan set. Primary erosion control techniques proposed include compost filter tubes, sedimentation fence barriers and floating silt fence. The Contractor will have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials will include, but are not limited to, compost

filter tubes, sedimentation fence, site bags for catch basins, erosion control matting and crushed stone. The erosion controls will be maintained in good condition until on-site soils are stabilized. All areas will be permanently stabilized following the completion of construction work. For additional information on erosion and sediment controls, please see the attached Stormwater Management Report in Appendix F of this report.

Trench Dewatering

It is anticipated that a NPDES Construction General Permit (CGP) will be required for the project; therefore, if trench dewatering is needed, all pumped effluent will be done in compliance with the dewatering requirements within the CGP. There will be no direct discharge of pumped water into any wetland, resource area, or closed drainage system.

2.3.3 Wetland Mitigation

Wetland mitigation is required, and the wetland impact mitigation measures are discussed in detail above under item 2.2.1 Resource Areas Impacts/Bordering Vegetated Wetland.

2.3.4 Flood Storage Compensation

Flood storage compensation is required, and the required measures are discussed in detail above under item 2.2.1 Resource Areas Impacts/Bordering Land Subject to Flooding.

APPENDICES

APPENDIX A - WETLANDS DELINEATION MEMO WITH DATA FORMS

October 12, 2022

To:	Danielle Spicer, P.E.
Cc:	Oxana Fartushnaya
From:	Brandon Faneuf, PWS
Date:	October 12, 2022
Project Name:	Peabody Bikeway Extension, Peabody, MA
Project Number:	Green No. 17118.0228
Subject:	Wetland Description

Introduction

This memo is to describe the types and extents of wetlands and wetland jurisdictional areas at the above-referenced site (Site). Wetland delineation work was originally performed on February 15, 2018 in conformance with the Massachusetts Wetlands Protection Act (MGL c. 131, §40)(WPA) and its Regulations (310 CMR 10.00). The site was reflagged, and the wetland boundaries were reconfirmed in 2022. Peabody has promulgated a local Wetlands & Rivers Protection Ordinance (The Ordinance) and Wetlands and Rivers Protection Regulations (Chapter 32) that exceed jurisdictional areas and performance standards of the WPA and 310 CMR 10.00. The project site is between Yankee Division Highway and Endicott Street, following the unfinished portion of the Independence Greenway bike trail and parallel to Proctor Brook.

Area of Interest (AOI)

The area between Yankee Division Highway and Endicott St., along Proctor Brook as referenced above, was investigated for wetland resource areas. To ensure that all potential jurisdictional areas that may extend onto the Area of Interest (AOI) were located and defined, all land within 200 feet of the AOI was investigated to the best possible extent while respecting private property rights.

The area of the AOI is heavily disturbed with a variety of developments and infrastructure. Along Proctor Brook, there is a historic railroad that is now decommissioned (i.e. the proposed Independence Greenway bike path). Left in its place is fill and grading that has affected the flow of the river and its floodplain. On either side of Proctor Brook there are housing developments including condominiums and single-family dwellings. Yankee Division Highway runs directly through the AOI in the western part. As a result of the historic disturbance, there is very little natural area left in the AOI and invasive, non-native plant species dominate much of the area.

Wetland Resource Areas

Wetland Resource Areas exist on either side of Yankee Division Highway adjacent to both Essex Center Drive and Northshore Road as well on either side of the abandoned railway between Northshore Road and Endicott Street. Wetlands revolve around a perennial stream, Proctor Brook, that flows west-to-east through the AOI and into a pond that exists to the southeast. Per 310 CMR 10.00 and the Ordinance, Proctor Brook is a perennial river and receives a two-hundred foot (200') Riverfront Area (RFA).

Multiple Bordering Vegetated Wetlands (BVW/BVW's) exist along the southern and western banks of Proctor Brook. These BVW's are delineated separately but are all hydrologically connected, mainly through Proctor Brook. Each alpha-numerically delineated section of BVW retains a one-hundred foot (100') buffer zone per 310 CMR 10.00 and the Ordinance.

The wetland types on site:

- Inland Bank- same as the mean annual high-water (aka bankfull conditions) mark, as delineated in the field with the 'MAHW' flags. This represents the first observable break-in-slope along the bank of the Brook.

- Land Under Waterbodies & Waterways- land between the two (2) mean low water marks (currently underwater and not flagged in the field).

- 200' Riverfront Area ("RFA") of the River. The inner boundary of the RFA is represented by the 'MAHW' flags along the Inland Bank. The RFA extends perpendicularly from the 'MAHW' flags without regard for topography.

- Bordering Vegetated Wetland ("BVW"), as delineated in the field with 'A', 'B', 'C', 'E', 'V', 'Y', and 'Z' series flags. These flags represent the edge of the BVW where it changes to from vegetated wetland to upland. Per 310 CMR 10.00 and The Ordinance, these receive 100' buffer zones.

- Bordering Land Subject to Flooding ("BLSF") associated with the River. This is the 100 year floodplain as delineated by FEMA (see attached FEMA Firmette). This follows Proctor Brook in the AOI.

Soils in the area consist of fine sandy loams and loamy sands on 0-8% slopes. The topography in the area is generally flat with land rising as it gets farther from Proctor Brook.

Table 1. Wetland Resource Areas

Flag Series	Wetland Type	Approx. Location
A1-A14 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Northwest of Independence Greenway and southwest of the parking area associated with Lahey Medical Center.
B1-B10 (pink flags)	N/A	Drainage ditch to between Independence Greenway and Yankee Division Highway.
C1-C7 (pink flags)	N/A	Drainage ditch between Northshore Road and Garden Road.
E1-E12 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Travels east-to-west along the northern bank of Proctor Brook south of the Peabody Municipal Light Plant.
V1-V17 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the southern bank of Proctor Brook and travels west. Located northeast of Jennifer Lane.
W1-W4 (blue flags)	Bank of Intermittent Stream w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Makes a semicircle adjacent to Endicott Street and south of Proctor Brook.
X1-X11 (blue flags)	Bank of Intermittent Stream w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off MAHW-11 and travels east along the southern portion of the AOI to Endicott Street.
Y1-Y7 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the southern bank of Proctor Brook and travels east. It is located north of Castle Circle. Starts at the end of the MAHW1-MAHW87 series.
Z1-Z8 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	Extends off of the northern bank of Proctor Brook and travels west. Located southwest of the condominium development, "Terrace Estates."

MAHW1-MAHW87 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins at Endicott Street and travels northwest. It delineates the southern Bank of Proctor Brook in the eastern portion of the AOI.
MAHW101-MAHW138 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins off of Warren Street Extension directly south of the Peabody Municipal Light Plant and travels northwest. It delineates the northern Bank of Proctor Brook.
MAHW201-MAHW230 (blue flags)	Inland Bank of Perennial Stream w/ 200' RFA per 310 CMR 10.00 and the Ordinance.	Begins off of Northshore Road and travels southeast. It delineates the northern Bank of Proctor Brook.

Other Resources

A search of other critical resources within the project area was conducted using GIS software and data available through various governmental agencies (FEMA, DEP, and others). The results of our search are listed in the table below.

Table 2. Selected MASSGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓[1]
NHESP Potential Vernal Pool		✓
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones (BLSF)	✓[2]	
Surface Water Protection Area		✓
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area		✓
Zone II Wellhead Protection Area		✓
Mass DCR Designated Coldwater Fisheries		✓

1. A NHESP Certified Vernal Pool exists just outside of the AOI to the southeast. It is located to the southwest of the intersection of the railroad right-of-way and Yankee Division Highway.
2. BLSF closely follows Proctor Brook in the area of the AOI (see attached Figures 5, 6, & 7).

Regulatory Jurisdiction

The wetland resource areas described above are regulated by the Massachusetts Department of Environmental Protection (DEP), through the Peabody Conservation Commission. The City of Peabody has its own City of Peabody Wetlands & Rivers Protection The Ordinance (The Ordinance) and Peabody Conservation Commission Bylaw (Bylaw).

View of Proctor Brook Looking Downstream (west) from Endicott Street

View of X-Series Intermittent Stream

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 1 & 2

View of Proctor Brook Looking Upstream (east) from Northshore Road

View of C-Series Drainageway Looking Southeast

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 3 & 4

View Looking Across Proctor Brook North-to-South near the Z-Series BVW

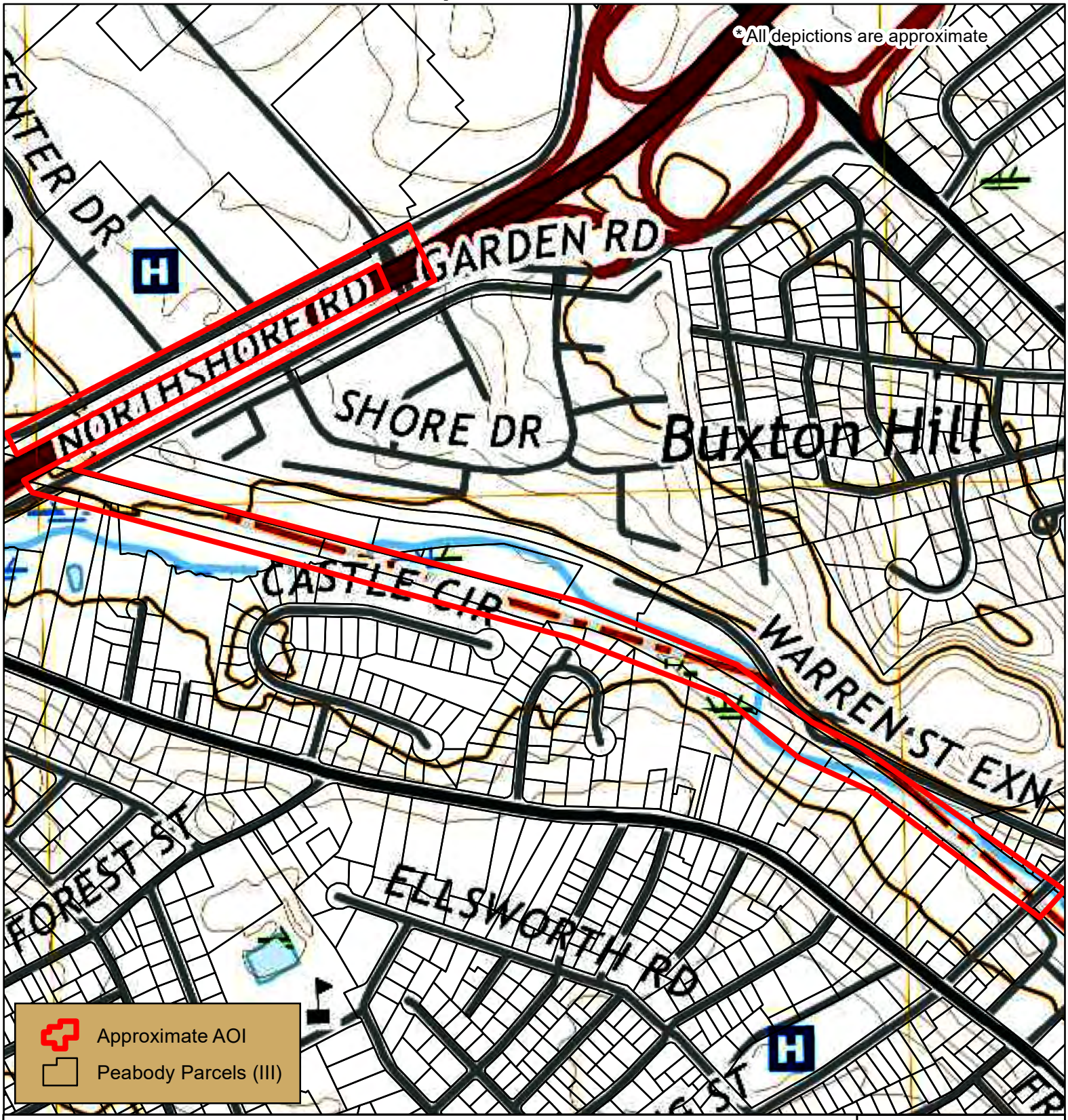
View of Typical Forest Interior Inside of the AOI

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 5 & 6

View of Phragmites Marsh Inside of MAHW-300 Series

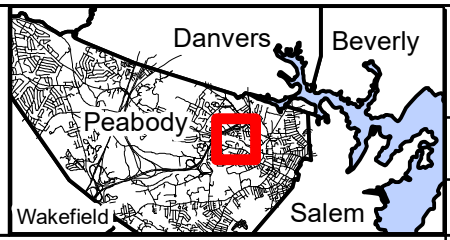
View of B-Series Drainageway Looking Northeast

Peabody Bikeway Extension Peabody, Massachusetts	SITE PHOTOGRAPHS	
Green International Affiliates, Inc.	Job No. 17118.0228	Pictures 7 & 8



Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 1



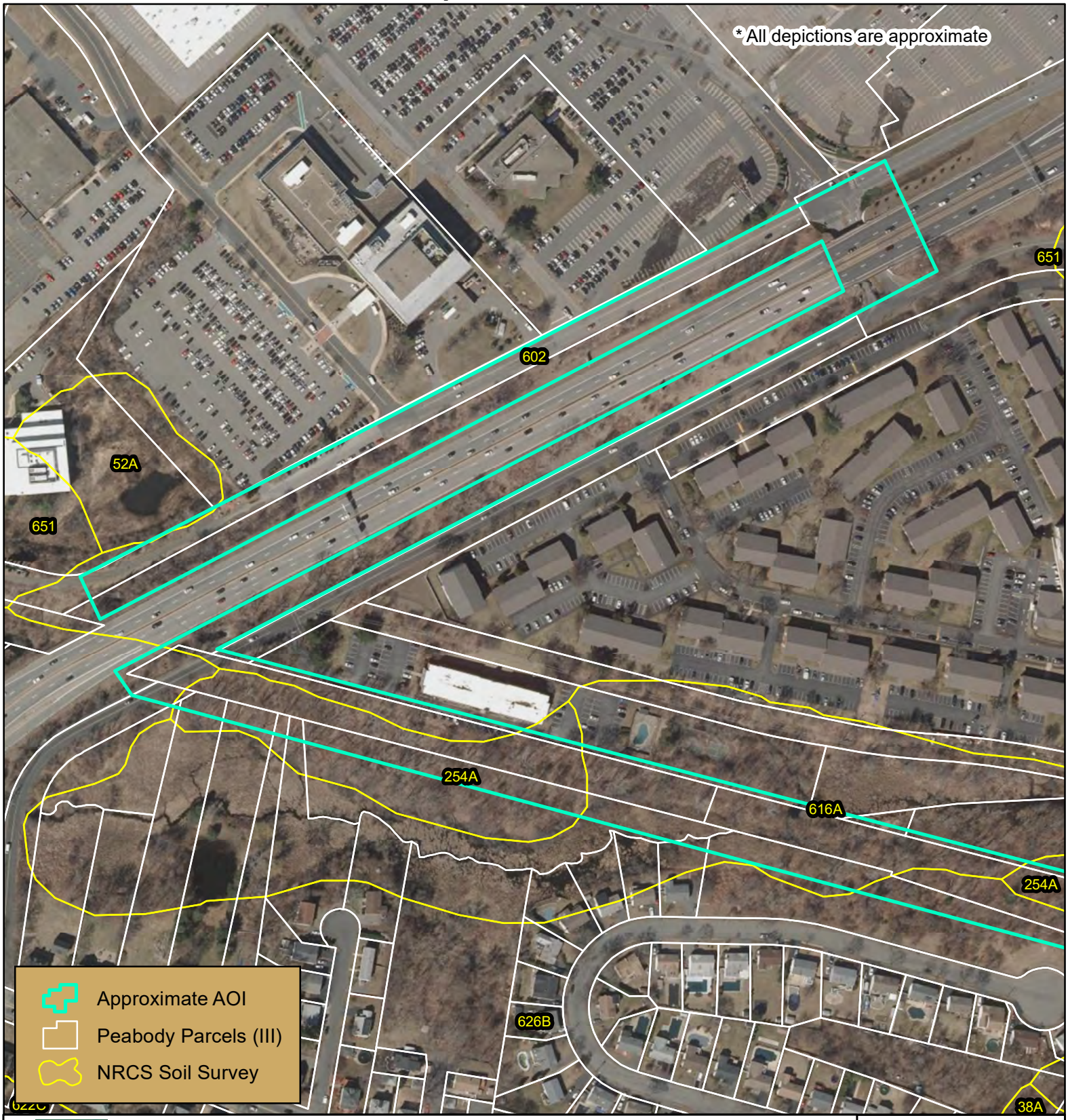
USGS Topographic Map
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 500 feet

Salem Quadrant (2021)

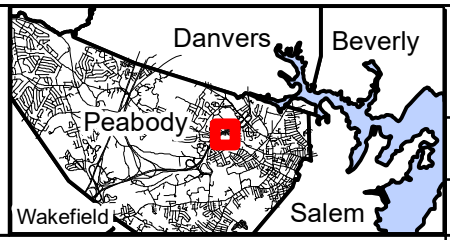
MASS GIS

0 250 500 1,000 1,500 Feet



Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 2



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

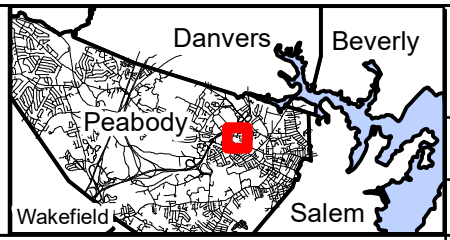
Aerial Orthophoto (2019)

MASS GIS

0 125 250 500 750 Feet

Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 3



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

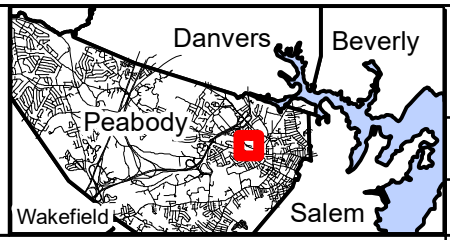
Aerial Orthophoto (2019)

MASS GIS

0 125 250 500 750 Feet

Green International Affiliates, Inc.
200 Ames Pond Drive, Suite 200, Tewksbury, MA 01876

FIGURE 4



NRCS Soil Overlay
Peabody Bikepath Extension
Peabody, Massachusetts

DATE:	10-4-2022	PROJECT #:	17118.0234
CREATED BY:	GL	SCALE:	1 inch = 250 feet

Aerial Orthophoto (2019)

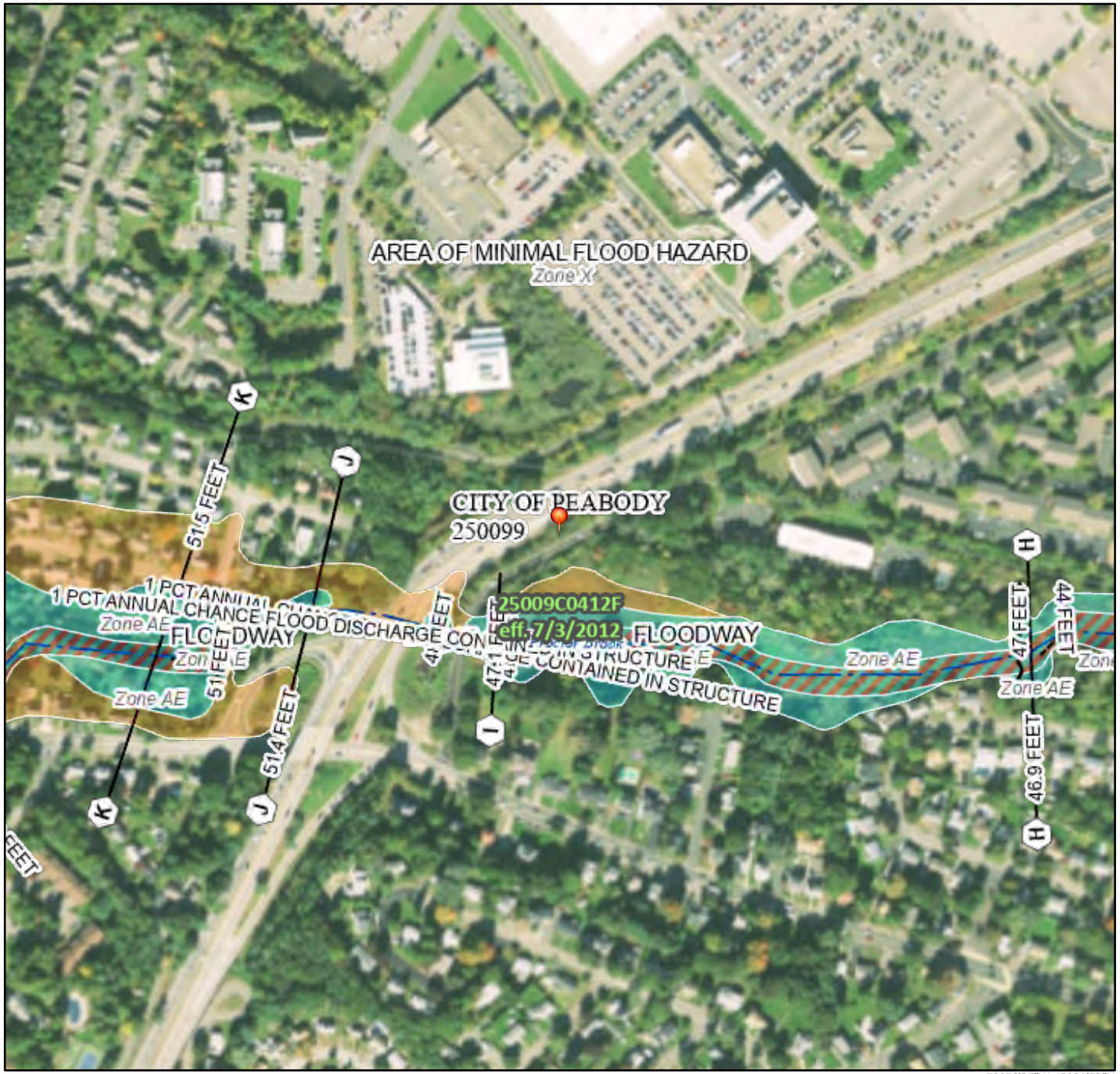
MASS GIS

0 125 250 500 750 Feet

National Flood Hazard Layer FIRMette

FEMA

70°57'13"W 42°32'20"N



70°56'35"W 42°31'53"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

Figure 5

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:07 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

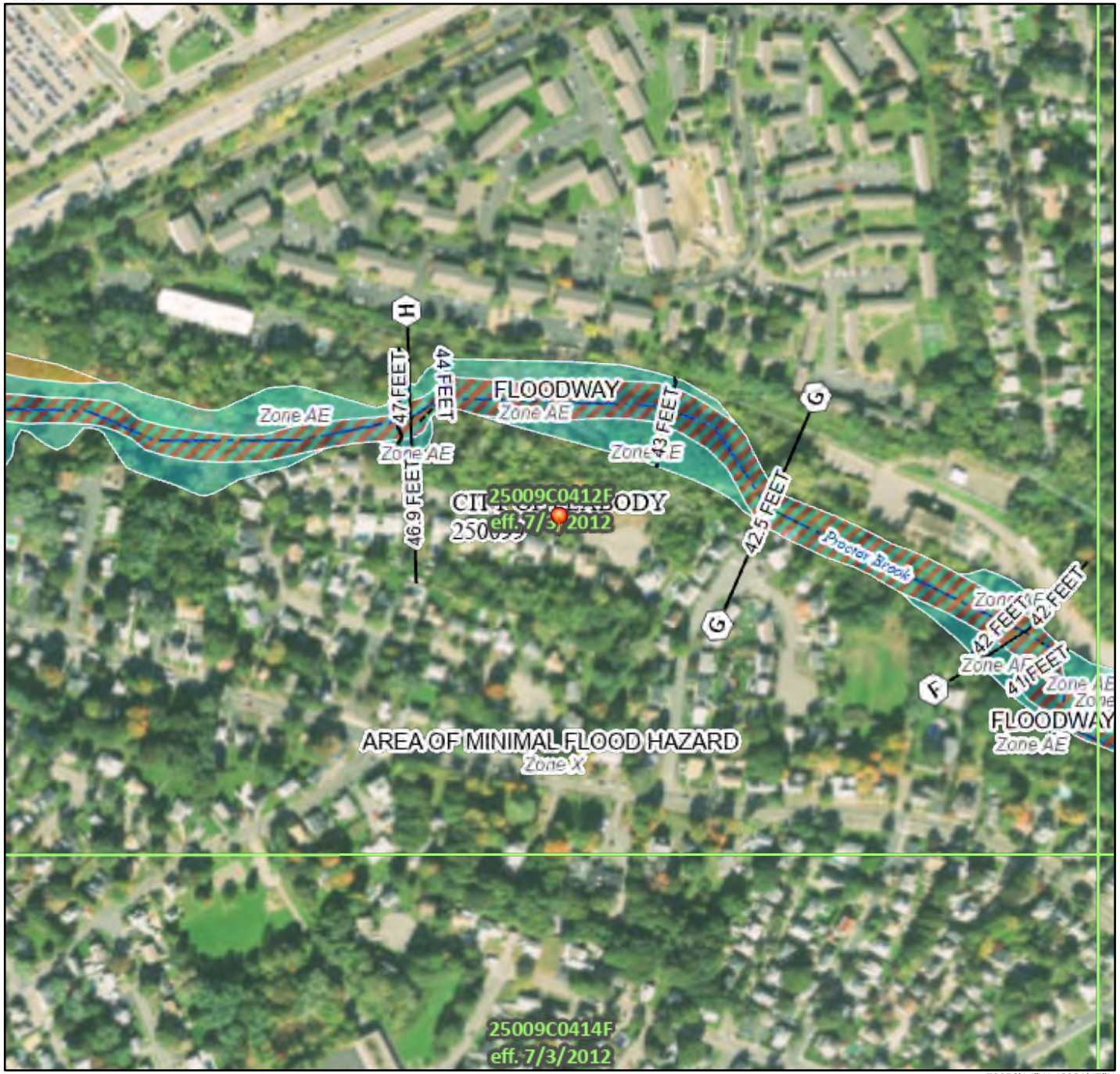
Proposal No. 609211-132091

A00860 - 79

National Flood Hazard Layer FIRMette

FEMA

70°56'52"W 42°32'14"N



70°56'14"W 42°31'47"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend FIGURE 6

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:05 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

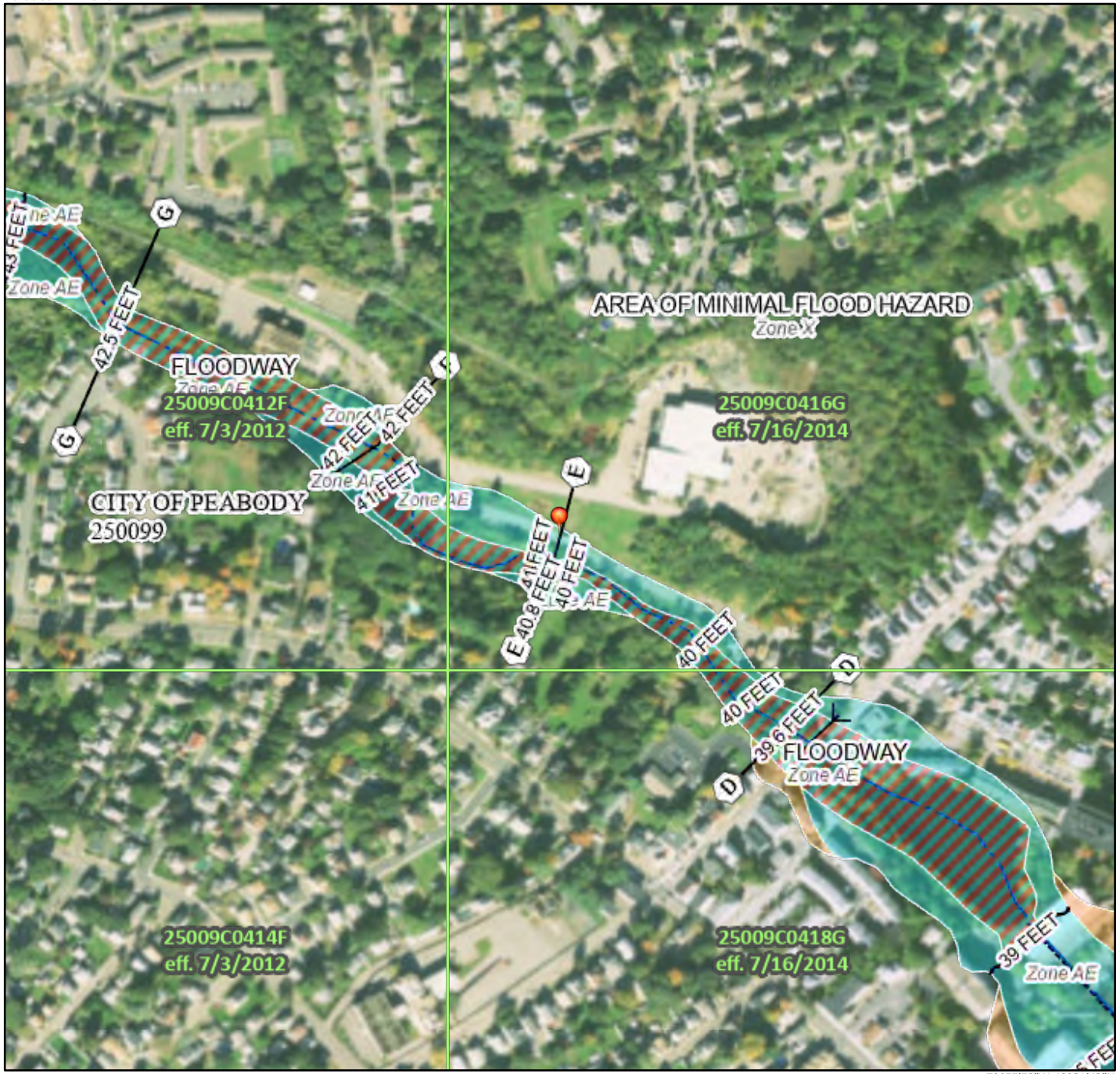
Proposal No. 609211-132091

A00860 - 80

National Flood Hazard Layer FIRMette

FEMA

70°56'30"W 42°32'9"N



70°55'53"W 42°31'43"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

FIGURE 7

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/4/2022 at 4:06 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00860 - 81

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **A-8**		Transect Number: **Upland**	Date of Delineation: **10/5/2022**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Crabapple/*Pyrus malus*	38.0%	100.0%	YES	UPL
Shrub Layer:				
Staghorn Sumac/*Rhus typhina*	63.0%	75.0%	YES	UPL
Red-Osier Dogwood/*Cornus stolonifera*	20.5%	25.0%	YES	FACW+*
Groundcover:				
Canada Goldenrod/*Solidago canadensis*	10.5%	100.0%	YES	FACU

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **1** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 83

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions: **52A Freetown Muck, 0-1% slopes**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oe	**0-2”**	**10YR 3/2 fine sandy loam**	
A	**2-6”**	**10YR 3/3 fine sandy loam**	
Bw	**6-20”**	**10YR 5/6 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

A00860 - 84

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **A-8**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Northern White Cedar/*Thuja occidentalis*	38.0%	100.0%	YES	FACW*
Shrub Layer:				
Speckled Alder/*Alnus rugosa*	38.0%	50.0%	YES	FACW+*
Red-Osier Dogwood/*Cornus stolonifera*	38.0%	50.0%	YES	FACW+*
Groundcover:				
Common Reed/*Phragmites australis*	85.5%	100.0%	YES	FACW*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 85

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions: **52A Freetown Muck, 0-1% slopes**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa1	**0-13"**	**N 2/0 sapric muck**	
Oa2	**13-20"**	**7.5YR 4/4 & 10YR 2/1 sapric muck**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ **Site Inundated**: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **B-6**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Crabapple/*Pyrus malus*	10.5%	22.0%	YES	UPL
Eastern White Pine/*Pinus strobus*	38.0%	78.0%	YES	FACU
Shrub Layer:				
Staghorn Sumac/*Rhus typhina*	38.0%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-10”**	**10YR 3/4 fine sandy loam**	
Bw	**10-20”**	**10YR 5/5 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____
Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **B-6**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Shrub Layer:				
Red-Osier Dogwood/*Cornus stolonifera*	38.0%	100.0%	YES	FACW+*
Groundcover:				
Cinnamon Fern/*Osmunda cinnamomea*	10.5%	34.0%	YES	FACW*
Sensitive Fern/*Onoclea sensibilis*	20.5%	66.0%	YES	FACW*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **3** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 89

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa	**0-5"**	**10YR 2/1 sapric muck**	
A	**5-20"**	**10YR 3/1 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ **Depth to soil saturation in observation hole**: **@ surface**
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **C-4**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Eastern Red Cedar/*Juniperus virginiana*	10.5%	100.0%	YES	FACU
Groundcover:				
Manicured Lawn	85.5%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **1**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 91

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-7”**	**10YR 4/2 fine sandy loam**	
Bw	**7-20”**	**10YR 5/3 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **C-4**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Groundcover:				
Manicured Lawn	63.0%	75.0%	YES	UPL
Tussock Sedge/*Carex stricta*	20.5%	25.0%	YES	OBL*

Proposal No. 609211-132091

A00860 - 93

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **1** Number of dominant non-wetland indicator plants: **1**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **602 Urban Land**
hydric soil inclusions:

Are field observations consistent with soil survey? yes **no**
Remarks:
The Websoil Survey does not include hydric soil inclusions in this area although they are present.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oa	**0-20”**	**10YR 2/1 sapric muck**	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ **Site Inundated**: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__**X**__	____
Wetland hydrology present:		
Hydric soil present	__**X**__	_____
Other indicators of hydrology present	__**X**__	_____
Sample location is in a BVW	__**X**__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **E-7**		Transect Number: **Upland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Norway Maple/*Acer platanoides*	38.0%	78.0%	YES	UPL
Eastern Red Cedar/*Juniperus virginiana*	10.5%	22.0%	YES	FACU
Shrub Layer:				
Eastern Burning-Bush/*Euonymus atropurpureus*	20.5%	35.0%	YES	FACU
Multiflora Rose/*Rosa multiflora*	38.0%	65.0%	YES	FACU
Woody Vines:				
Oriental Bittersweet/*Celastrus orbiculate*	20.5%	100.0%	YES	UPL

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **0** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 95

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **301B Montauk fine sandy loam, 0-8% slopes, stony**
hydric soil inclusions: **616A Fluvaquents**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-5"**	**10YR 3/2 fine sandy loam**	
Bw1	**5-10"**	**10YR 4/3 fine sandy loam**	
Bw2	**10-20"**	**10YR 4/6 fine sandy loam**	

Remarks:

3. Other:

Conclusion: Is soil hydric? yes **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ Depth to soil saturation in observation hole: _____
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ Drainage patterns in BVW: _____
- ❑ Oxidized rhizospheres: _____
- ❑ Water-stained leaves: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X___
Other indicators of hydrology present	____	__X___
Sample location is in a BVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

A00860 - 96

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_____ Prepared by: **Green International** Project location: **Peabody Bike Trail** DEP File #:_____

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ **Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II**
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: **E-7**		Transect Number: **Wetland**	Date of Delineation: **2/15/2018**
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Red Maple/*Acer rubrum*	63.0%	86.0%	YES	FAC*
Gray Birch/*Betula populifolia*	10.5%	14.0%	NO	FAC*
Shrub Layer:				
Highbush Blueberry/*Vaccinium corymbosum*	20.5%	50.0%	YES	FACW-*
Speckled Alder/*Alnus rugosa*	20.5%	50.0%	YES	FACW+*
Woody Vines:				
Poison Ivy/*Toxicodendron radicans*	10.5%	100.0%	YES	FAC*

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **0**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes** no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 97

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes** no
title/date: **Websoil Survey, Essex County, MA, Southern Part 10/6/17**
map number: **MA606**
soil type mapped: **301B Montauk fine sandy loam, 0-8% slopes, stony**
hydric soil inclusions: **616A Fluvaquents**

Are field observations consistent with soil survey? **yes** no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	**0-7"**	**10YR 4/1 loamy fine sand**	
C	**7-20"**	**10YR 3/1 fine sand**	**7.5YR 4/4**

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes** no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: _____
- ❑ Depth to free water in observation hole: _____
- ❑ **Depth to soil saturation in observation hole**: **@ surface**
- ❑ Water marks: _____
- ❑ Drift lines: _____
- ❑ Sediment Deposits: _____
- ❑ **Drainage patterns in BVW**: _____
- ❑ Oxidized rhizospheres: _____
- ❑ **Water-stained leaves**: _____
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  _____
  _____
  _____
- ❑ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Proposal No. 609211-132091

A00860 - 98

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **V16** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Goldenrod	*Solidago sp.*	10.5	50	YES	NO	FACU
	Dewberry	*Rubus hispidus*	10.5	50	YES	YES	FACW
Shrub	Glossy buckthorn*	*Frangula alnus*	20.5	40	YES	YES	FAC
	Multiflora rose	*Rosa multiflora*	20.5	40	YES	NO	FACU
	Tree-of-heaven	*Ailanthus altissima*	10.5	20	YES	NO	NI
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Green ash*	*Fraxinus pennsylvanica*	20.5	50	YES	YES	FACW
	Black cherry	*Prunus serotina*	20.5	50	YES	NO	FACU

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **3** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

Upland @ ***V16***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%

Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C	**0-20**	**10YR 4/3**	**-**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

A00860 - 100

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **W** Transect #: **V16** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Spotted touch-me-not*	*Impatiens capensis*	38	100	YES	YES	FACW
Shrub	Multiflora rose	*Rosa multiflora*	10.5	25	YES	NO	FACU
	Glossy buckthorn*	*Frangula alnus*	10.5	25	YES	YES	FAC
	White ash	*Fraxinus americana*	10.5	25	YES	NO	FACU
	Silky dogwood*	*Cornus amomum*	10.5	25	YES	YES	FACW
Vine	N/A	*N/A*	N/A	N/A	N/A	NO	N/A
Tree	Willow*	*Salix sp.*	10.5	100	YES	YES	FACW

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **2**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 101

Wetland @ ***V16***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%

Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-10**	**10YR 3/2**	**5YR 4/3**
Cg	**10-20**	**10YR 4/1**	**5YR 4/6**

Remarks:

3. Other: Intermittent Stream adjacent to test location.

Conclusion: Is soil hydric? **Yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☑ Depth to soil saturation in observation hole: 0"
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☑ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☑ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion

	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐

Sample location is in a BVW **YES**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Y5** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Poison ivy*	*Toxicodendron radicans*	3	50	YES	YES	FAC
	Goldenrod	*Solidago sp.*	3	50	YES	NO	FACU
Shrub	Glossy buckthorn*	*Frangula alnus*	10.5	50	YES	YES	FAC
	Honeysuckle*	*Lonicera spp.*	10.5	50	YES	YES	FAC
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Black cherry	*Prunus serotina*	20.5	39	YES	NO	FACU
	Gray birch*	*Betula populifolia*	10.5	20	YES	YES	FAC
	Black locust	*Robinia pseudoacacia*	10.5	20	YES	NO	FACU-
	Northern red oak	*Quercus rubra*	10.5	20	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **4** Number of dominant non-wetland indicator plants: **5**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 103

Upland @ ***Y5***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
Title/date: Essex County, Southern Part
Map number: Accessed via Web Soil Survey
Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%
Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C	**0-20**	**10YR 4/3**	**-**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Ecosystem Solutions** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Y5** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Bristly blackberry*	*Rubus hispidus*	3	33	YES	YES	FACW
	Poison ivy*	*Toxicodendron radicans*	3	33	YES	YES	FAC
	Goldenrod	*Solidago sp.*	3	33	YES	NO	FACU
Shrub	Honeysuckle*	*Lonicera spp.*	10.5	28	YES	YES	FAC
	Black cherry	*Prunus serotina*	10.5	28	YES	NO	FACU
	Speckled alder	*Alnus incana*	3	8	NO	NO	NI
	Silky dogwood*	*Cornus amomum*	10.5	28	YES	YES	FACW
	Green ash*	*Fraxinus pennsylvanica*	3	8	NO	YES	FACW
Vine	Oriental bittersweet	*Celastrus orbiculatus*	10.5	100	YES	NO	NI
Tree	Red maple*	*Acer rubrum*	20.5	60	YES	YES	FAC
	Gray birch*	*Betula populifolia*	10.5	31	YES	YES	FAC
	Big-tooth aspen	*Populus grandidentata*	3	9	NO	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **6** Number of dominant non-wetland indicator plants: **3**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 105

Upland @ ***Y5***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
Title/date: Essex County, Southern Part
Map number: Accessed via Web Soil Survey
Soil type mapped: 626B- Merrimac-Urban land complex, 0-8%
Hydric soil inclusions: none

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-7**	**10YR 2/2**	**-**
Bg	**7-20**	**10YR 6/3**	**5YR 4/6**

Remarks:

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☑ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion

	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐

Sample location is in a BVW **YES**

Proposal No. 609211-132091

A00860 - 106

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **U** Transect #: **Z7** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Sedge*	*Carex spp.*	10.5	100	YES	YES	FACW
Shrub	Honeysuckle*	*Lonicera spp.*	38	48	YES	YES	FAC
	Box-elder*	*Acer negundo*	10.5	13	NO	YES	FAC+
	Glossy buckthorn*	*Frangula alnus*	10.5	13	NO	YES	FAC
	Japanese knotweed	*Polygonum cuspidatum*	10.5	13	NO	NO	FACU-
	Green ash*	*Fraxinus pennsylvanica*	10.5	13	NO	YES	FACW
Vine	Oriental bittersweet	*Celastrus orbiculatus*	3	50	YES	NO	NI
	Fox grape	*Vitis labrusca*	3	50	YES	NO	FACU
Tree	Black cherry	*Prunus serotina*	10.5	50	YES	NO	FACU
	Black locust	*Robinia pseudoacacia*	10.5	50	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **2** Number of dominant non-wetland indicator plants: **4**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **NO**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 107

Upland @ ***Z7***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
Title/date: Essex County, Southern Part
Map number: Accessed via Web Soil Survey
Soil type mapped: 316A- Fluvaquents, frequently flooded, 0-3%
Hydric soil inclusions: Swansea, Unnamed Soils

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
^C1	**0-8**	**10YR 4/3**	**-**
^C2	**8-20**	**10YR 6/3**	**-**

Remarks: Fill is associated with a buried sewer pipe between the BVW and Procotor Brook.

3. Other:

Conclusion: Is soil hydric? **No**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☐ Depth to soil saturation in observation hole:
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☐	☑
Wetland hydrology present		
Hydric soil	☐	☑
Other indicators of hydrology	☐	☑
Sample location is in a BVW		**NO**

Proposal No. 609211-132091

A00860 - 108

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:

Prepared by: **Green International** Project Location: Peabody Bikeway Extension DEP File #:

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Observation Plot Number: **W** Transect #: **Z7** Date: **10/5/2022**

	Common Name	Scientific Name	Percent Cover	Percent Dominance	Dominant Plant?	Wetland Indicator Plant?	Wetland Indicator Category
Ground	Dewberry	*Rubus hispidus*	10.5	25	YES	YES	FACW
	White avens	*Geum canadense*	10.5	25	YES	NO	FACU
	Goldenrod	*Solidago sp.*	10.5	25	YES	NO	FACU
	Poison ivy*	*Toxicodendron radicans*	10.5	25	YES	YES	FAC
Shrub	American elder*	*Sambucus canadensis*	10.5	25	YES	YES	FACW-
	Glossy buckthorn*	*Frangula alnus*	10.5	25	YES	YES	FAC
	Honeysuckle*	*Lonicera spp.*	10.5	25	YES	YES	FAC
	Silky dogwood*	*Cornus amomum*	10.5	25	YES	YES	FACW
Vine	N/A	*N/A*		N/A	N/A	N/A	N/A
Tree	Box-elder*	*Acer negundo*	10.5	50	YES	YES	FAC+
	Black locust	*Robinia pseudoacacia*	10.5	50	YES	NO	FACU-

FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due t o physiological or morphological adaptations, describe the adaptation next to the asterisk

Vegetation conclusion:

Number of dominant wetland indicator plants: **7** Number of dominant non-wetland indicator plants: **2**

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **YES**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Proposal No. 609211-132091

A00860 - 109

*Wetland @ **Z7***

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site?

Title/date: Essex County, Southern Part

Map number: Accessed via Web Soil Survey

Soil type mapped: 616A- Fluvaquents, frequently flooded, 0-3%

Hydric soil inclusions: Swansea, Unnamed Soils

Are field observations consistent with soil survey? Yes

Remarks:

2. Soil Description

Horizon	Depth	Color	Redox
A	**0-10**	**10YR 2/2**	**-**
Bg	**10-20**	**10YR 6/2**	**5YR 4/6**

Remarks:

3. Other:

Conclusion: Is soil hydric? **Yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated:
- ☐ Depth to free water in observation hole:
- ☑ Depth to soil saturation in observation hole: 12"
- ☐ Water marks:
- ☐ Drift lines:
- ☐ Sediment Deposits:
- ☐ Drainage patterns in BVW:
- ☐ Oxidized rhizospheres:
- ☐ Water-stained leaves:
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo):
- ☐ Other:

Vegetation & Hydrology Conclusion	YES	NO
Number of wetland indicator plants ≥ # of non-wetland indicator plants	☑	☐
Wetland hydrology present		
Hydric soil	☑	☐
Other indicators of hydrology	☑	☐
Sample location is in a BVW	**YES**	

Proposal No. 609211-132091

A00860 - 110

APPENDIX B – PHOTOS

Photo Log – December 2016 & November 2022

Picture 1 – Looking Northeast on Essex Center Drive

Picture 2 – Looking Southeast at Northshore Road intersection with driveway Route 128 underpass

Picture 3 - Looking Southwest on Northshore Road

Picture 4 – Looking East at the Old Boston & Maine Railroad ROW proposed trailhead

Picture 5 – Looking north at the existing culvert outlet (downstream) (Sta. 329+85)

Picture 6 — Looking at the existing culvert outlet (downstream) (Sta. 329+85)

Picture 7 – Looking south at the existing culvert inlet (upstream) (Sta. 329+85)

Picture 8 – Looking at the existing culvert inlet (Sta. 329+85)

Picture 9 – Looking south at the existing culvert outlet (Proctor Brook side) (Sta. 340+10)

Picture 10 – Looking at the existing culvert inlet (intermittent stream side) (Sta. 340+10)

Picture 11 – Former culvert remains on the downstream side of Proctor Brook (Sta. 346+20)

Picture 12 – Former culvert remains in the middle of the Proctor Brook channel (Sta. 346+20)

Picture 13 – View south (downstream) at former culvert remains in Proctor Brook channel (Sta. 346+20)

Picture 14 –View east form the upstream side of former Proctor Brook crossing at Sta. 346+20

Picture 15 – View east (downstream) from the west bank of Proctor Brook at the remaining stonewall and retaining wall (Sta. 351+50)

Picture 16 – Old railroad bridge remains in the vicinity of Sta. 351+50

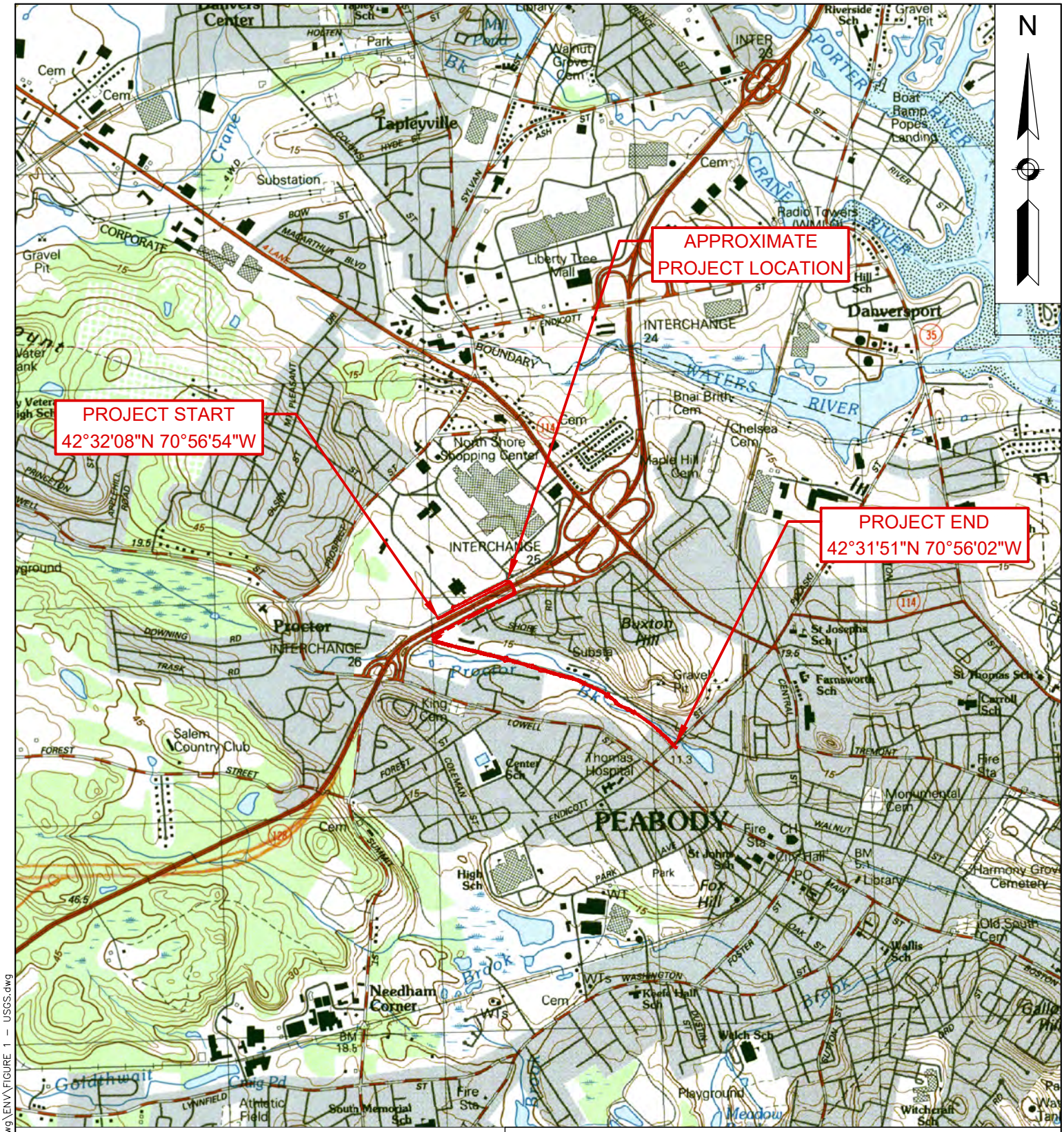
Picture 17 – Old railroad bridge remains in the vicinity of Sta. 351+50

Picture 18 – View southwest at old railroad bridge remains (Sta. 351+50)

Picture 19 – View west at the location of the existing 15-inch RCP culvert conveying intermittent stream under former railroad bed at Sta. 358+50 near eastern project limit

APPENDIX C – FIGURES

Figure 1 – USGS Topographic Map
Figure 2 – Aerial Map
Figure 3 – Protected Resource Area Map
Figure 4 – FEMA Map
Figure 5 – Soils Map
Figure 6A-6H – Resource Area Impacts
Figure 7A-7H – BLSF Impacts and Flood Storage



LEGEND:

APPROXIMATE LIMIT OF WORK

SCALE IN FEET

1000 0 1000 2000

ELEVATIONS IN METERS

NOTE: DATA TAKEN FROM MASSGIS

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 1 - USGS.dwg

USGS LOCUS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

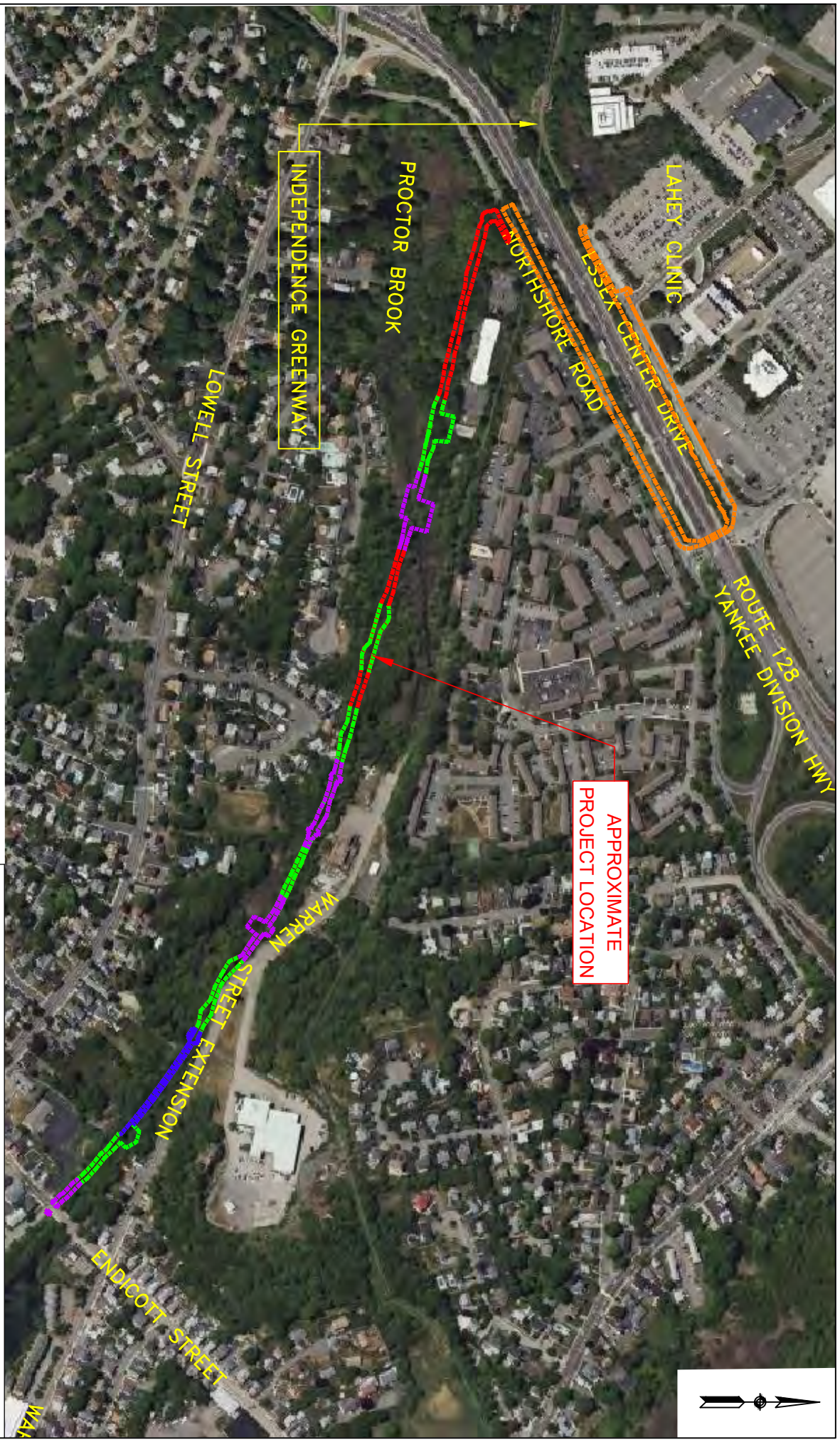
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118
DATE: 1/31/2023	DRAWN BY: JK
REVISED:	CHECKED BY: OF

FIGURE 1

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 2 – AERIAL.dwg



LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(j))
- APPROXIMATE LIMIT OF WORK (OUTSIDE LIMITED PROJECT PROVISIONS – LOCATED WITHIN BLSF)

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

AERIAL MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:

CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
DATE: 03/13/2024
REVISED:

PROJECT NO. 17118
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 2

LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(j))
- APPROXIMATE LIMIT OF WORK (OUTSIDE LIMITED PROJECT PROVISIONS – LOCATED WITHIN BLSF)
- SURVEYED WETLANDS
- SURVEYED BANK/MAHW/PERENNIAL STREAM
- SURVEYED BANK/INTERMITTENT STREAM
- 200–FOOT RIVERFRONT AREA
- 100–FOOT WETLAND BUFFER
- CERTIFIED VERNAL POOLS
- POTENTIAL VERNAL POOLS
- SURVEYED DITCH

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

PROTECTED RESOURCE AREA MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

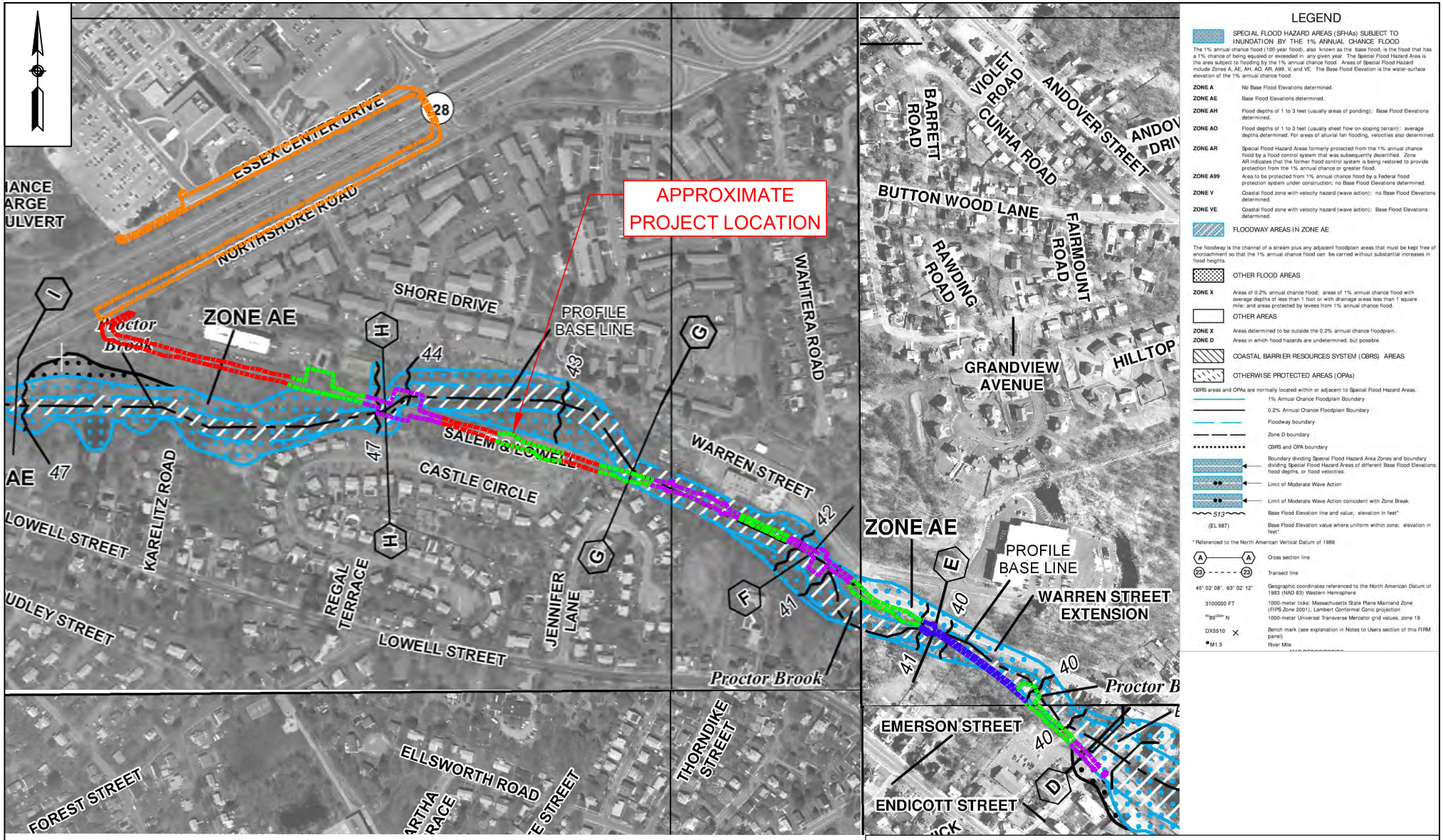
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 03/13/2024
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 3

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 3 – RESOURCE AREA.dwg

A00860 - 129



LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(j))
- APPROXIMATE LIMIT OF WORK (OUTSIDE LIMITED PROJECT PROVISIONS – LOCATED WITHIN BLSF)

NOTE:
THE FLOOD ZONE DATA SHOWN IS TAKEN FROM THE (FEDERAL EMERGENCY MANAGEMENT AGENCY) FEMA FOR THE TOWN OF PEABODY, MA (FIRM COMMUNITY PANELS 25009C0412F AND 25009C0414F, DATED 7/3/2012, AND 25009C0416G AND 25009C0418G, DATED 7/16/2014).

SCALE IN FEET
250 0 250 500
1" = 500'

NOTE: DATA TAKEN FROM MASSGIS

FEMA MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

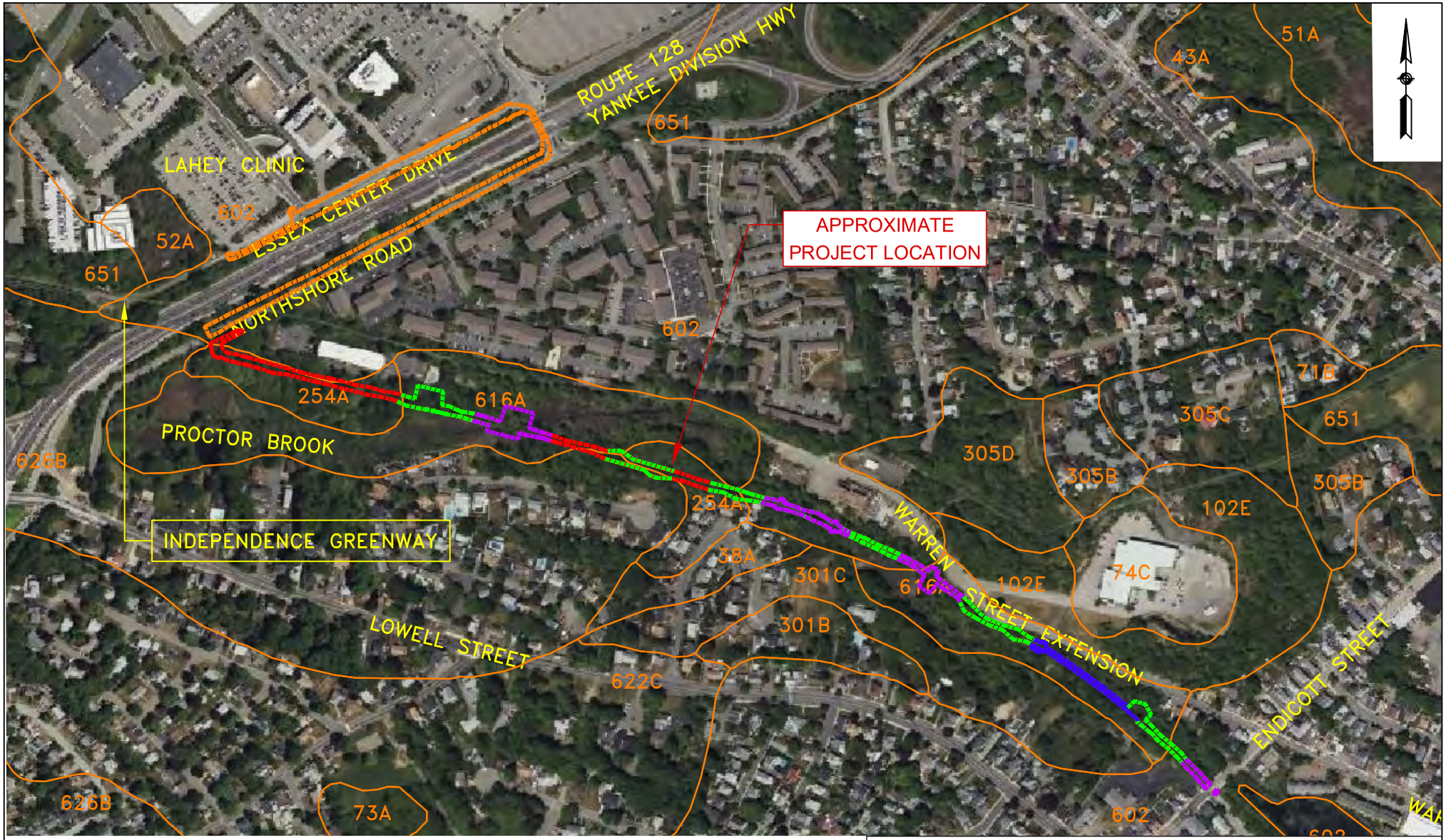
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 03/13/2024
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 4

Proposal No. 609211-132091
A00860 - 131
Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 4 – FEMA.dwg



LEGEND:

- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))
- APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(j))
- APPROXIMATE LIMIT OF WORK (OUTSIDE LIMITED PROJECT PROVISIONS – LOCATED WITHIN BLSF)
- NRCS SOIL SURVEY BOUNDARY
- 73A NRCS SOIL TYPE

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS AND THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE (NRCS).

SOILS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 03/13/2024
REVISED:
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 5

Proposal No. 609211-132091

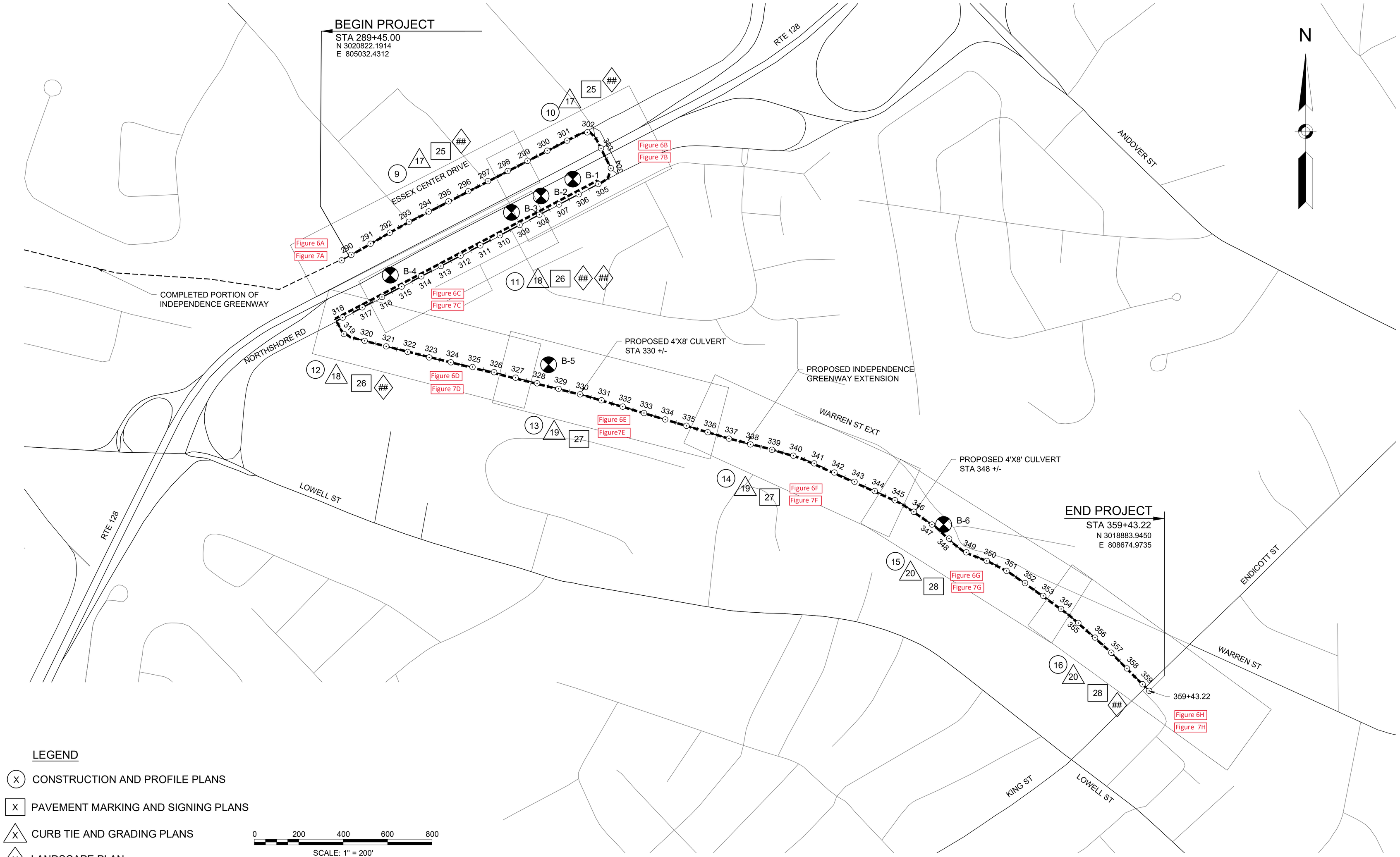
Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 5 – SOILS MAP.dwg

A00860 - 133

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	140
PROJECT FILE NO.	609211		

KEY PLAN



LEGEND

(X) CONSTRUCTION AND PROFILE PLANS

[X] PAVEMENT MARKING AND SIGNING PLANS

△X CURB TIE AND GRADING PLANS

◇X LANDSCAPE PLAN

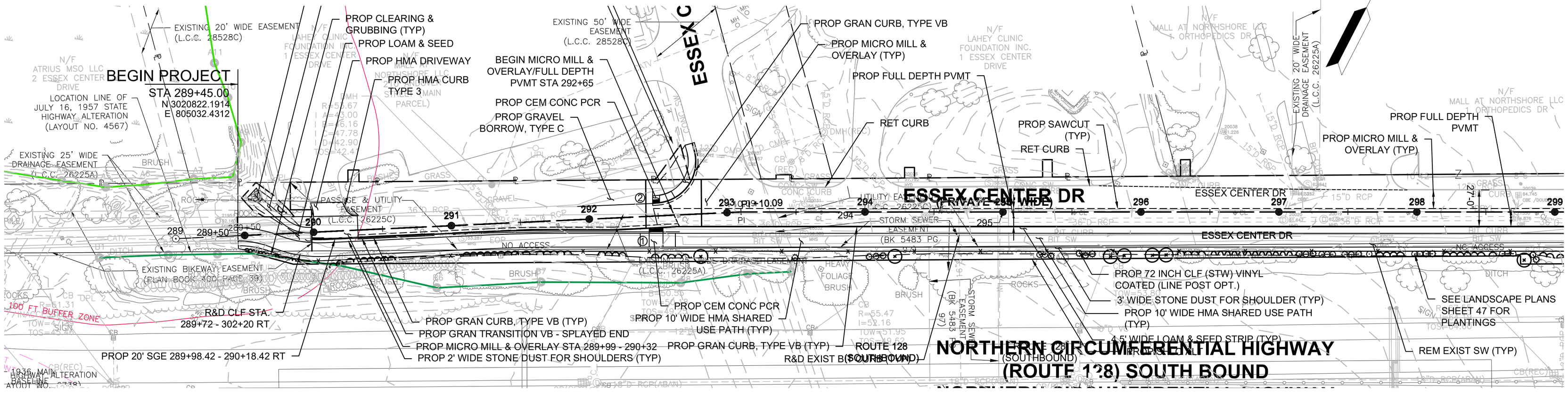
0 200 400 600 800

SCALE: 1" = 200'

Proposal No. 609211-132091

A00860 - 135

SHT003_HDI(KEY PLAN).DWG Plotted on 2-Feb-2024 4:43 PM



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS	TOTAL IMPACTS
PERMANENT LUW/WATERWAYS (SF)	10,343
TEMPORARY LUW/WATERWAYS (SF)	2,082
PERMANENT BVW IMPACT (SF)	2,225
TEMPORARY BVW IMPACT (SF)	4,641
WETLAND REPLICATION AREA (SF)	2,500
RIVERFRONT AREA (SF)	103,288
0–100 (SF)	77,465
100–200 (SF)	25,823
100–FT BUFFER ZONES (SF)	54,594
PERMANENT BANK IMPACT (LF)	618
TEMPORARY BANK IMPACT (LF)	201

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

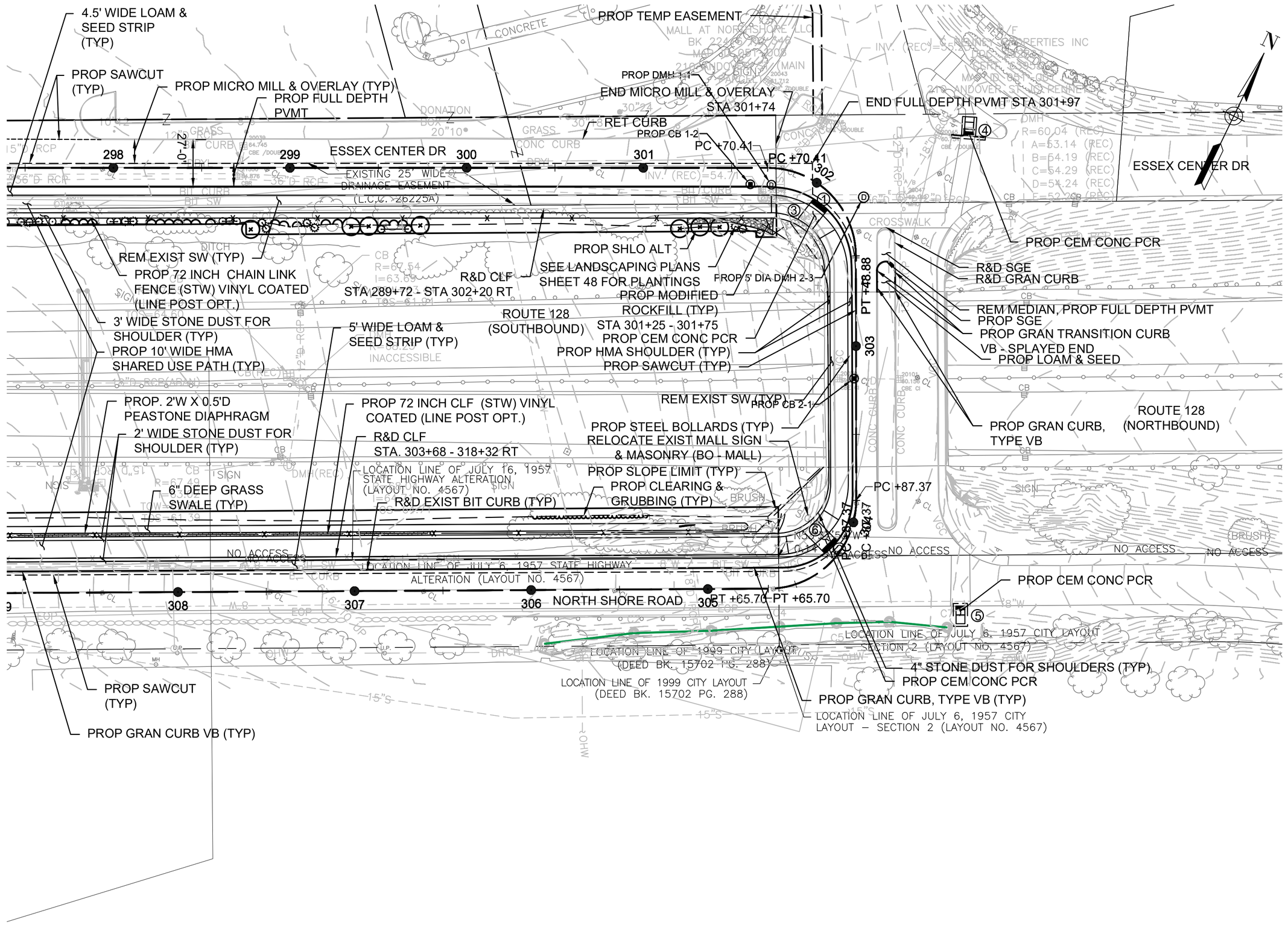
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6A

Proposal No. 609211-132091

A00860 - 136

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

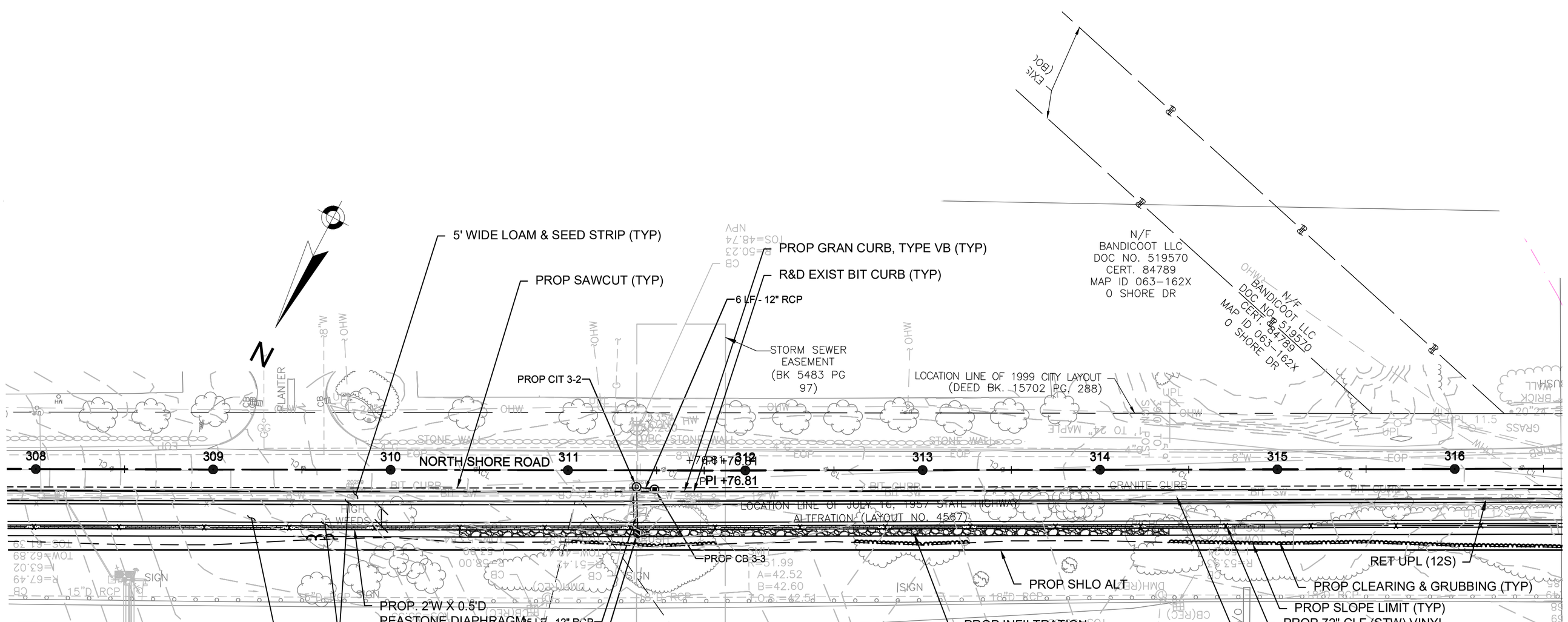
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: | CHECKED BY: DS/OF

FIGURE 6B

A00860 - 137

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

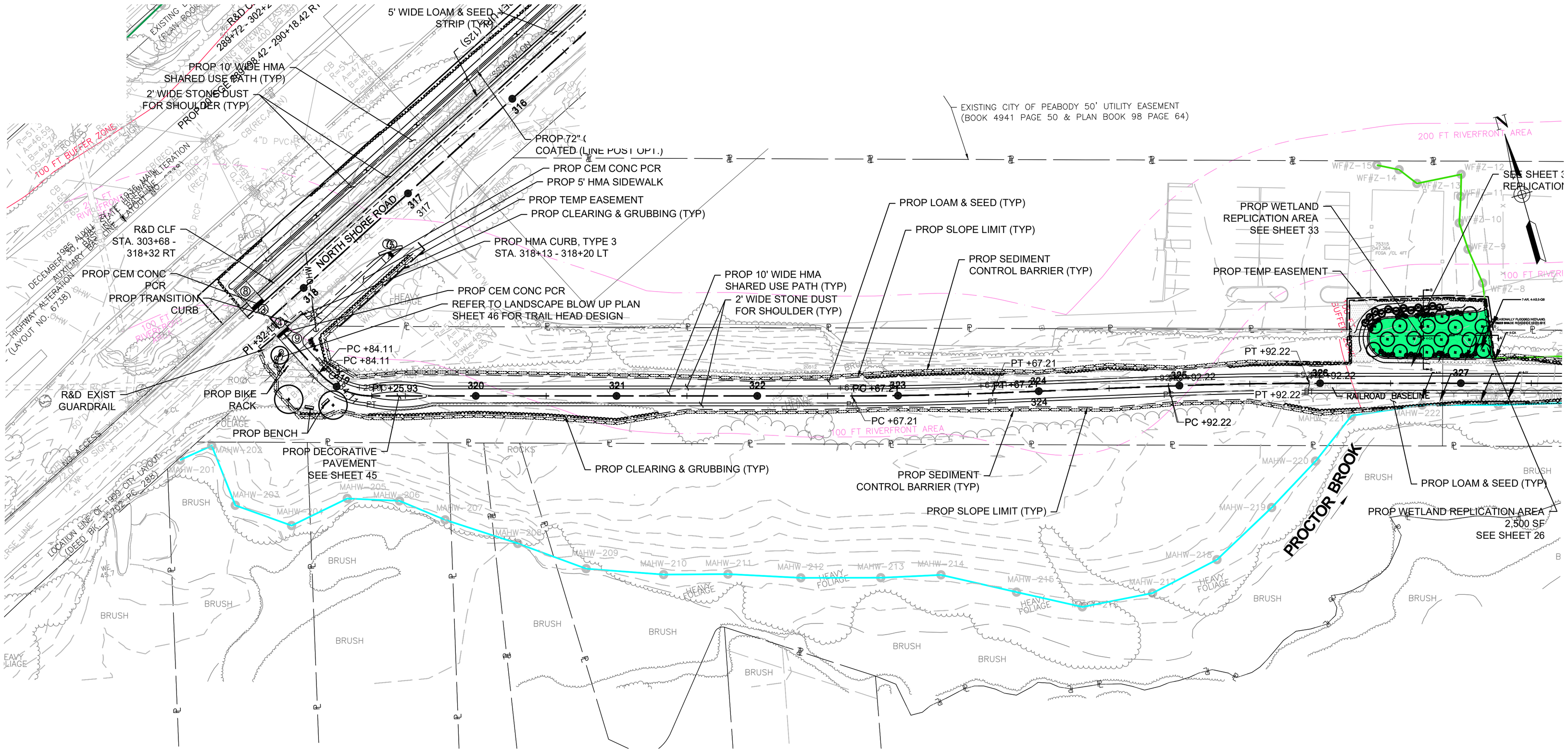
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: | CHECKED BY: DS/OF

FIGURE 6C

A00860 - 138



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)
- WETLAND REPLICATION AREA

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

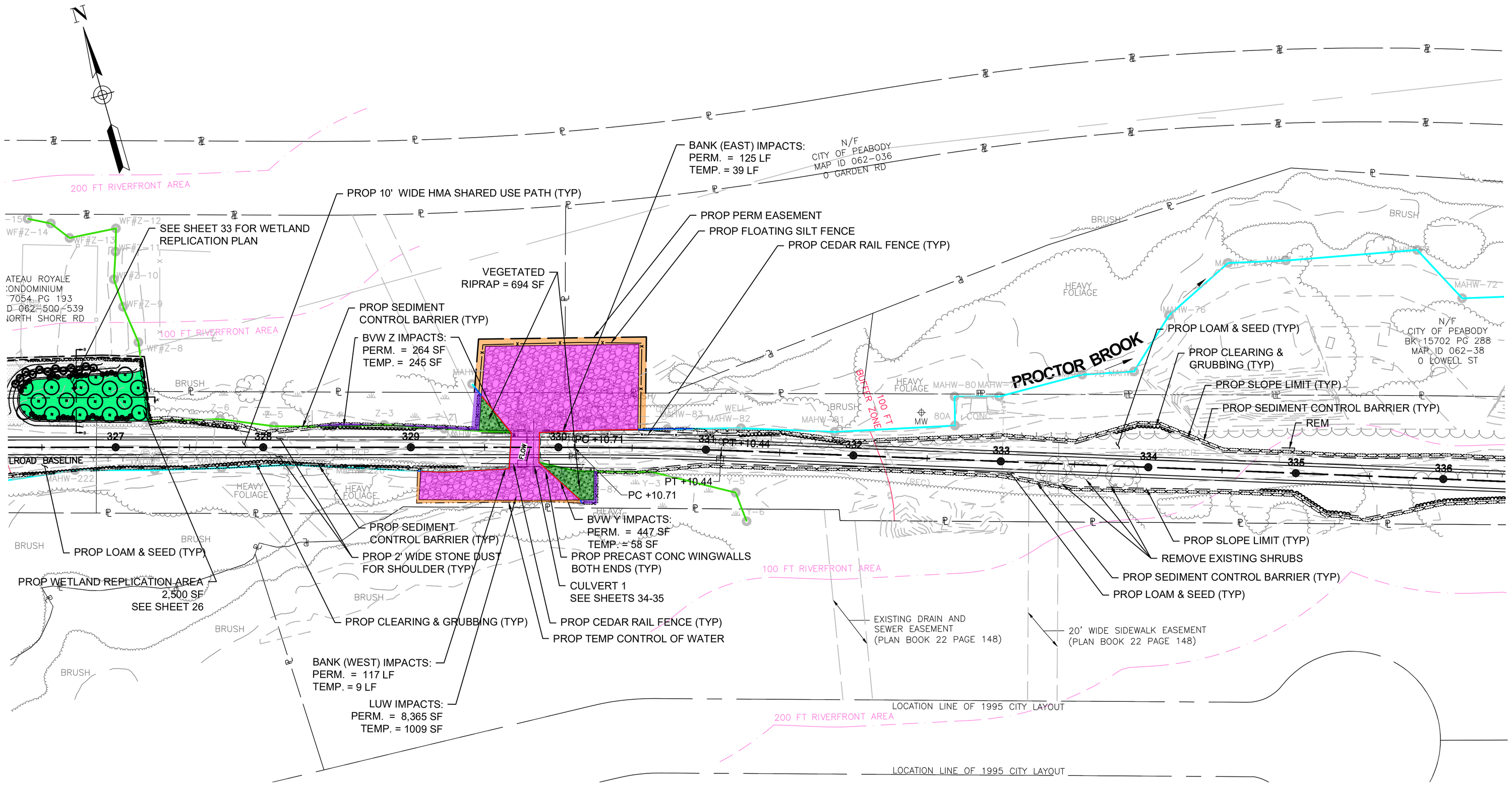
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6D

Proposal No. 609211-132091
A00860 - 139

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)
- WETLAND REPLICATION AREA

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

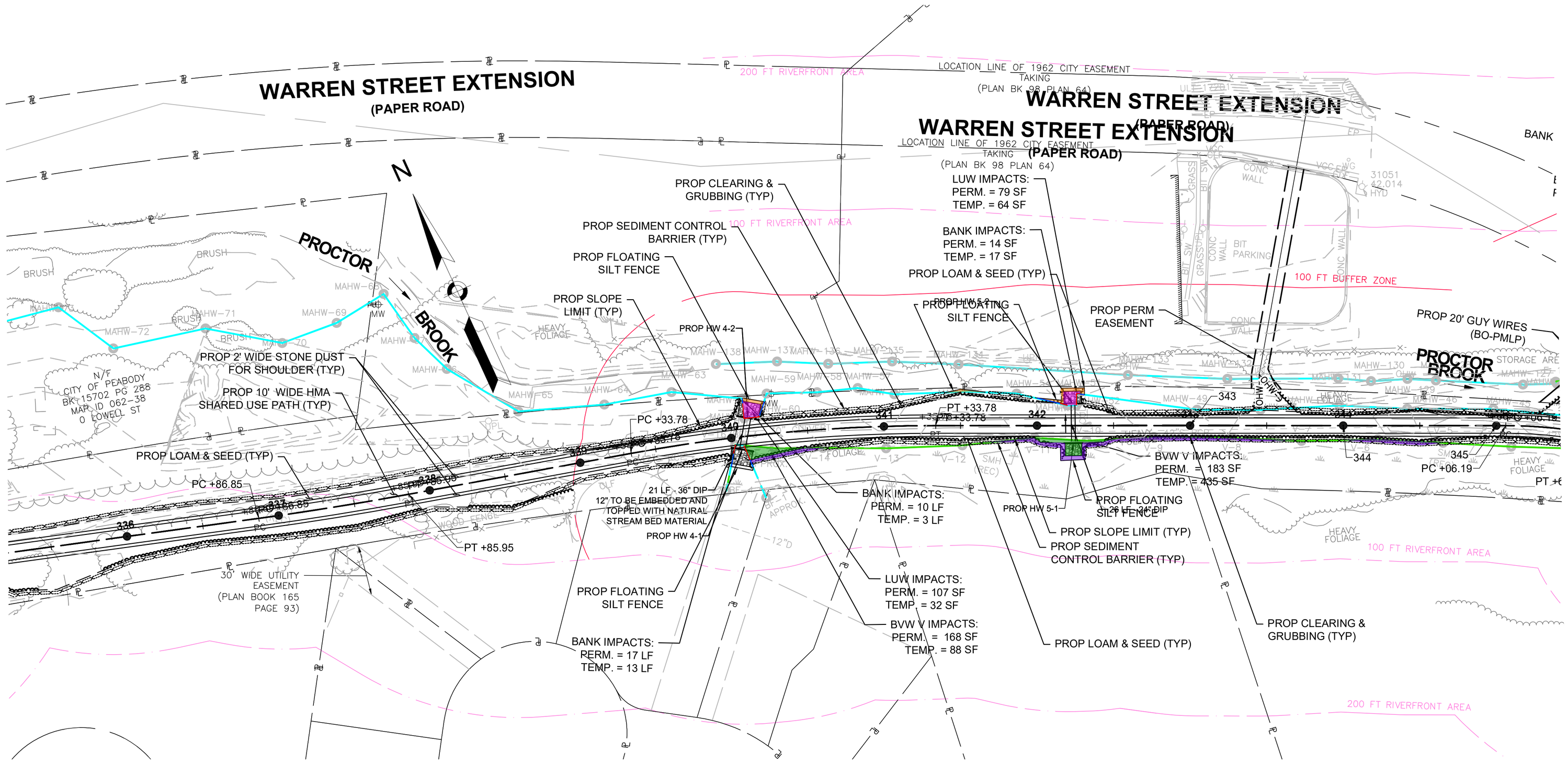
SCALE: AS NOTED	PROJECT NO. 17118
DATE: 09/29/2023	DRAWN BY: JK
REVISED:	CHECKED BY: DS/OF

FIGURE 6E

A00860 - 140

Proposal No. 609211-132091

A00860 - 141



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

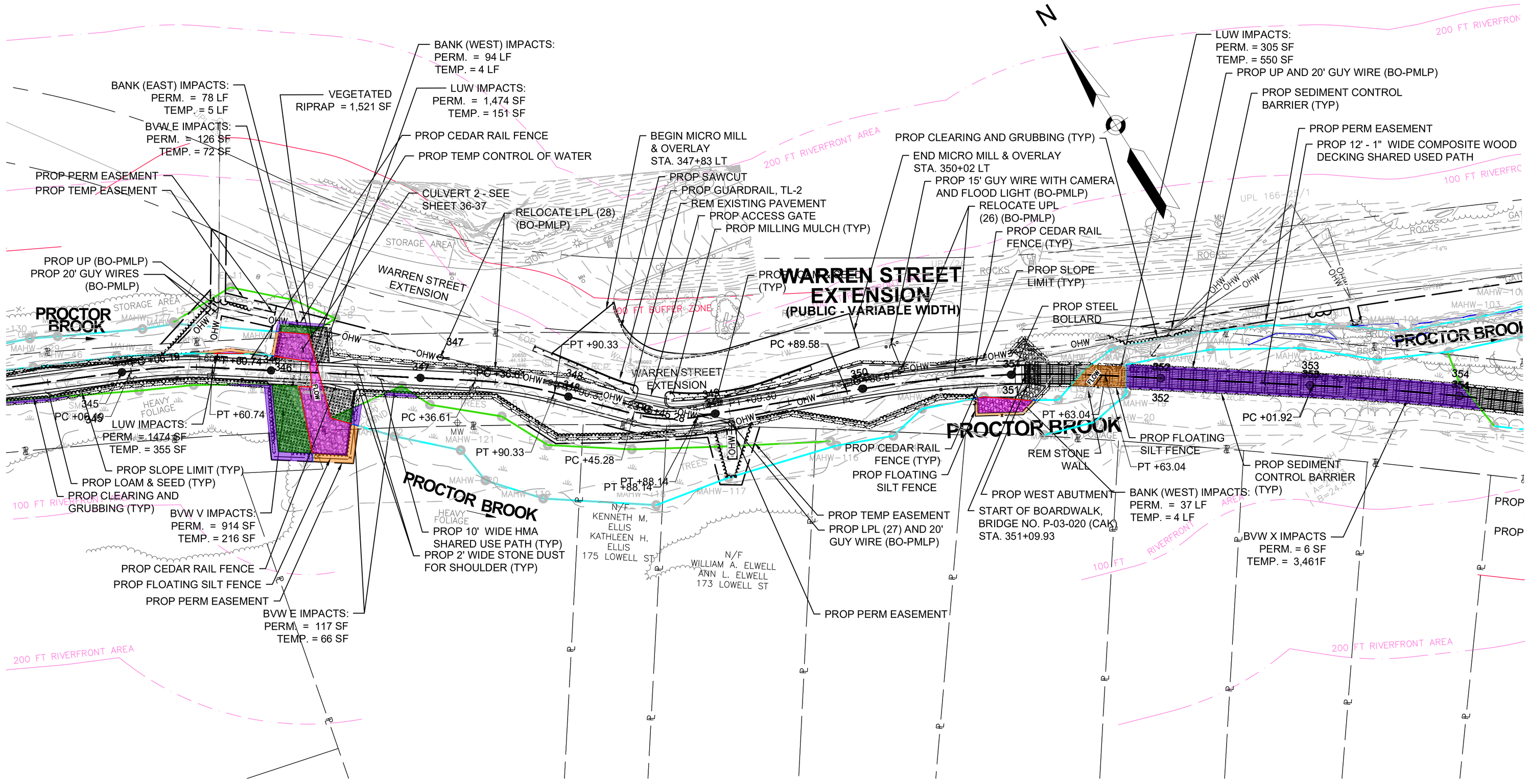
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6F

Proposal No. 609211-132091

A00860 - 142



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

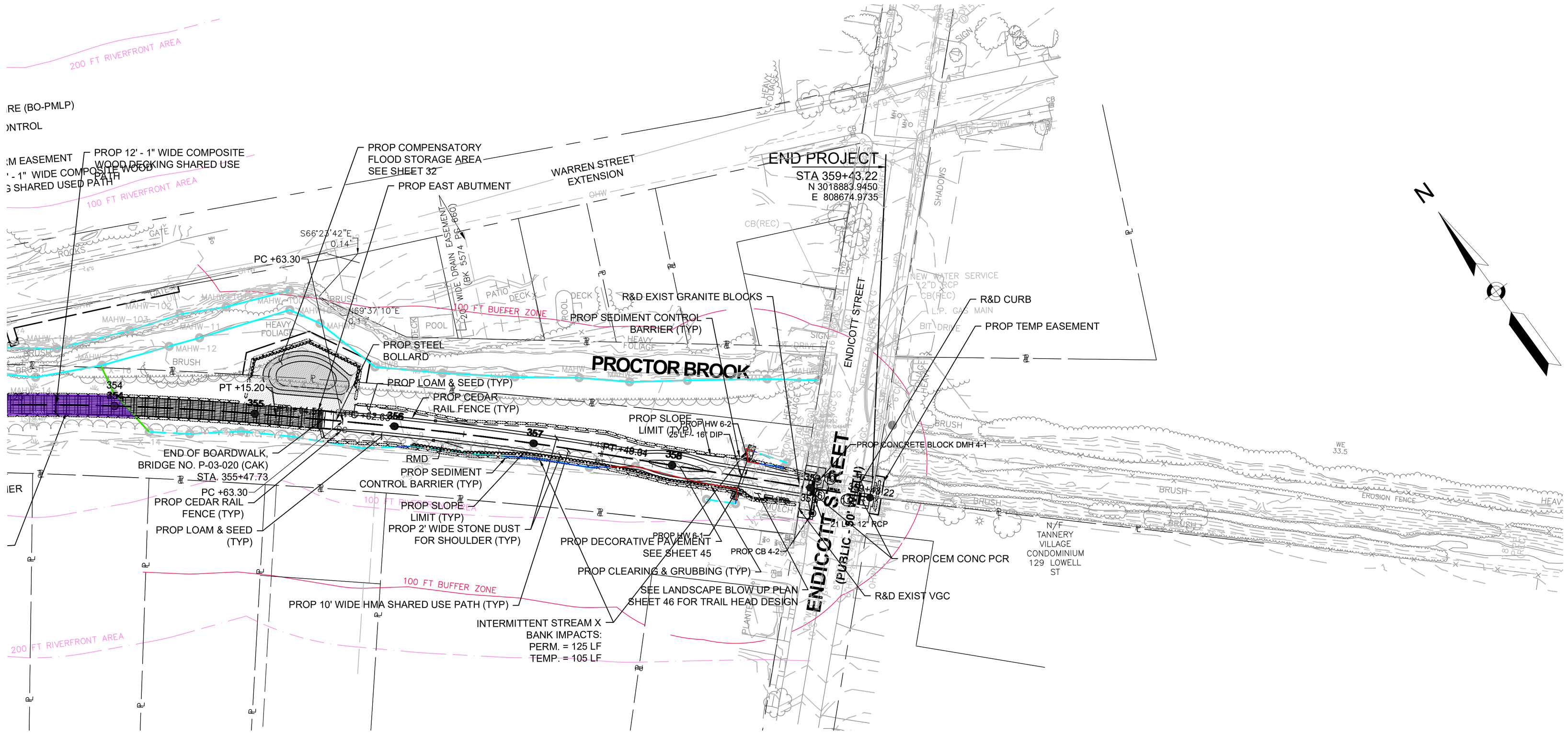
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118
DATE: 09/29/2023	DRAWN BY: JK
REVISED:	CHECKED BY: DS/OF

FIGURE 6G

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

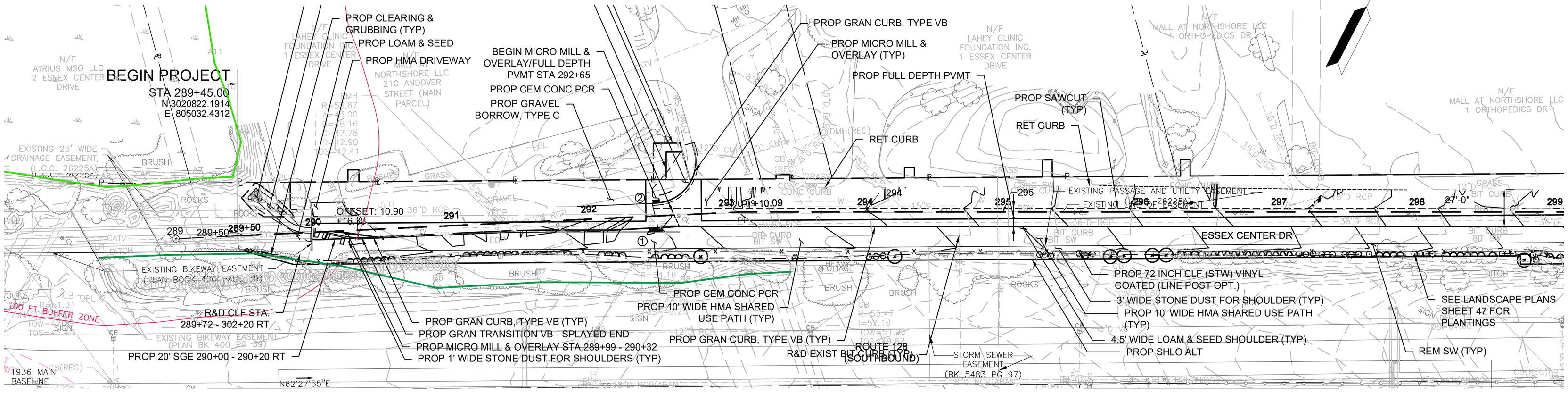
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6H

A00860 - 143



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

NET CUT/FILL SUMMARY (ALL STATIONS)			
ELEVATION	INCREMENTAL NET CUT/FILL VOL (CF)	COMPENSATORY FLOOD STORAGE CUT VOL (CF)	TOTAL CUT/FILL VOL (CF)
34-35	301	-921	-620
35-36	-159	-1,400	-1,559
36-37	2,197	-1,151	1,046
37-38	2,033	0	2,033
38-39	1,305	0	1,305
39-40	5,246	0	5,246
40-41	2,207	0	2,207
41-42	-726	0	-726
42-43	79	0	79
43-44	-4,458	0	-4,458
44-45	-1,980	0	-1,980
45-46	-1,495	0	-1,495
46-47	-1,490	0	-1,490
47-47.1	-79	0	-79
TOTAL:	2,982	-3,472	-490

RESOURCE AREA IMPACTS	TOTAL IMPACTS
BORDERING LAND SUBJECT TO FLOODING (SF)	69,340
TOTAL COMPENSATORY FLOOD STORAGE (CF)	3,472
NET CUT/FILL ACROSS PROJECT (CF)	-490

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

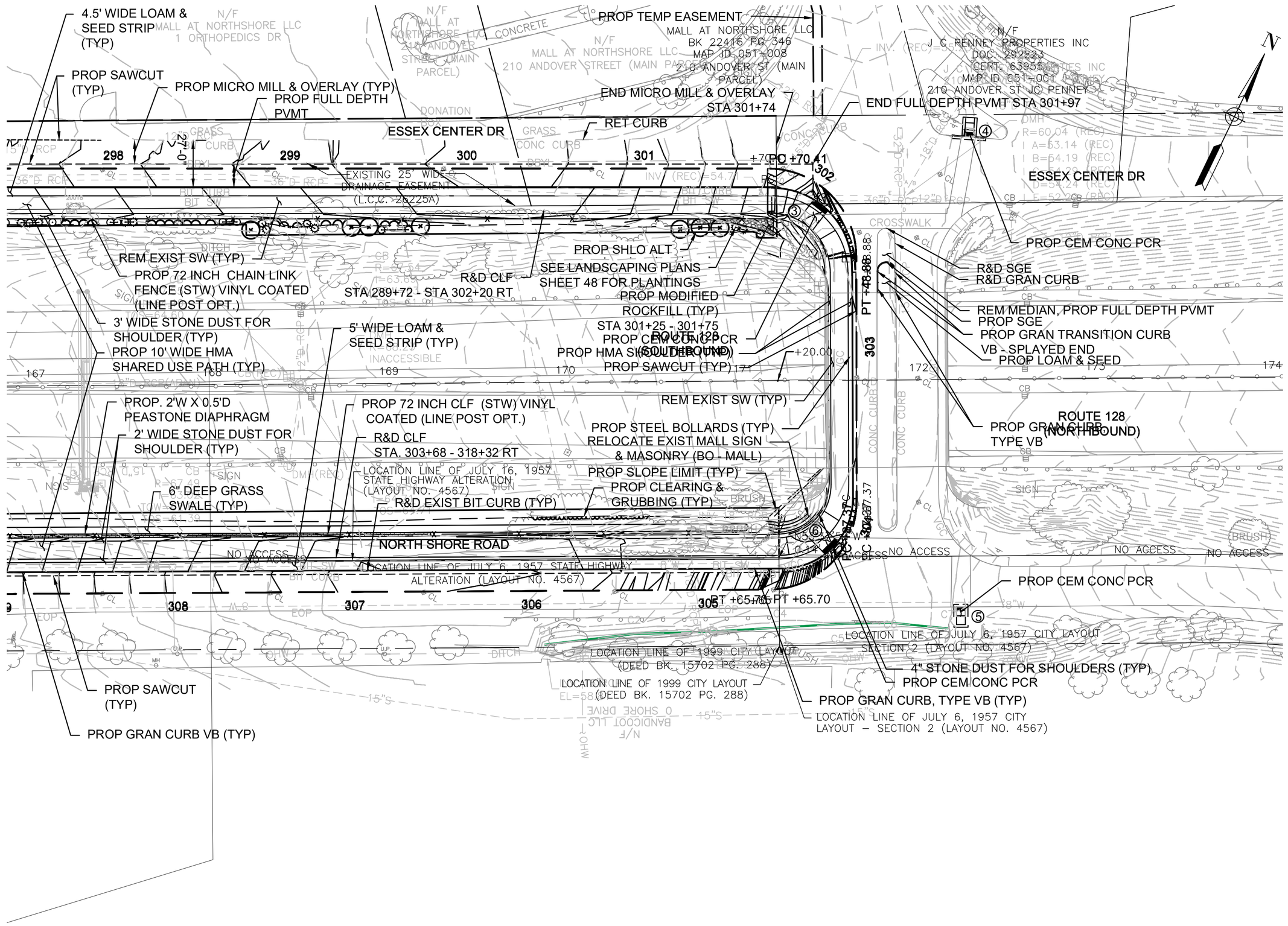
SCALE: AS NOTED | PROJECT NO. 17118
DATE: 10/18/2023 | DRAWN BY: JK
REVISED: | CHECKED BY: DS/OF

FIGURE 7A

Proposal No. 609211-132091

A00860 - 144

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

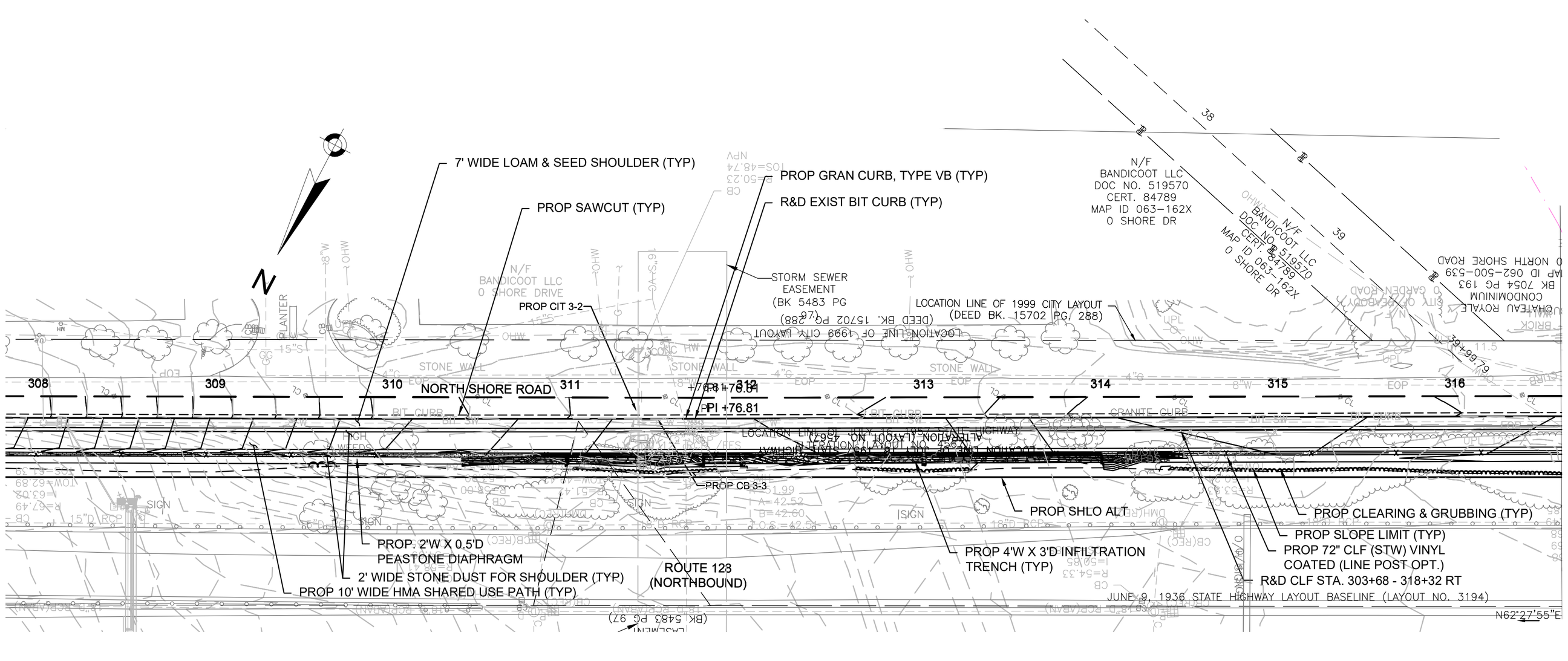
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:	PREPARED FOR:
GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DR. SUITE 200, TEWKSBURY, MA 24 ALBION RD, LINCOLN, RI	CITY OF PEABODY 24 LOWELL STREET PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118	FIGURE 7B
DATE: 10/18/2023 REVISED:	DRAWN BY: JK CHECKED BY: DS/OF	

A00860 - 145

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

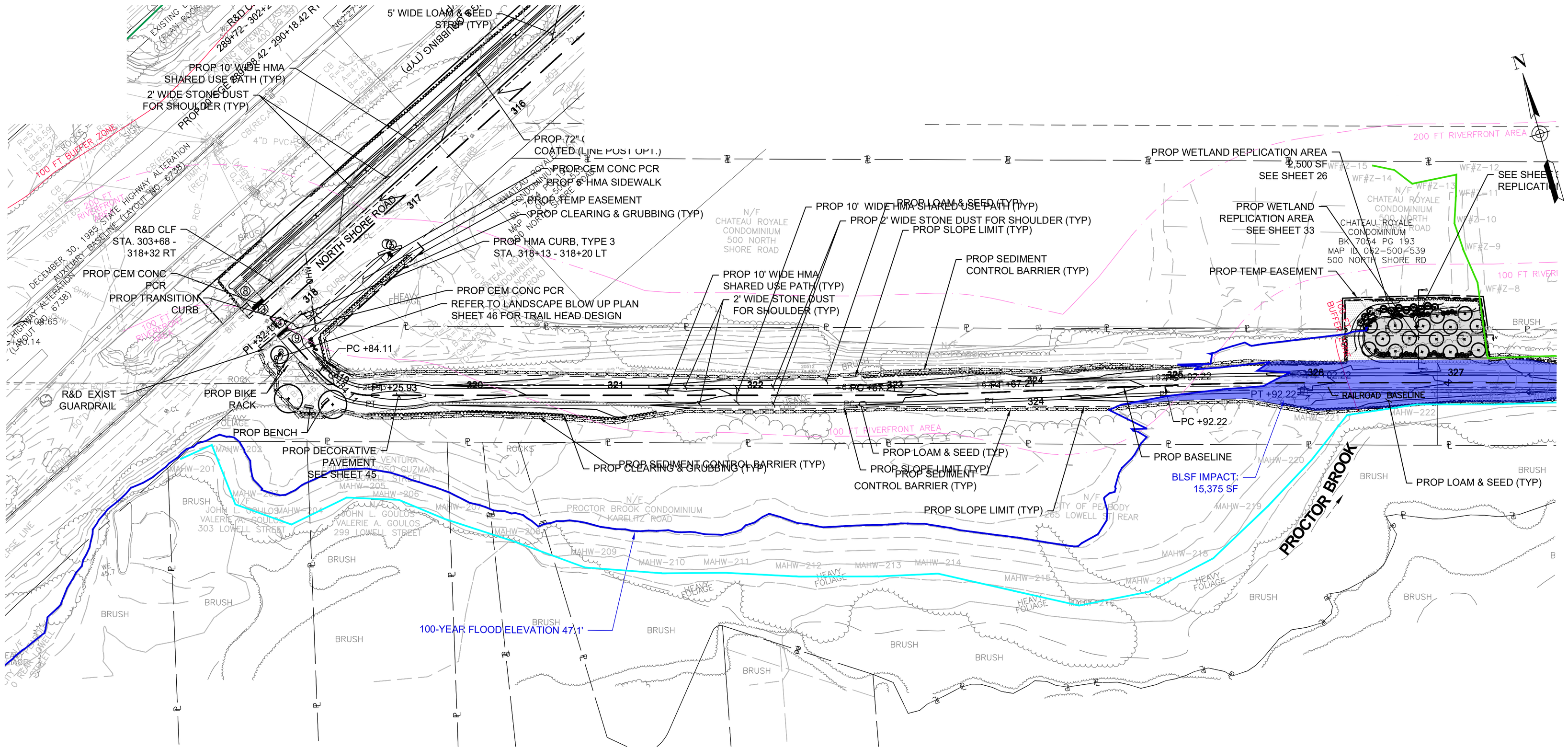
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 10/18/2023 | DRAWN BY: JK
REVISED: | CHECKED BY: DS/OF

FIGURE 7C

A00860 - 146

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100-YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

STA 324+50 TO STA 329+50 FLOODPLAIN ELEVATION: 47.1'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
42-43	21
43-44	-345
44-45	-1,621
45-46	-1,459
46-47	-1,490
47-47.1	-79
TOTAL:	-4,971

STA 329+50 TO 330+00 FLOODPLAIN ELEVATION: 46.9'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
41-42	0
42-43	26
43-44	45
44-45	-359
45-46	-36
46-46.9	0
TOTAL:	-324

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

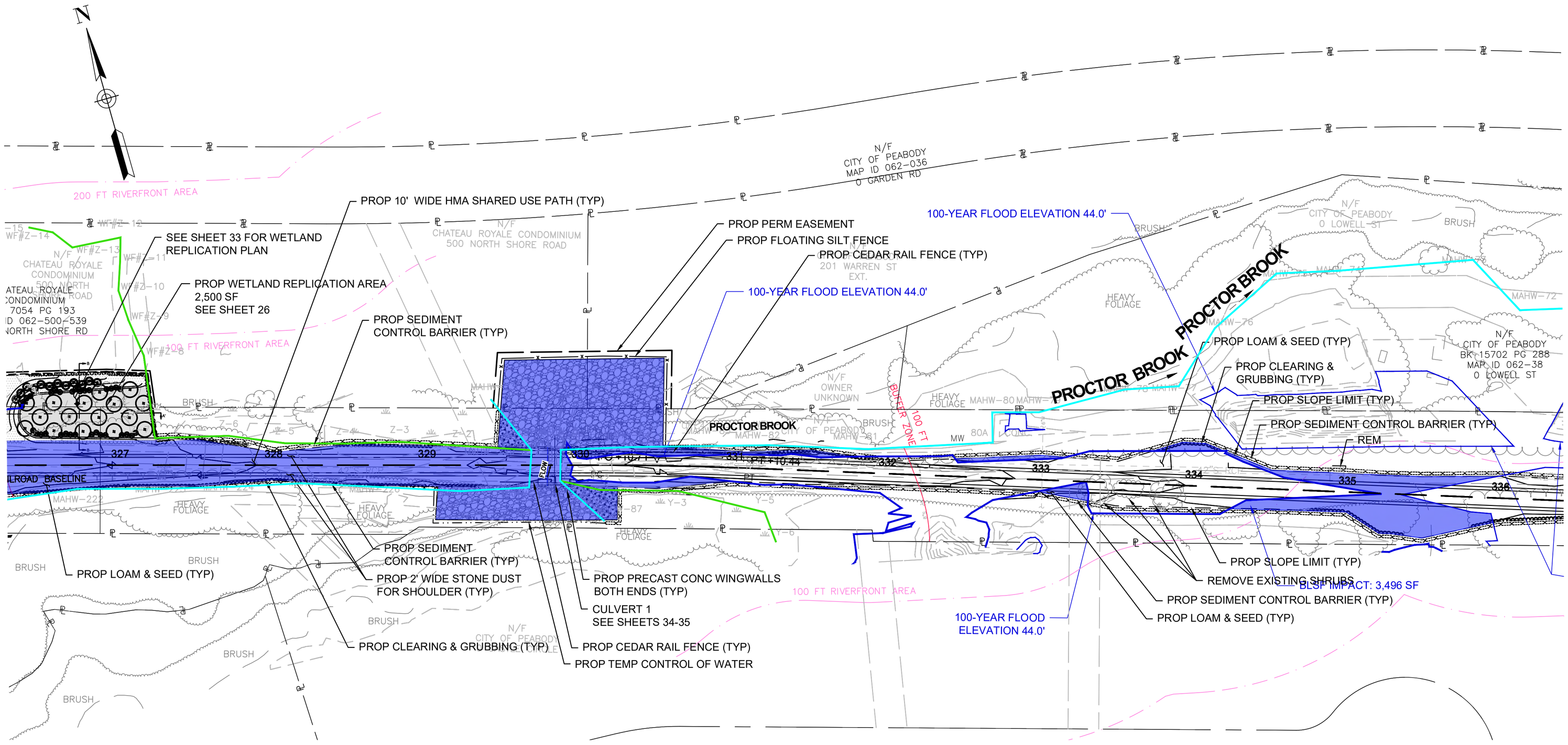
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118
DATE: 10/18/2023 REVISED:	DRAWN BY: JK CHECKED BY: DS/OF

FIGURE 7D

A00860 - 147

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100-YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

STA 330+00 TO 339+00 FLOODPLAIN ELEVATION: 44.0'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
38-39	0
39-40	0
40-41	0
41-42	10
42-43	56
43-44	-4,158
TOTAL:	-4,092

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

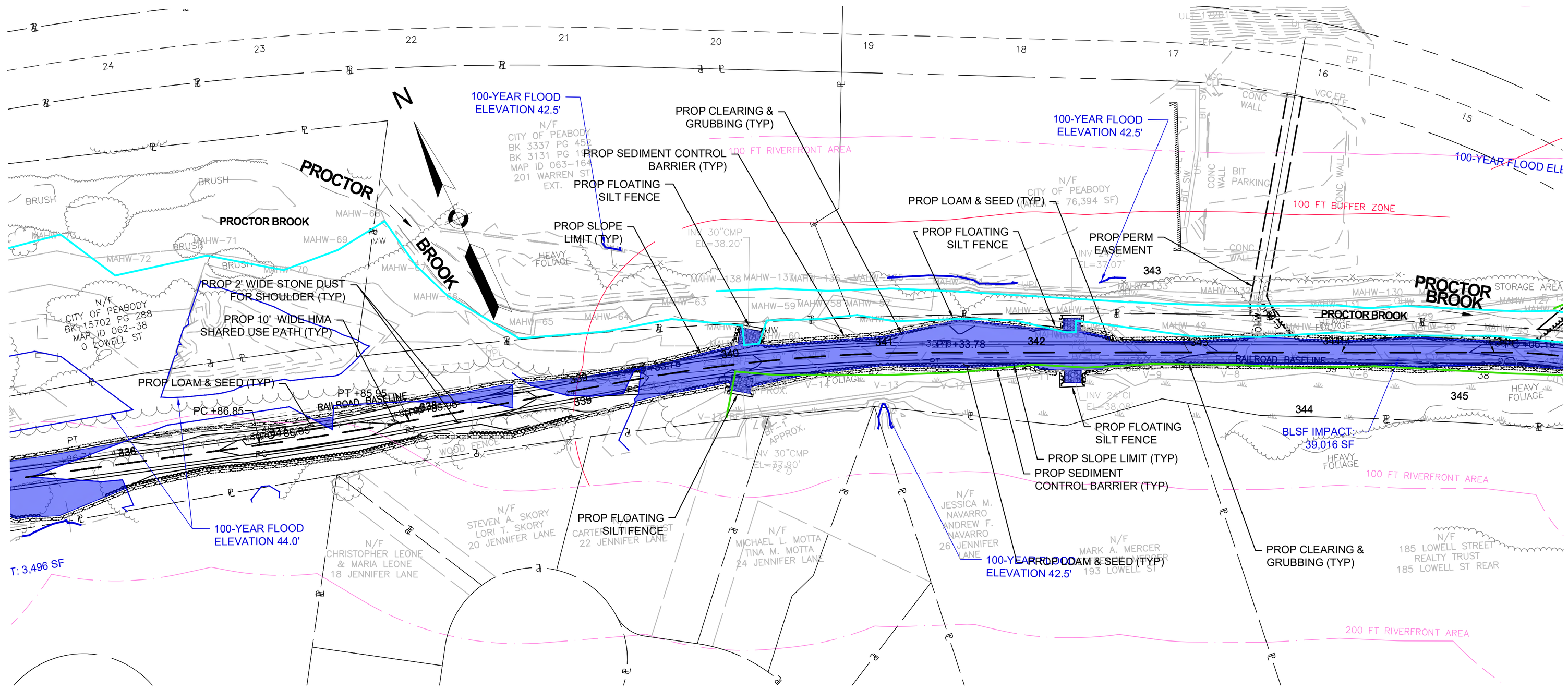
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7E

A00860 - 148

Proposal No. 609211-132091

A00860 - 149



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

STA 339+00 TO STA 345+50 FLOODPLAIN ELEVATION: 42.5'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
37-38	0
38-39	0
39-40	295
40-41	-739
41-42	-737
42-42.5	-24
TOTAL:	-1,206

STA 345+50 TO STA 346+50 FLOODPLAIN ELEVATION: 42.0'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
36-37	0
37-38	0
38-39	0
39-40	205
40-41	1,159
41-42	2
TOTAL:	1,365

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

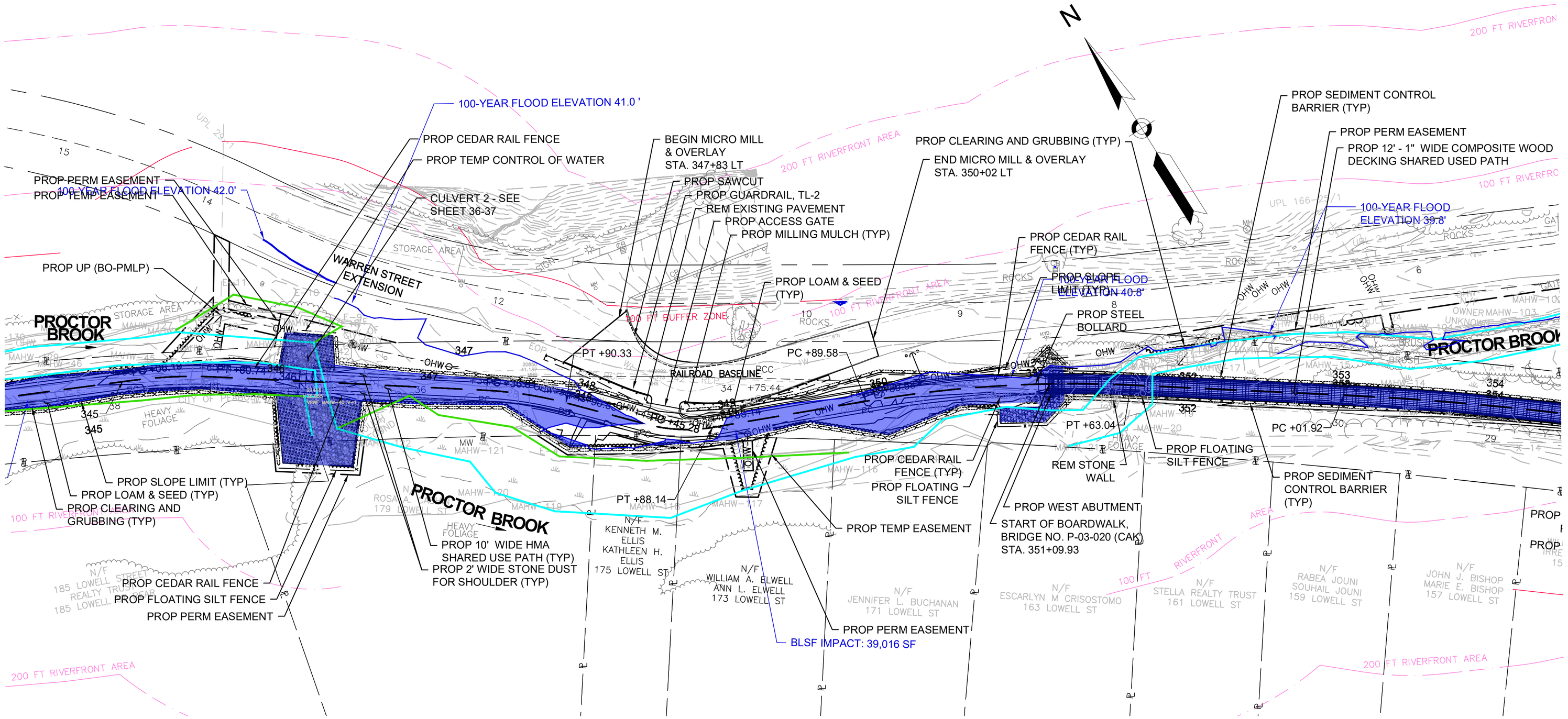
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7F

Proposal No. 609211-132091

A00860 - 150



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

STA 346+50 TO STA 351+00 FLOODPLAIN ELEVATION: 41.0'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
35-36	0
36-37	0
37-38	0
38-39	-8
39-40	970
40-41	232
TOTAL:	1,193

STA 351+00 TO STA 352+50 FLOODPLAIN ELEVATION: 40.8'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
35-36	0
36-37	0
37-38	26
38-39	21
39-40	1,045
40-40.8	1,556
TOTAL:	2,648

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

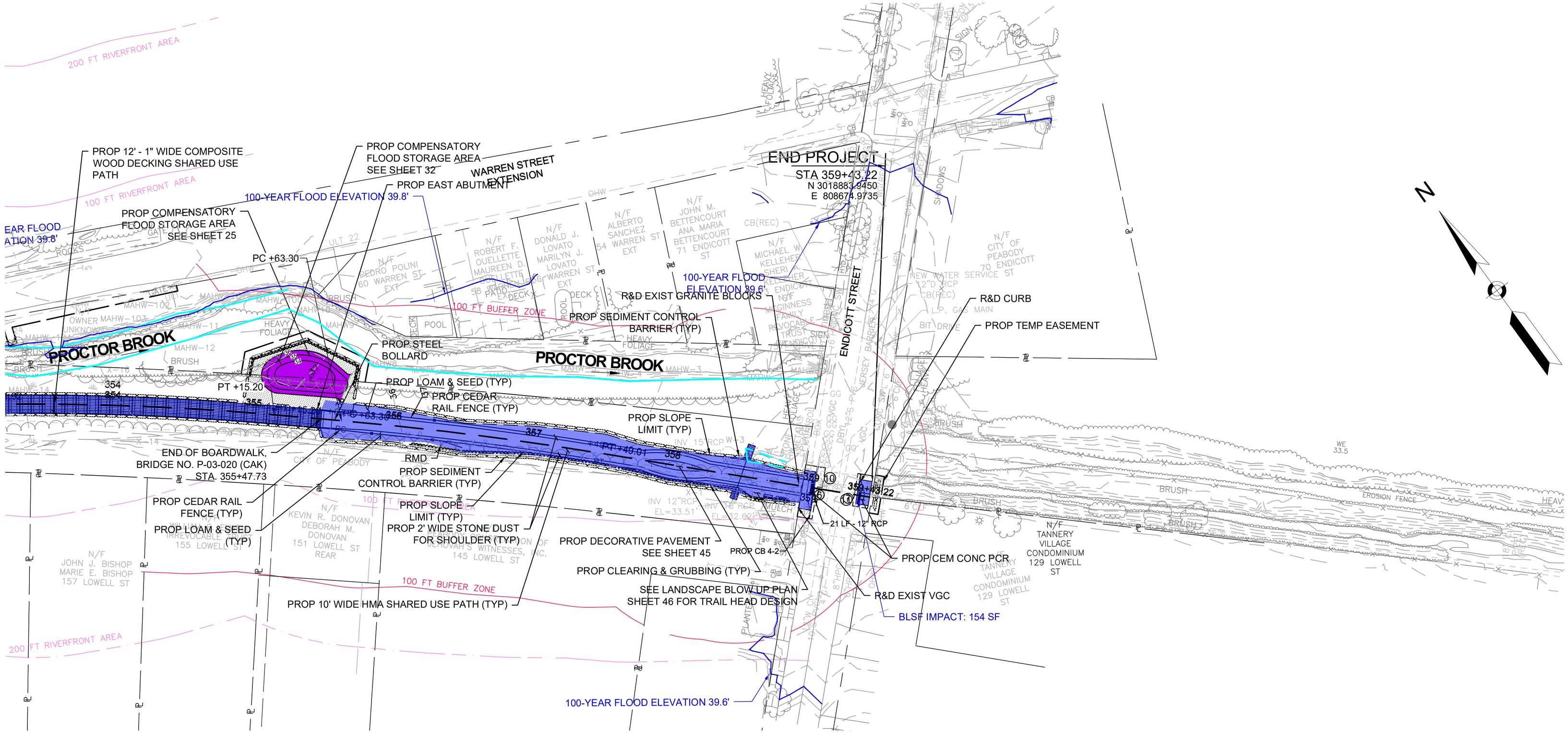
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7G

Proposal No. 609211-132091

A00860 - 151



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- SEDIMENT CONTROL BARRIER
- 100 PROPOSED CONTOUR
- 100 EXISTING CONTOUR
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPENSATORY FLOOD STORAGE AREA
- BLSF IMPACT AREA

STA 352+50 TO STA 358+50 FLOODPLAIN ELEVATION: 39.8'	
ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)
34-35	301
35-36	-159
36-37	2,197
37-38	2,007
38-39	1,292
39-39.8	2,731
TOTAL:	8,369

COMPENSATORY FLOOD STORAGE AREA STA 355+00 TO STA 355+50 FLOODPLAIN ELEVATION: 39.8'	
ELEVATION	INCREMENTAL NET CUT VOLUME (CF)
34-35	-921
35-36	-1,400
36-37	-1,151
TOTAL:	-3,472

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED:
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7H

APPENDIX D – WILDLIFE HABITAT EVALUATION

January 30, 2023

To:	Danielle Spicer, P.E.
Cc:	Oxana Fartushnaya
From:	Brandon Faneuf, PWS
Date:	January 30, 2023
Project Name:	Independence Greenway Extension, Peabody, MA
Project Number:	Green No. 17118.0234
Subject:	Wildlife Habitat Evaluation

Introduction

This memo analyzes areas where physical impacts to wetland resource areas under the Wetlands Protection Act (M.G.L. c.131, §40) and Regulations (310 CMR 10.00) for the above-referenced project (Project).

Area of Interest (AOI)

The area between Yankee Division Highway and Endicott St., along Proctor Brook as referenced above, was analyzed for potential adverse impacts to wildlife habitat on November 2, 2022.

The area of the AOI is heavily disturbed with a variety of developments and infrastructure. Along Proctor Brook, there is a historic railroad that is now decommissioned (i.e. the proposed Independence Greenway bike path). Left in its place is fill and grading that has affected the flow of the river and its floodplain. On either side of Proctor Brook there are housing developments including condominiums and single-family dwellings. Yankee Division Highway runs directly through the AOI in the western part. As a result of the historic disturbance, there is very little natural area left in the AOI and invasive, non-native plant species dominate much of the area.

Appendix A Wildlife Habitat Evaluation

Attached to this memo is a wildlife habitat evaluation (WHE) that outlines potential “Important Habitat Features” within the AOI.

Impacts

Table 1. Impacts to Wetland Resource Areas

Resource Area	Cumulative Impact	Regulatory Threshold to require WHE	Regulatory Citation (310 CMR 10.00)
Bordering Vegetated Wetland (BVW) (all BVW is presumed significant for wildlife habitat)	Perm: 2,225 SF Temp: 4,641 SF	No threshold	10.55(4)(b) (preface to Wetlands Regulations relative to protection of wildlife habitat- 1987 Regulatory Revisions- Section IV)
Land Under Waterbodies and Waterways (LUW) (all land under water is presumed significant for wildlife habitat)	Perm: 10,343 SF Temp: 2,082 SF	10% of the land in this resource area on a single lot or **5,000sf (whichever is less)**[1]	10.56(4)(a)(4)
Bank (all banks are presumed significant for wildlife habitat)	Perm: 618 SF Temp: 201 SF	10% of the length of bank on a single lot or **50 linear feet (whichever is less)**[1]	10.54(4)(a)(5)
Riverfront Area (RFA)	103,288 SF	No threshold, however, different review requirements apply depending on whether the Riverfront is undisturbed (310 CMR 10.58(4)) (and the size of impact), **previously developed (310 CMR 10.58(5))**[1] or if the activity is grandfathered or exempted from requirements for the Riverfront Area (310 CMR 10.58(6)).	10.58(4)(b), (4)(d)1.c, (4)(d)2.c, (4)(d)3.b
Bordering Land Subject to Flooding (BLSF)	69,340 SF	10% of the land in this resource area on a single lot or **5,000sf (whichever is less)**[1]	10.57(4)(a)(3)

[1] Bold wording indicates the applicable standard for this project/AOI.

Analysis

Resource Area impacts are spread throughout the AOI. However, the nature of the habitat within the AOI is fairly uniform (heavily disturbed and dominated by invasive species). Therefore, individual impact areas are not treated separately for this exercise.

BVW – Approximately 2,225 square feet of permanent impacts and 4,641 square feet of temporary disturbance to BVW are proposed. All BVW in the AOI is impacted by invasive and/or noxious species including, but not limited to Phragmites (*Phragmites australis*), invasive honeysuckles (*Lonicera spp.*), glossy buckthorn (*Frangula alnus*), poison ivy (*Toxicodendron radicans*), Japanese knotweed (*Polygonum cuspidatum*), and Asian bittersweet (*Celastrus orbiculatus*). There are also no *Important Habitat Features* within or around the portions of BVW to be impacted.

LUW – Approximately 10,343 square feet of permanent impacts and 2,082 square feet of temporary disturbance to Land Under Waterbodies and Waterways are proposed. This is above the 5,000 SF threshold found in 10.56(4)(a)(4). Regardless, LUW occurs below the mean annual high-water mark (MAHW flags) along Proctor Brook. As such, we have determined that open water areas along the brook *may* be important habitat for winter waterfowl. Further, there may be plunge pools significant to fisheries. However, any plunge pools within the AOI are caused by the gross neglect of culvert pipes. That is, the pipes are no longer functional and water discharging from them tend to be at incorrect heights relative to the stream below, causing erosion and (therefore) plunge pools. However, we do not believe that an Appendix B WHE is required for this project since the proposed work is not expected to reduce the capacity of the resource areas to provide food, shelter, or overwintering habitat to wildlife per 310 CMR 10.60(2)(b).

Notwithstanding the requirements of 310 CMR 10.56(4)(a)4., the impact on Land under Water Bodies and Waterways caused by the installation of a stream crossing is exempt from the requirement to perform a habitat evaluation in accordance with the procedures established under 310 CMR 10.60.

Bank – Approximately 618 linear feet of permanent impacts and 201 linear feet of temporary of disturbance to Bank are proposed. This is greater than the 50 LF threshold for non-single lot projects requiring a WHE. We do not believe, however, that an Appendix B WHE is required for this project because there are no Important Habitat Features found on or even around the areas of Bank proposed for alteration. Further, the proposed work is not expected to reduce the capacity of the resource areas to provide food, shelter, or overwintering habitat to wildlife per 310 CMR 10.60(2)(b).

Notwithstanding the requirement of 310 CMR 10.54(4)(a)5., the impact on bank caused by the installation of a stream crossing is exempt from the requirement to perform a habitat evaluation in accordance with the procedures contained in 310 CMR 10.60.

Riverfront Area – Approximately 103,288 square feet of disturbance to degraded Riverfront Area is proposed, per 310 CMR 10.58(5). No Important Habitat Features are located within the RFA, which includes the vast majority of the project area/AOI. With the dominance of invasive and/or noxious

plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings, the proposed work will only result in a net improvement to wildlife habitat.

BLSF – Approximately 69,340 square feet of disturbance to BLSF is proposed. This is above the 5,000 SF threshold found in 10.56(4)(a)(3). However, no Important Habitat Features are located within the BLSF area, which includes a large portion of the project area. With the dominance of invasive and/or noxious plant species within the project area, the fact that the site is an abandoned railroad bed that has been in disrepair for decades, with substandard stream crossings, the proposed work will only result in a net improvement to wildlife habitat across the project.

Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions. Except for work which would adversely affect vernal pool habitat, a project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Alterations beyond the above threshold, or altering vernal pool habitat, may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60. As discussed previously, the proposed work is not anticipated to have any adverse effects on wildlife habitat.

Conclusion

Although significant disturbance is proposed in several wetland resource area types, we do not believe that an Appendix B WHE is required for this project because there are no Important Habitat Features found on or even around the Bank, BLSF, and Riverfront areas proposed for alteration. The areas that are currently dominated by invasive and/or noxious species are expected to result in a net improvement to wildlife habitat and their overall capacities to provide food, shelter, or overwintering habitat to wildlife per 310 CMR 10.60(2)(b). While there are open water areas along the brook, which may have Important Habitat Features for winter waterfowl as well as plunge pools significant for fisheries, the disturbance to wildlife habitat required to replace the stream crossings is temporary and the natural streambed will be reestablished and the LUW area will be restored upon completion of construction.

In compliance with 310 CMR 10.60(1), we do not anticipate any long-term adverse effects on wildlife habitat following two growing seasons of project completion and thereafter. In accordance with 310 CMR 10.60(3)(e), the project does not alter ten or more acres of Land Subject to Flooding or Land under Water found to be significant to the protection of wildlife habitat, or 2,000 feet or more of Bank found to be significant to the protection of wildlife habitat.

Overall, although significant disturbance is proposed as a result of this project, the existing condition of the project area is such that we believe that not only will there be no adverse impacts to wildlife habitat, but that the proposed project, as designed, will result in a net improvement to wildlife habitat.

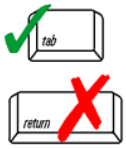
Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands program

Wildlife Habitat Protection Guidance

Appendix A: Simplified Wildlife Habitat Evaluation

Project Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Independence Greenway Extension, Peabody
Project Location (from NOI)

Brandon B. Faneuf, CWB
Name of Person Completing Form

01/30/2023
Date

Important Habitat Features

Direct alterations to the following important habitat features in resource areas may be permitted only if they will have no adverse effect (refer to Section V).

- ☐ Habitat for state-listed animal species (receipt of a positive opinion or permit from MNHESP shall be presumed to be correct. Do not refer to Section V).
- ☐ Sphagnum hummocks and pools suitable to serve as nesting habitat for four-toed salamanders
- ☐ Trees with large cavities (≥18" tree diameter at cavity entrance)
- ☐ Existing beaver, mink or otter dens
- ☐ Areas within 100 feet of existing beaver, mink or otter dens (if significant disturbance)
- ☐ Existing nest trees for birds that traditionally reuse nests (bald eagle, osprey, great blue heron)
- ☐ Land containing freshwater mussel beds
- ☒ Wetlands and waterbodies known to contain open water in winter with the capacity to serve as waterfowl winter habitat
- ☐ Turtle nesting areas
- ☐ Vertical sandy banks (bank swallows, rough-winged swallows or kingfishers)

The following habitat characteristics when not commonly encountered in the surrounding area:

- ☐ Stream bed riffle zones (e.g. in eastern MA)
- ☐ Springs
- ☐ Gravel stream bottoms (trout and salmon nesting substrate)
- ☒ Plunge pools (deep holes) in rivers or streams
- ☐ Medium to large, flat rock substrates in streams

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wetlands program

Wildlife Habitat Protection Guidance

Appendix A: Simplified Wildlife Habitat Evaluation

Activities

When any one of the following activities is proposed within resource areas, applicants should complete a Detailed Wildlife Habitat Evaluation (refer to Appendix B).

- ☐ Activities located in mapped "Habitat of Potential Regional or Statewide Importance"
- ☐ Activities affecting certified or documented vernal pool habitat, including habitat within 100' of a certified or documented vernal pool when within a resource area
- ☐ Activities in bank, land under water, bordering land subject to flooding (presumed significant) where alterations are more than twice the size of thresholds
- ☐ Activities affecting vegetated wetlands >5000 sq. ft. occurring in resource areas other than Bordering Vegetated Wetland
- ☐ Activities affecting the sole connector between habitats >50 acres in size
- ☐ Installation of structures that prevent animal movement
- ☐ Activities for the purpose of bank stabilization using hard structure solutions that significantly affect ability of stream channel to shift and meander, or disrupt continuity in cover that would inhibit animal passage
- ☐ Dredging (greater than 5,000 sf)

COMMENTS:

1. Proctor Brook is a perennial river. Unless it freezes in the winter, it will contain open water for waterfowl.
2. Natural plunge pools do not exist. Any plunge pool present is the result of gross neglect of existing culvert pipes over a period of decades.

APPENDIX E – ABUTTER INFORMATION

- Certified Abutters List
- Abutter Notification
- Affidavit of Service

NOTIFICATION TO ABUTTERS UNDER THE MASSACHUSETTS WETLANDS PROTECTION ACT AND/OR CHAPTER 32 THE CITY OF PEABODY'S LOCAL WETLANDS AND RIVERS PROTECTION ACT

In accordance with the second paragraph of Massachusetts General Laws, Chapter 131, Section 40 and/or Chapter 32 the City of Peabody's Local Wetlands and Rivers Protection Act, you are hereby notified of the following:

1. The name of the applicant is: The City of Peabody
2. The applicant has filed a Notice of Intent with the Conservation Commission.
3. The address of the proposed activity is: Former B & M Railroad Easement, Northshore Road, Essex Center Drive, Endicott Street
4. The proposed activity is: The project proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, MA for a total project length of approximately 1.3 miles.
5. Copies of the (CIRCLE ONE) **Notice of Intent/Request for Determination of Applicability/Abbreviated Notice of Intent/Abbreviated Notice Resource Area Delineation** may be **examined only** in the Community Development Department, Conservation Commission Office, City Hall, 24 Lowell St., Peabody, MA between the hours of 8:30 am to 4 p.m., Monday, Tuesday, Wednesday; 8:30 to 7 p.m. Thursday and 8:30 to 12:30 on Friday (with the exception of lunch). Email is also available and is the preferred form of request. Please make request to: lucia.delnegro@peabody-ma.gov
6. Copies of the **NOI/RDA/ANRAD/ANOI** may be obtained from the applicant by calling: 978-538-5780 or by emailing brendan.callahan@peabody-ma.gov
7. Information regarding the date and time of the public hearing may be obtained from the Commission Office at 978-538-5782.

NOTE: Notice of the public hearing including the date, time and place, will be published in the local paper, ex. (Weekly News, Lynn Item or Salem News) at least five (5) days in advance of the hearing.

NOTE: Notice of public hearing, including the date, time and place will be posted in City Hall by the Clerk's Office not less than forty-eight (48) hours in advance.

NOTE: You may contact your local Conservation Commission or the Department of Environmental Protection (DEP) for more information about this application of the Wetlands Protection Act. To contact DEP, call:

DEP Northeast Region: 978-694-3200

PROPOSED MEETING DATE: May 8, 2024
Location of meeting TBD: Via Zoom and start time is 7PM unless otherwise noted.

City of Peabody

Conservation Commission

City Hall • 24 Lowell Street • Peabody, Massachusetts 01960 • Tel. 978-538-5900

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act & Peabody's Local Ordinance Chapter 32-Wetlands and River Protection Regulations

I, Danielle Spicer, on behalf of the City of Peabody hereby certify under the pains
(Applicants/owner's name)

and penalties of perjury that on April 10, 2024 I gave notification to abutters in
(date)

compliance with the second paragraph of the Massachusetts General Laws, Chapter 131, Section 40, the DEP Guide to Abutter Notification and Peabody's Local Ordinance Chapter 32-Wetlands and Rivers Protection Regs. Article IV § 32-16 in connection with the following matter:

A(n) Notice of Intent application was filed under the Massachusetts Wetlands Protection Act and the City of Peabody Wetlands & Rivers Protection Ordinance by

the City of Peabody with the Peabody Conservation Commission on
name

April 10, 2024 for a property located at
date

Former B & M Railroad Easement, Northshore Road, Essex Center Drive, Endicott Street.
Property location

The form of notification and the list of abutters to whom it was given and their addresses are attached to this Affidavit of Service.

Danielle Spicer Signature

4/9/2024 Date

Revised LMD 7/16/2009

City of Peabody
CERTIFICATION OF ABUTTERS

RECEIVED
APR 03 2024
By

DATE: 4/3/24

PROPERTY OWNER: City of Peabody

PROPERTY LOCATION: Essex Center Drive to Endicott St, Peabody, MA MAP: _____ LOT: _____

REQUESTED BY: Green International Affiliates PHONE: 978-843-5225

email: JKeel@greenintl.com

_____ **Chapter 138, Section 15A** – direct abutters & churches, synagogues, hospitals, & schools within 500'

_____ **Chapter 40A, Section 11** – abutter to abutter within 300'

Special Permit _____ **Variance** _____ **Entertainment License** _____ **Site Plan Review** _____

_____ **Chapter 41, Section 81T** – Notice of Submission of Plan – direct abutters

__X__ **Chapter 32, City of Peabody Code** – Wetlands & Rivers Protection Regulations – abutter to abutter within 300'

__X__ **Chapter 131, Section 40** – Notice of Intent – all abutters within 100'

_____ **700 CMR 3.06**, State Permits for billboard signs – Notification within 500'

Please allow up to 5 business days for the completion of your request.

Project Location: The project will consist of modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared-use path; construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street; construction of a light duty timber boardwalk structure supported on helical piles; and various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements. Please see the attached locus map.

See Attached

BOARD OF ASSESSORS
CITY OF PEABODY

CERTIFIED 4/5/24

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
062-017	LAHEY CLINIC FOUNDATION INC		41 MALL RD	BURLINGTON, MA 01803
051-001	J C PENNEY PROPERTIES INC		6501 LEGACY DR	PLANO, TX 75024
051-008	MALL AT NORTHSHORE LLC		PO BOX 6120	INDIANAPOLIS, IN 46206
062-005	EVANGELIDIS KOSMA L & ZOE		309 LOWELL ST	PEABODY, MA 01960
062-006	COSTA BOB F & TONIA		305 LOWELL ST	PEABODY, MA 01960
062-007	GOULOS JOHN L & VALERIE A		299 LOWELL ST	PEABODY, MA 01960
062-008	VENTURA GUSTAVO &	GUZMAN ERIDANIA VICIOSO	301 LOWELL ST	PEABODY, MA 01960
062-009	GOULOS JOHN L & VALERIE A		299 LOWELL ST	PEABODY, MA 01960
062-017B	MALL AT NORTHSHORE LLC	C/O NO SHORE ORTHOPEDICS RLTY LLC	1 ORTHOPEDICS DR	PEABODY, MA 01960
062-018	ATRIUS MSO LLC		275 GROVE ST	NEWTON, MA 02446
062-018A	U S POSTAL SERVICE		4 ESSEX CENTER DR	PEABODY, MA 01960
062-033	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-034	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-036	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-038	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-047	CORREA SEBASTIAO A & CREUZA M		41 CASTLE CIR	PEABODY, MA 01960
062-048	YASSIN HUSAIN & SABRAH ZAINAB		43 CASTLE CIR	PEABODY, MA 01960
062-049	SMITH SUSAN F & ERIC W		45 CASTLE CIR	PEABODY, MA 01960
062-050	GIUNTA PHILIP		47 CASTLE CIR	PEABODY, MA 01960
062-051	LESSARD RONALD J & LISA M		49 CASTLE CIR	PEABODY, MA 01960
062-052	OLDYTOWSKI STANLEY J		51 CASTLE CIR	PEABODY, MA 01960
062-053	VESS JACK & JO ANN P		53 CASTLE CIR	PEABODY, MA 01960
062-054	ZARRO SALVATORE G & MARY ELLEN		55 CASTLE CIR	PEABODY, MA 01960
062-055	LATACZ MARK & MALGORZATA TRS	KML FAMILY TRUST	57 CASTLE CIR	PEABODY, MA 01960
062-056	BUCKLEY KEVIN J & DIANE K		59 CASTLE CIR	PEABODY, MA 01960
062-057	KOLA ALEKSANDER & IRENA		61 CASTLE CIR	PEABODY, MA 01960
062-058	DUGAN DAVID T & ANDREA		63 CASTLE CIR	PEABODY, MA 01960
062-059	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-072	SILVA LUDGERO A & MARIA B		22 CASTLE CIR	PEABODY, MA 01960
062-073	MEMMOLO SHAUNA		20 CASTLE CIR	PEABODY, MA 01960
062-074	CAMPBELL JOYCE A & JASON		18 CASTLE CIR	PEABODY, MA 01960
062-075	MCKINNEY C L & J G TRS/LIFE ESTATE	CL MCKINNEY FAM & JG MCKINNEY FAM TRS	16 CASTLE CIR	PEABODY, MA 01960
062-500	KAVJIAN DONNA M TRUSTEE	DONNA M KAVJIAN REVOC TRUST	9 SNOWY OWL LN	MARSHFIELD, MA 02050
062-501	INNIS WARREN A TRUSTEE	A & W REALTY TRUST II	8 GOODRIDGE ST	PEABODY, MA 01960
062-502	ROHNKE MATTHEW KARL		500 NO SHORE RD - UNIT 3A	PEABODY, MA 01960
062-503	ATHAS KENNETH A		500 NO SHORE RD - APT 4A	PEABODY, MA 01960
062-504	THRASIVOULOS JOHN &	KETTINGER ROXANA	500 NO SHORE RD - UN 5A	PEABODY, MA 01960
062-505	INNIS WARREN A & ALDYTH M TRS	CHATEAU ROYALE #6A TRUST	3 LONGSPUR RD	IPSWICH, MA 01938
062-506	DARCY JR CORNELIUS J &	SWEENEY-DARCY DIANE J CO-TRS	500 NO SHORE RD UNIT 7A	PEABODY, MA 01960
062-507	DESPRES EUGENE D &	DUNN VIRLEIA M	500 NORTH SHORE RD - UNIT 8A	PEABODY, MA 01960
062-508	MANUEL THOMAS F & KAREN A		500 NO SHORE RD UNIT 9A	PEABODY, MA 01960
062-509	MACHADO MARIA E LF EST	KANELLOS SANDRA MACHADO	91 MAPLEWOOD RD	LYNN, MA 01904
062-510	MCGONNELL RICHARD P & DIANA		500 NO SHORE RD UNIT 11A	PEABODY, MA 01960
062-511	BORDONARO JOSEPH		500 NO SHORE RD - UNIT 12A	PEABODY, MA 01960
062-512	OSTROWSKI RAYMOND E TR	RAYMOND E OSTROWSKI REVOC TR	17 LEDGEWOOD DR	DANVERS, MA 01923
062-513	VISCONTE LOUISE J M LIFE ESTATE	DREW JOANNE R	500 NO SHORE RD UNIT 2B	PEABODY, MA 01960
062-514	MCGUIRE JEREMY		500 NO SHORE RD - UNIT 3B	PEABODY, MA 01960
062-515	BROOKS COREY J		500 NO SHORE RD UNIT 4B	PEABODY, MA 01960
062-516	STOWELL AMY		500 NO SHORE RD - UNIT 5B	PEABODY, MA 01960
062-517	OLSON DIANNE M		500 NO SHORE RD - UNIT 6B	PEABODY, MA 01960
062-518	ARCHIBALD DANIEL A & CARLA M TRS	ARCHIBALD FAMILY TRUST OF 2021	6 PROCTOR CIR	PEABODY, MA 01960
062-519	PATTEN NANCY M TRUSTEE	THE NANCY M PATTEN REVOCABLE TRUST	500 NO SHORE RD - UNIT 8B	PEABODY, MA 01960

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
062-520	LINEHAN BRIAN		500 NO SHORE RD - UNIT 9B	PEABODY, MA 01960
062-521	DASILVA ELIZABETH		500 NO SHORE RD - UNIT 10B	PEABODY, MA 01960
062-522	STENSON DAVID K		500 NO SHORE RD UNIT 11B	PEABODY, MA 01960
062-523	ALSAYEDALI ANAS		500 NO SHORE RD - UNIT 12B	PEABODY, MA 01960
062-524	BARRETO YVONNE M TRUSTEE	YVONNE M BARETTO TRUST	15 CROWN WAY	MARBLEHEAD, MA 01945
062-525	MACHADO MARIA LF EST	KANELLOS SANDRA MARCHADO	91 MAPLEWOOD RD	LYNN, MA 01904
062-526	BARRETO JOHN S V TRUSTEE	UN 1C NO SHORE RD PBDY RLTY TRUST	15 CROWN WAY	MARBLEHEAD, MA 01945
062-527	BORGES SALVIO & IVANETE		500 NO SHORE RD - UNIT 2C	PEABODY, MA 01960
062-528	PANTANO ANGELINA		500 NO SHORE RD UNIT 3C	PEABODY, MA 01960
062-529	D'ENTREMONT ROLAND R		500 NO SHORE RD UNIT 4C	PEABODY, MA 01960
062-530	DE LOS SANTOS EURYES		500 NO SHORE RD - UNIT 5C	PEABODY, MA 01960
062-531	KETTINGER DARLYN		500 NORTH SHORE RD - UNIT 6-C	PEABODY, MA 01960
062-532	RIVERA SAULO M TERRERO		500 NO SHORE RD - UNIT 7C	PEABODY, MA 01960
062-533	THRASIVOULOS JOHN & ROXANA		500 NO SHORE ROAD- UNIT 8C	PEABODY, MA 01960
062-534	WENG YUJIA & ZHENG YUANMING		1 PARTRIDGEBERRY LN	SOUTH HAMILTON, MA 01982
062-535	DONAHUE ELIZABETH A TRUSTEE	ELIZABETH A DONAHUE TRUST	500 NO SHORE RD - UNIT 10C	PEABODY, MA 01960
062-536	RICCIARDI MELINA		3 GEMMA DR	PEABODY, MA 01960
062-537	KIERE GEORGE		500 NO SHORE RD UNIT 12C	PEABODY, MA 01960
062-538	CAMPBELL JONATHAN		500 NO SHORE RD - UNIT 13C	PEABODY, MA 01960
062-539	INNIS ALVAN A & GRACE M TRS	CHATEAU ROYALE #14C TRUST	8 GOODRIDGE ST	PEABODY, MA 01960
062-700	MATTIVELLO CAMILLE P LF EST	MANZO CAMILLE M	7 KARELITZ RD - UNIT A	PEABODY, MA 01960
062-701	GITTER TAMMY R		7 KARELITZ RD - UNIT B	PEABODY, MA 01960
062-800	BUNNELL PATRICK		6 KARELITZ RD - UNIT A	PEABODY, MA 01960
062-801	SYLVESTER JOANNE M LF EST	SYLVESTER JULIE M	6 KARELITZ RD - UNIT B	PEABODY, MA 01960
063-095	CITY OF PEABODY	MUNICIPAL LIGHT PLANT	201 WARREN ST EXT	PEABODY, MA 01960
063-096A	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
063-162X	BANDICOOT LLC	C/O BRICKPOINT PROPERTIES INC	2 MAIN ST - SUITE 310	STONEHAM, MA 02180
063-164	CITY OF PEABODY	OLD ELECTRIC POWER PLANT	201 WARREN ST EXT	PEABODY, MA 01960
063-166	MANIERI WANDA		16 JENNIFER LN	PEABODY, MA 01960
063-167	LEONE CHRISTOPHER & MARIA		18 JENNIFER LN	PEABODY, MA 01960
063-168	SKORY STEVEN A & LORI T		20 JENNIFER LN	PEABODY, MA 01960
063-169	CARTER JR ROBERT T & CINDY TRS	CARTER LIVING TRUST	22 JENNIFER LN	PEABODY, MA 01960
073-207	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
074-004	MERCER MARK A & JEFFREY W		193 LOWELL ST	PEABODY, MA 01960
074-006A	ARSENAULT EDWARD J & GEORGIA E TRS	185 LOWELL STREET REALTY TRUST	185 LOWELL ST	PEABODY, MA 01960
074-007	BOSTON COMMUNITY PROPERTIES LLC		231 EAST MAIN ST	WESTBOROUGH, MA 01581
074-009	CASHIN ROSA A		179 LOWELL ST	PEABODY, MA 01960
074-010	DELOSA RYAN S & MOLLY E		175 LOWELL ST	PEABODY, MA 01960
074-011	ELWELL WILLIAM A & ANN L		173 LOWELL ST	PEABODY, MA 01960
074-012	BUCHANAN JENNIFER L		171 LOWELL ST	PEABODY, MA 01960
074-013	GRENHAM KAREN M & ROBERT H JR		169 LOWELL ST	PEABODY, MA 01960
074-014	CRISOSTOMO ESCARLYN M		163 LOWELL ST	PEABODY, MA 01960
074-015	SPYROPOULOS STELLA LF EST	BERUBE JOYCE Z	161 LOWELL ST	PEABODY, MA 01960
074-016	JOUNI RABEA & SOUHAIL		159 LOWELL ST	PEABODY, MA 01960
074-017	BISHOP JOHN J & MARIE E		157 LOWELL ST	PEABODY, MA 01960
074-018	ELWELL W A & DONOVAN D M &	KARAZURNA K A TRUSTEES	155 LOWELL ST	PEABODY, MA 01960
074-019	NUNZIATO JOHN		151 LOWELL ST	PEABODY, MA 01960
074-020	DONOVAN KEVIN R & DEBORAH M		151 LOWELL ST (R)	PEABODY, MA 01960
074-021C	PEPIN MARK R		147 LOWELL ST	PEABODY, MA 01960
074-021X	VULAJ VAT		143 LOWELL ST	PEABODY, MA 01960
074-023	AMPET INC		164 DAYTON ST	DANVERS, MA 01923
074-024	CARRION JUAN		P O. BOX 294	MARBLEHEAD, MA 01945

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
074-025	CIKO NIKOLLA & MARIKA		87 ENDICOTT ST	PEABODY, MA 01960
074-025A	DUTRA JOSSANIA		81 ENDICOTT ST	PEABODY, MA 01960
074-025C	KHATRI POOJA		83 ENDICOTT ST	PEABODY, MA 01960
074-026	MCGINNESS ROBERT M & LORI E TRS	MCGINNESS FAMILY REVOCABLE TR	75 ENDICOTT ST	PEABODY, MA 01960
074-027	KELLEHER MICHAEL W & SHERI A		73 ENDICOTT ST	PEABODY, MA 01960
074-028	BETTENCOURT JOHN M &	BETTENCOURT ANA MARIA A TRS	71 ENDICOTT ST	PEABODY, MA 01960
074-029	SANCHEZ ALBERTO		54 WARREN ST EXT	PEABODY, MA 01960
074-030	LOVATO DONALD J & MARILYN J		56 WARREN ST EXT	PEABODY, MA 01960
074-030A	OUELLETTE ROBERT F & MAUREEN D		58 WARREN ST EXT	PEABODY, MA 01960
074-031	POLINI PEDRO		60 WARREN ST EXT	PEABODY, MA 01960
074-032	PILKONS WALTER T & DORTHEA L		159 BAHIA VIA	FORT MYERS BEACH, FL 33931
074-033	CANAS JOAQUIM C & MARIA O TRS	CANAS 2015 FAMILY TRUST	14 DANIEL TER	PEABODY, MA 01960
074-034	TEJADA JOHANNA		69 ENDICOTT ST	PEABODY, MA 01960
074-065	CITY OF PEABODY	SCHOOL ADMIN OFFICE	70 ENDICOTT ST	PEABODY, MA 01960
074-075B	LCM REALTY MANAGEMENT LLC		PO BOX 433	DANVERS, MA 01923
074-075C	SPENCER III GERALD D & JEFFREY V		78 ENDICOTT ST	PEABODY, MA 01960
074-265	WHEATON JR CHARLES E		13 JENNIFER LN	PEABODY, MA 01960
074-267	ARSENAULT EDWARD J JR & JEANNE		187R LOWELL ST	PEABODY, MA 01960
074-268	MOTTA MICHAEL L & TINA M		24 JENNIFER LN	PEABODY, MA 01960
074-269	NAVARRO JESSICA M & ANDREW F		26 JENNIFER LN	PEABODY, MA 01960
074-270	HAJRO TAULANT & INA		28 JENNIFER LN	PEABODY, MA 01960
074-277	SAINI BALBIR		15 JENNIFER LN	PEABODY, MA 01960
074-278X	PEABODY CONGREGATION OF	JEHOVAH'S WITNESSES INC	79 ENDICOTT ST	PEABODY, MA 01960
074-283	PEABODY CROSSING LLC		9 ATLANTIC AVE	MARBLEHEAD, MA 01945
074-502	ECK THOMAS J & WALLINS VICTORIA J		P.O. BOX 217	ROCKPORT, MA 01966
074-503	DELANEY DENISE A		129 LOWELL ST - UNIT 2	PEABODY, MA 01960
074-504	NGUYEN JOHN V & TRAM PHOEBE T		129 LOWELL ST - UNIT 3	PEABODY, MA 01960
074-505	KOVIL NICOLE FRANCES		49 BELLINGTON AVE	REVERE, MA 02151
074-506	KWONG JOHN C & DEBORAH M		129 LOWELL ST - UNIT 5	PEABODY, MA 01960
074-507	RAZA REBWAR & ASHNA		129 LOWELL ST - UNIT 6B	PEABODY, MA 01960
074-508	JONES JR WILLIAM & JACLYN		129 LOWELL ST - UNIT 7	PEABODY, MA 01960
074-509	CLIFFORD LAWRENCE & SHEILA		129 LOWELL ST - UNIT 8	PEABODY, MA 01960
074-510	BEALE ANDREW		129 LOWELL ST - UNIT 9	PEABODY, MA 01960
074-511	HAM DEBORAH		129 LOWELL ST - UNIT 10	PEABODY, MA 01960
074-512	CARON BRUCE R & GAIL E		129 LOWELL ST - UNIT 11	PEABODY, MA 01960
074-513	MARC AMINADA		129 LOWELL ST - UNIT 12	PEABODY, MA 01960
074-514	O'CONNELL CAROLYN TRUSTEE	CAROLYN O'CONNELL REVOCABLE TR	129 LOWELL ST - UNIT 13	PEABODY, MA 01960
074-515	DOYLE CHARLES L &	MAHONEY-DOYLE ANNE M	129 LOWELL ST UNIT 14	PEABODY, MA 01960
074-516	DALLAIRE STEPHANIE		129 LOWELL ST - UNIT 15	PEABODY, MA 01960
074-517	GANGI SUSAN		129 LOWELL ST UNIT 16	PEABODY, MA 01960
074-518	OCAMPO PATRICIA M		129 LOWELL ST - UNIT 17	PEABODY, MA 01960
074-519	LAMOUREUX MATTHEW M		129 LOWELL ST - UNIT 18	PEABODY, MA 01960
074-520	GUARINO JAMES & ANDREA M		129 LOWELL ST - UNIT 19	PEABODY, MA 01960
074-521	MARRS DAVID P		129 LOWELL ST - UNIT 20	PEABODY, MA 01960
074-522	GILDEA MICHAEL C & LIU YEWEI		129 LOWELL ST - UNIT 21	PEABODY, MA 01960
074-523	BISEGNA BONITA A		129 LOWELL ST - UNIT 22	PEABODY, MA 01960
074-524	HANSON RHEA		129 LOWELL ST - UNIT 23	PEABODY, MA 01960
074-525	BRUCE RICHARD P		129 LOWELL ST - UNIT 24	PEABODY, MA 01960
074-526	WEED PATRICIA A		129 LOWELL ST UN 25	PEABODY, MA 01960
074-527	ARMSTRONG RICHARD		129 LOWELL ST UNIT 26	PEABODY, MA 01960
074-528	MULLEN ERIN N		129 LOWELL ST - UNIT 27	PEABODY, MA 01960
074-529	DOE VIRGINIA MARIE		129 LOWELL ST #28	PEABODY, MA 01960

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
074-530	CORBETT STEVEN M		129 LOWELL ST - UNIT 29	PEABODY, MA 01960
074-531	LISA ROAD LLC		5 LISA RD	PEABODY, MA 01960
074-532	SILVA GORETI		129 LOWELL ST-UN31	PEABODY, MA 01960
074-533	MACKENZIE AMANDA JOY		129 LOWELL ST - UNIT 32	PEABODY, MA 01960
074-534	MCKEEN DOROTHY J		129 LOWELL ST - UNIT 33	PEABODY, MA 01960
074-535	CHONG DIANA G		129 LOWELL ST - UNIT 34	PEABODY, MA 01960
074-536	DOMBROWSKI DAVID J		129 LOWELL ST - UNIT 35	PEABODY, MA 01960
074-537	KISCHEL MICHAEL & ALYSSA T C		129 LOWELL ST - UNIT 36	PEABODY, MA 01960
074-538	HAN HYUNGSOON		129 LOWELL ST - UNIT 37	PEABODY, MA 01960
074-539	SHULMAN STEPHEN & MEGAN		129 LOWELL ST - UNIT 38	PEABODY, MA 01960
074-540	BRENNAN LISA M TRUSTEE	THE LISA M BRENNAN REALTY TRUST	129 LOWELL ST - UNIT 39	PEABODY, MA 01960
074-541	PATEL MARGI		129 LOWELL ST - UNIT 40	PEABODY, MA 01960
074-542	OGRABISZ GAYLE		129 LOWELL ST UNIT 41	PEABODY, MA 01960
074-543	HYLAND MICHAEL		129 LOWELL ST - UNIT 42	PEABODY, MA 01960
074-544	BOGGOCH EDWARD J		129 LOWELL ST - UNIT 43	PEABODY, MA 01960
074-545	WENDT DANIEL R		129 LOWELL ST - UNIT 44	PEABODY, MA 01960
074-546	ATAIDE MARIA G		129 LOWELL ST - UNIT 45	PEABODY, MA 01960
074-547	SILVA FERNANDA M & ZELIO M		129 LOWELL ST - UNIT 46	PEABODY, MA 01960
074-548	MOREAU TRACY A		129 LOWELL ST - UNIT 47	PEABODY, MA 01960
074-549	MARTIN KATHLEEN D		129 LOWELL ST - UNIT 48	PEABODY, MA 01960
074-550	DUNNE MAUREEN A &	TSONIS DEMETRI G	129 LOWELL ST - UNIT 49	PEABODY, MA 01960
074-551	GALLAGHER SEAN P TRUSTEE	GALLAGHER FAMILY TRUST	129 LOWELL ST - UNIT 50	PEABODY, MA 01960
074-552	COYNE JEAN M		129 LOWELL ST - UNIT 51	PEABODY, MA 01960
074-553	BETTENCOURT B T & C M LIFE ESTATE	BETTENCOURT DAVID M	129 LOWELL ST - UNIT 52	PEABODY, MA 01960
074-554	GOMES ANA PAULA		129 LOWELL ST - UNIT 53	PEABODY, MA 01960
074-555	MUSE DONNA L		129 LOWELL ST - UNIT 54	PEABODY, MA 01960
074-556	KYMINAS DANA		129 LOWELL ST - UNIT 55	PEABODY, MA 01960
074-725	DAVIS EDWARD & GIA L		354 LOWELL ST	PEABODY, MA 01960
074-726	MARC-AURELE ALEXANDER J &	RICE LINDSAY G	30 JENNIFER LN - UNIT B	PEABODY, MA 01960
085-221	CITY OF PEABODY	CITY HALL	24 LOWELL ST	PEABODY, MA 01960

Teresa Read
Lesley George
Susan E. Ambrillos

4/5/24

APPENDIX F – STORMWATER MANAGEMENT REPORT (BOUND SEPARATELY)

Stormwater Management Report

Independence Greenway Extension

Peabody, MA

Prepared for

10 Park Plaza
Boston, MA 02116

Prepared by Green International Affiliates, Inc.
Water Resources/Permitting Group
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876
(978) 923-0400

Date: March 12, 2024

Table of Contents

Introduction 1
Project Summary 2
Project Description 2
Existing Conditions 7
Proposed Conditions 15
Impaired Waters and TMDLs 21
Stormwater Management Standards 22
Standard 1: No New Untreated Discharges 22
Standard 2: Peak Rate/Flood Control 23
Standard 3: Recharge 25
Standard 4: Water Quality Treatment 27
Standard 5: Land Uses with Higher Potential Pollutant Loads 30
Standard 6: Critical Areas 31
Standard 7: Redevelopment 32
Standard 8: Erosion and Sediment Control 33
Stabilization Activities 34
Standard 9: O&M Plan 35
Standard 10: Illicit Discharges 36

List of Tables

Table 1: Existing Drainage Areas 9
Table 2: Existing SCMs 9
Table 3: Wetland Resource Areas 9
Table 4: Proposed Drainage Areas 18
Table 5: Proposed SCMs 18
Table 6: Impaired Waters and TMDL Information 21
Table 8: Peak Discharge Rates (cfs) 24
Table 9: Required Recharge Volume for Project 26
Table 10: Provided Recharge Volumes by Design Point 26
Table 11: Water Quality Treatment Required and Provided by Design Point 28

List of Figures

Figure 1: USGS Locus Figure 3
Figure 2: Aerial Figure 5
Figure 3: Protected Resource Area Map (Not Included in Stormwater Report)
Figure 4: FEMA Map (Not Included in Stormwater Report)
Figure 5: Soils Figure 11
Figure 6: Existsing Watershed Plans 13
Figure 7: Proposed Watershed Plans 21

List of Appendices

Appendix A: MassDEP Checklist for Stormwater Report
- Massachusetts Stormwater Report Checklist
- Redevelopment Checklist

Appendix B: Soils and FEMA Information
- NRCS Soil Survey Information
- On-Site Subsurface Investigations by GZA
- FEMA Flood Insurance Rate Map (FIRM)
- Flood Insurance Study (FIS)

Appendix C: Supporting Calculations
- Recharge Volume Calculations
- Water Quality Calculations
- TSS Removal Calculations
- Pretreatment Calculations
- HydroCAD Storage Table

Appendix D: Hydraulic and Hydrologic Data
- Existing Conditions HydroCAD Calculations
- Proposed Conditions HydroCAD Calculations
- Proctor Brook StreamStats
- Proctor Brook Culvert Hydraulic and Scour Analysis Summary Report

Appendix E: O&M Plan, LTPPP, and IDCS

Introduction

This Stormwater Management Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00). Appendix A includes a completed Massachusetts Department of Environmental Protection (MassDEP) Checklist for Stormwater Report, stamped by a professional engineer.

The project follows the guidance presented in the MassDOT Stormwater Handbook (the Handbook), and stormwater management systems are designed in accordance with MassDEP Standards.

Project Summary

Project Description

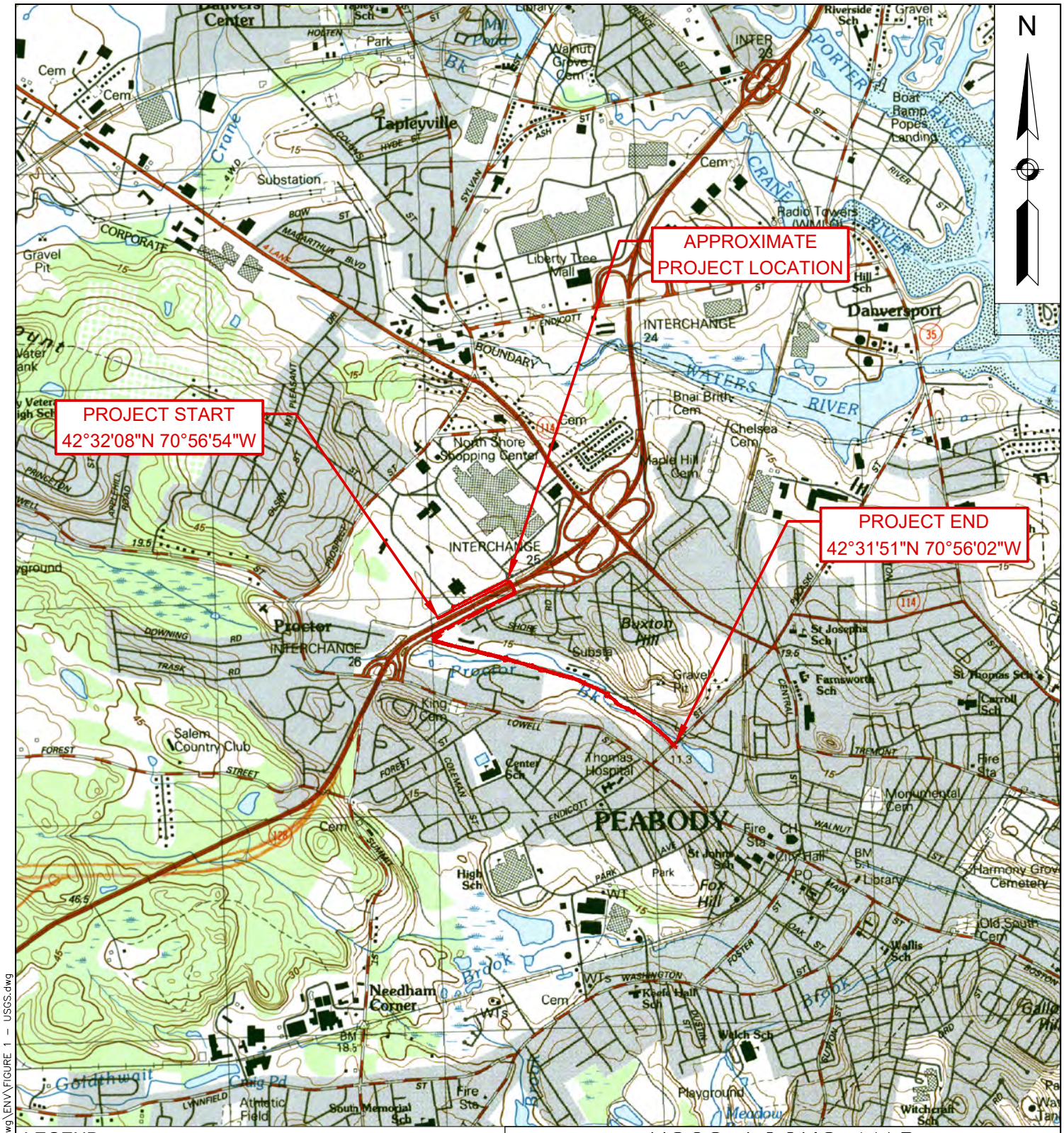
The Applicant, MassDOT, is proposing Project 609211 to construct the Independence Greenway extension in Peabody, MA. The project consists of an approximately 1.3-mile extension of the Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street. The Independence Greenway currently consists of two discontinuous segments separated by Interstate 95 and Route 1. The west section of the existing Independence Greenway runs 2.9 miles between Russell Street near the Ipswich River and Lt. Ross Park. It opened in 2008. The east section is 1.7 miles long and runs from Peabody Road at Proctor Brook and ends at the Northshore Mall near Lahey Medical Center. The trail was built on the route of the former Boston and Maine (B&M) Railroad right-of-way (ROW) north of Lowell Street. The existing Greenway is owned and maintained by the City of Peabody.

This project transforms the former railroad bed into a shared use pedestrian pathway. As the proposed project is a pathway for pedestrian and/or nonmotorized vehicle access, it is therefore categorized as a “Redevelopment Project” under the Massachusetts Stormwater Management Standards. The project is required to meet only Standards 2 & 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 & 6 to the maximum extent practicable.

This project provides an opportunity to improve the existing drainage system and improve the quality of stormwater runoff discharged to adjacent wetlands. This project will incorporate the installation of practical Stormwater Control Measures (SCMs). The goal of the proposed stormwater improvements is to improve the quality of discharged stormwater to the maximum extent that it is practical.

The following report was created in accordance with the “Massachusetts Stormwater Handbook” last revised in January 2008. The report is organized into sections that correspond to the categories listed in the “Massachusetts Stormwater Report Checklist”. The checklist is included in Appendix A of this report along with a “Redevelopment Checklist”. The following is a more detailed description of the existing and proposed drainage areas and the design methodology for this project.

See Figure 1 for the Project Locus Map and Figure 2 for the Aerial Map.



LEGEND:

APPROXIMATE LIMIT OF WORK

SCALE IN FEET

1000 0 1000 2000

ELEVATIONS IN METERS

NOTE: DATA TAKEN FROM MASSGIS

USGS LOCUS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

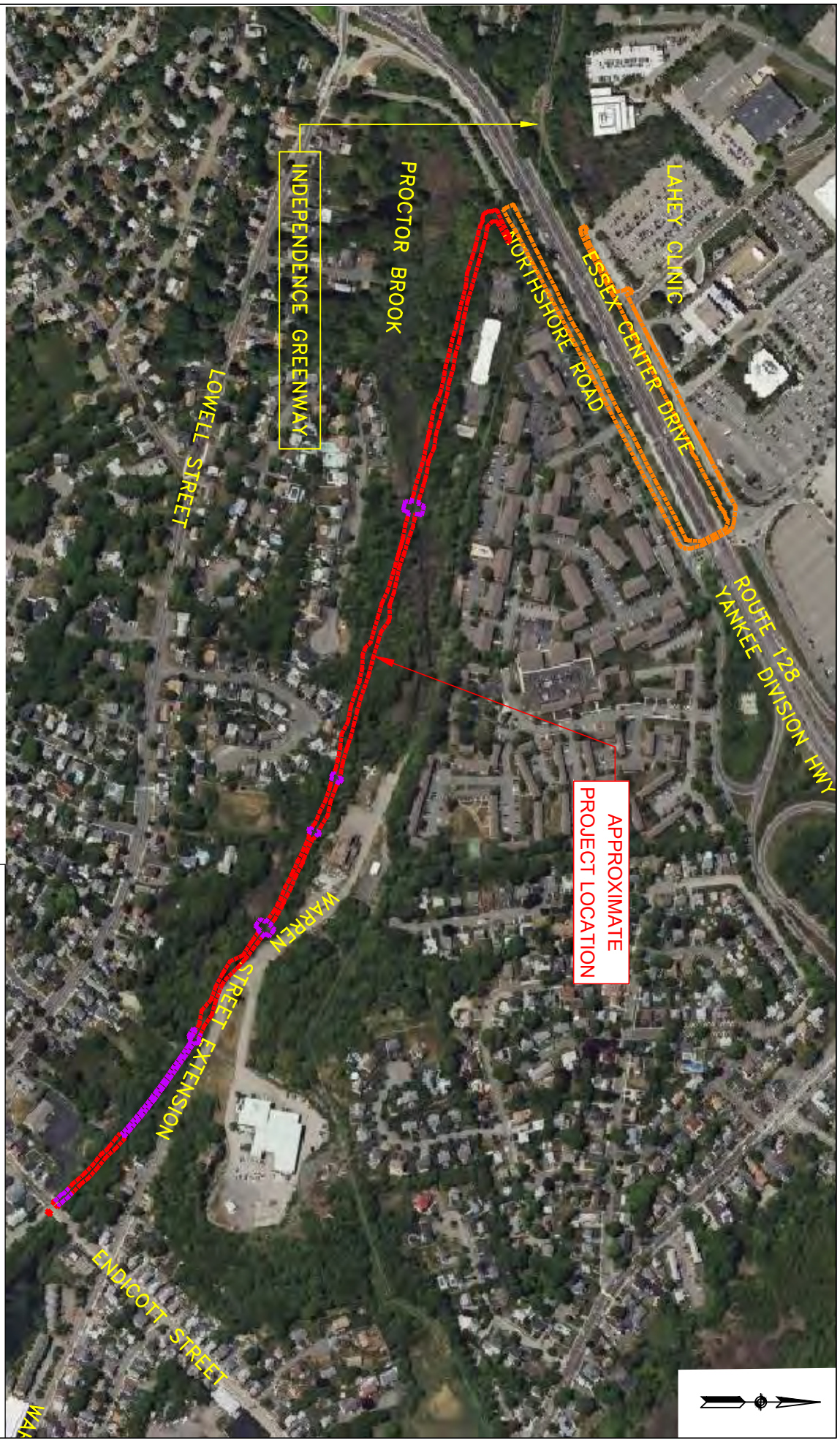
SCALE: AS NOTED
PROJECT NO. 17118
DATE: 1/31/2023
REVISED:
DRAWN BY: JK
CHECKED BY: OF

FIGURE 1

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 1 – USGS.dwg

This Page is left Blank for Double Sided Printing

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 2 – AERIAL.dwg



LEGEND:

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))

SCALE IN FEET

250 0 250 500

1" = 500'

AERIAL MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR., SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 12/13/2023
DRAWN BY: JK/VR
REVISED:
CHECKED BY: OF

FIGURE 2

NOTE: DATA TAKEN FROM MASSGIS

This Page is left Blank for Double Sided Printing

Existing Conditions

The existing site can be analyzed as ten (10) watershed areas that contribute runoff to ten (10) discharge points. The existing drainage areas are delineated in Figure 6 - Existing Watershed Plan. For the purpose of this hydrologic analysis, the following assumptions were made:
When the watershed boundary fell outside of the limit of work an arbitrary line was delineated as the watershed boundary.

The total watershed area for the existing conditions is used as the comparison base for the watershed area in the proposed conditions.

There are protected wetland resource areas that exist surrounding Proctor Brook which runs adjacent to North Shore Road. The Riverfront Area associated with Proctor Brook, Buffer Zones, as well as 100-year floodplain extend into the project limits along the Independence Greenway Extension. The upstream and downstream side of Proctor brook are hydraulically connected by existing culverts which cross North Shore Road and Endicott Street. Wetland “A” is also in close proximity to the project limits north of Essex Center Drive.

Some areas of the existing drainage system on the roadways within the project limits and the entirety of the Independence Greenway Extension includes “country drainage” (i.e. no curb), where the runoff sheet flows into the pervious shoulder, roadside ditches, wetlands, or private front yards. These watershed areas include EDA-1, -3, and -6 through -10.

There are separate closed drainage systems spread throughout the project, servicing existing watershed areas via catch basin curb inlets and at low points. Where stormwater does not sheet flow off the roadway via country drainage, it travels via curb along the roadway into these closed drainage systems.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. These locations were analyzed as Discharge Points during the hydrologic analysis, as indicated on the attached Existing Watershed Plan. Brief descriptions of each contributing area are below.

DRAINAGE AREA EDA-1
This area consists mostly of a pervious median adjacent to Essex Center Drive and the start of the Independence Greenway. This area also includes approximately 400’ of the impervious path. Stormwater runoff travels via overland flow into a ditch on the south side of Essex Center Drive and discharges to the north through a culvert beyond the project limits to Wetland “A” at DP-1.

DRAINAGE AREA EDA-2
This area consists mostly of impervious roadway and sidewalk along Essex Center Drive, as well as portions of several parking lots and driveways abutting the roadway to the north. This area also includes one half of the bridge that connects Essex Center Drive with North Shore Road at the eastern project limit. Portions of grass medians and a gravel shoulder are also included in this area. Stormwater runoff travels via gutter flow along the curb into a closed drainage system. The closed drainage system discharges beyond the project limits to the north through a culvert to Wetland “A” at DP-2.

DRAINAGE AREA EDA-3
This area consists of the impervious westbound lane of North Shore Road, as well as one half of the bridge that connects North Shore Road with Essex Center Drive (STA. 303+20 to 306+57). This area also includes pervious grass area within the median on the bridge and the area between North Shore Road and Route 128 to the north. Stormwater runoff from the roadway travels via country drainage and discharges into a ditch on the south side of the roadway at DP-3. Stormwater runoff from the grass area adjacent to the roadway travels via overland flow into a culvert, which discharges to the ditch at DP-3.

DRAINAGE AREA EDA-4
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 306+57 to 314+97). Stormwater runoff from the road travels via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-4.

DRAINAGE AREA EDA-5
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 314+97 to the project limit approximately 500 feet west). Stormwater runoff from the road travels via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-5.

DRAINAGE AREA EDA-6
This area consists entirely of woods starting perpendicular to the eastbound lane of North Shore Road that extends southwest (STA. 318+45 to 329+88). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north through a culvert at DP-6.

DRAINAGE AREA EDA-7
This area consists entirely of woods that extends southwest (STA. 329+88 to 340+31). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-7.

DRAINAGE AREA EDA-8
This area consists entirely of woods that extends southwest (STA. 340+31 to 346+35). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-8.

DRAINAGE AREA EDA-9
This area consists mostly of woods and a portion of Proctor Brook that extends southwest (STA. 346+35 to 351+77). This section of woods is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs

parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north at DP-9.

DRAINAGE AREA EDA-10
This area consists of woods and a portion of Proctor Brook that extends southwest (STA. 351+77 to 359+02). This section of woods is approximately 15 to 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges southwest through a culvert that crosses under Endicott Street at DP-10.

Table 1 presents the existing drainage areas and their characteristics. Figure shows existing drainage patterns and delineations by design point.

Table 1: Existing Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
EDA-1	*DP-1*	*2.14*	*50*
EDA-2	*DP-2*	*2.60*	*84*
EDA-3	*DP-3*	*0.54*	*70*
EDA-4	*DP-4*	*1.46*	*55*
EDA-5	*DP-5*	*0.76*	*54*
EDA-6	*DP-6*	*0.88*	*49*
EDA-7	*DP-7*	*0.78*	*47*
EDA-8	*DP-8*	*0.30*	*37*
EDA-9	*DP-9*	*0.34*	*70*
EDA-10	*DP-10*	*0.29*	*88*

Table 2 lists the existing Stormwater Control Measures (SCMs) and provides a description of each.

Table 2: Existing SCMs

SCM	*Description*
N/A	*N/A*

Proctor Brook and its adjacent Bordering Vegetated Wetland is located within the Project area and listed in Table 3.

Table 3: Wetland Resource Areas

Wetland Resource Area	*Wetland Type*	*Description*
Proctor Brook	*Brook*	*Headwaters, outlet small pond in wetland north of Downing Road, Peabody to Grove/Goodhue Street bridge, Salem (formerly part of MA93-06) (interrupted urban).*
Wetland "A"	*Wetland*	*North of Essex Center Drive.*

The Project is located within the 100-year floodplain as shown on the FIRM community panel 25009C0412F, dated 07/03/2012 included in Appendix B.

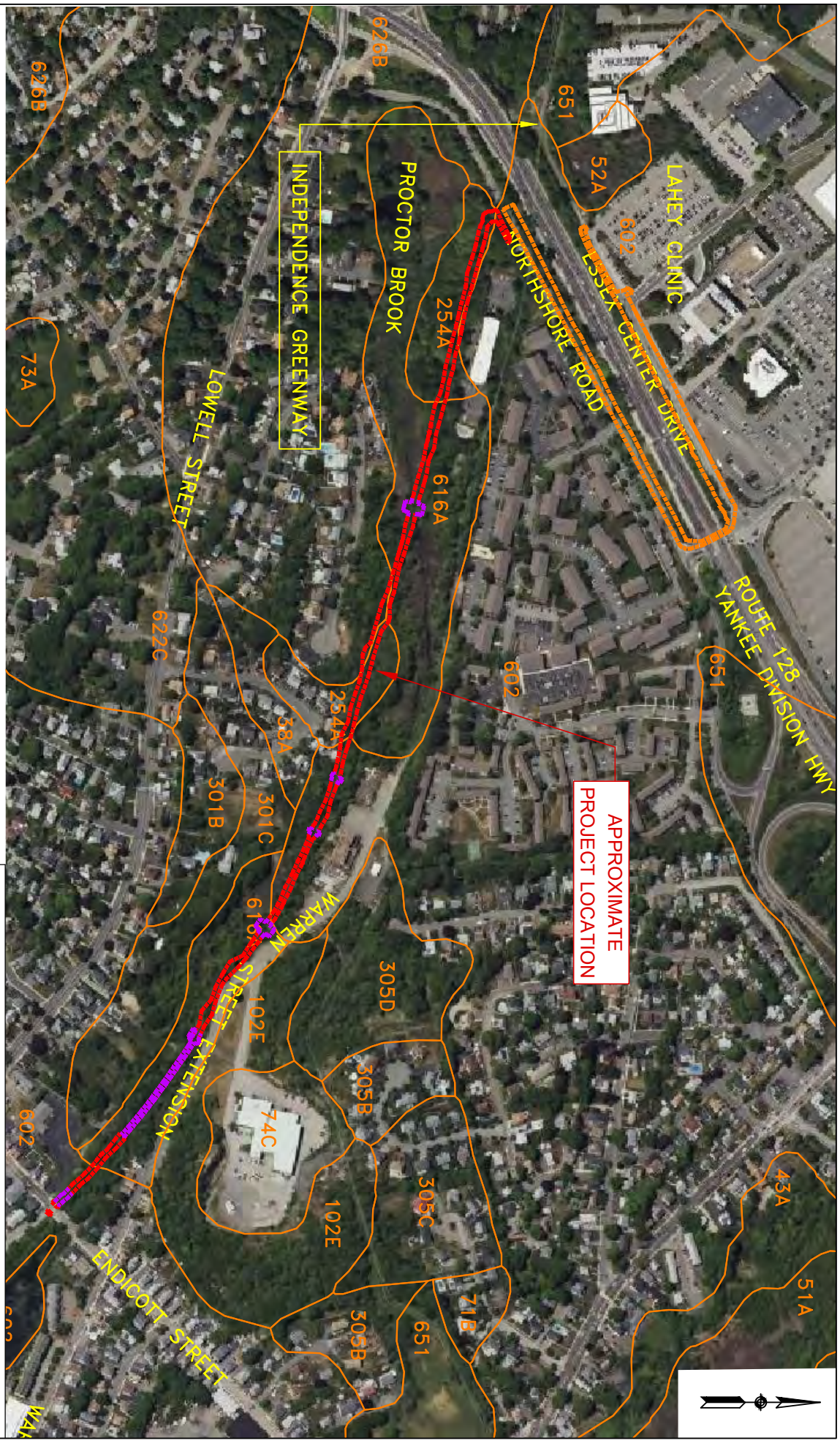
Review of the NRCS Soil Survey map of the Project area identified the following soils within the project limits:

- 38A - “Pipestone loamy fine sand, 0 to 3 percent slopes” (HSG A/D)
- 43A - “Scarboro mucky fine sandy loam, 0 to 3” (HSG A/D)
- 51A - “Swansea muck, 0 to 1 percent slopes” (HSG B/D)
- 52A - “Freetown muck, 0 to 1 percent slopes” (HSG B/D)
- 71B - “Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony” (HSG D)
- 73A - “Whitman fine sandy loam 0 to 3 percent slopes, extremely stony” (HSG D)
- 102E - “Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes” (HSG D)
- 254A - “Merrimac fine sandy loam, 0 to 3 percent slopes” (HSG A)
- 301B - “Montauk fine sandy loam, 0 to 8 percent slopes, very stony” (HSG C)
- 301C - “Montauk fine sandy loam, 8 to 15 percent slopes, very stony” (HSG C)
- 305B - “Paxton fine sandy loam, 3 to 8 percent slopes” (HSG C)
- 305C - “Paxton fine sandy loam 8 to 15 percent slopes” (HSG C)
- 305D - “Paxton fine sandy loam, 15 to 25 percent slopes” (HSG C)
- 311B - “Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony” (HSG C/D)
- 616A - “Fluvaquents, frequently flooded, 0 to 3 percent slopes” (HSG B/D)
- 622C - “Paxton-Urban land complex, 3 to 15 percent slopes” (HSG C)
- 626B - “Merrimac-Urban land complex, 0 to 8 percent slopes” (HSG A)
- 628C – “Canton-Urban land complex, sloping” (No Designation)
- 651 – “Udorthents, smoothed” (No Designation)
- 724C – “Hollis-Urban land-Rock outcrop complex, sloping” (No Designation)

On-site subsurface investigations were performed within the Project area by GZA in 2019. Appendix B provides detailed soils information, including the NRCS soil survey data for the Project area and results of on-site subsurface investigations.

See Figure 5 for the Soils Figure and Figure 6 for the Existing Watershed Plans.

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\FIGURE 5 – SOILS MAP.dwg



LEGEND:

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(6))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(f))

APPROXIMATE LIMIT OF WORK (LIMITED PROJECT 310 CMR 10.53(3)(i))

NRCS SOIL SURVEY BOUNDARY

73A NRCS SOIL TYPE

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM MASSGIS AND THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE (NRCS).

SOILS MAP

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
DATE: 12/13/2023
REVISED:

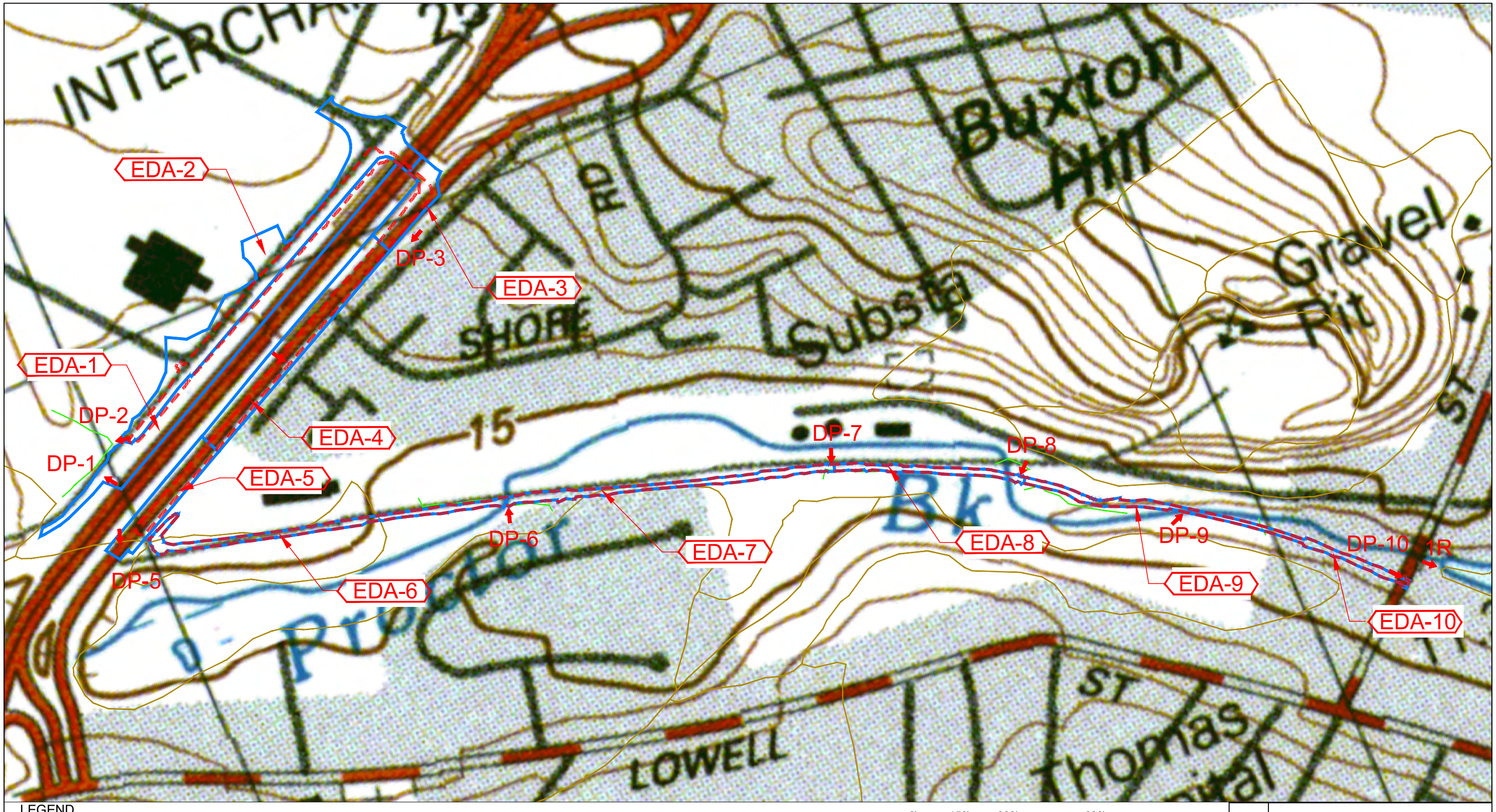
PROJECT NO. 17118
DRAWN BY: JK/VR
CHECKED BY: OF

FIGURE 5

This Page is left Blank for Double Sided Printing

Proposal No. 609211-132091

A00860 - 189



LEGEND

- LIMIT OF WORK
- WETLANDS
- NRCS SOIL SURVEY BOUNDARY
- EXISTING WATERSHED BOUNDARY
- EXISTING WATERSHED NUMBER — EDA-X
- DESIGN POINT — DP-X

0' 150' 300' 600'

1" = 300 FEET

DATE	REVISIONS

PEABODY, MASSACHUSETTS

INDEPENDENCE GREENWAY EXTENSION
EXISTING WATERSHED PLAN

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 I F: (978) 399-0033 I WWW.GREENINTL.COM

SCALE 1" = 300'	DATE:	PROJECT NO. 17118
APPROVED: _____	DESIGNED BY: BV DRAWN BY: BV CHECKED BY: DS	FIGURE NO. 6

This Page is left Blank for Double Sided Printing

Proposed Conditions

The proposed stormwater management analysis can be summarized as ten (10) watershed areas that contribute runoff to ten (10) discharge points. The overall watershed area and discharge points of analysis are the same in the proposed condition as in the existing condition. The proposed drainage areas are delineated in Figure 7 - Proposed Watershed Plan.

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.3 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 56-span light duty timber boardwalk structure will be approximately 437’- 9” long with an out-to-out width of 13’-0” and will provide a clear width of 12’- 1” to accommodate two 5’- 0” wide travel lanes, one in each direction, and two 1’-0” shoulders on each side.

The proposed bituminous shared-use trail pavement will match the dimensions of the existing discontinued railroad structure. This will include 10’-0” wide hot mix asphalt pavement carrying two 5’-0” wide travel lanes, one in each direction, and two 2’-0” wide crushed stone shoulders on both sides. Bike traffic on the existing Independence Greenway has not been formally quantified, but users report that the facility is heavily utilized by bicyclists and pedestrians.

The proposed shared-use trail will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (Fourth Edition, 2012) and the MassDOT Separated Bike Lane Planning & Design Guide 2015. The proposed bridge will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges and the most recent supplemental Specifications, Standard Nomenclature and Engineering Directives.

New catch basins have been proposed to replace existing catch basins at certain locations where proposed roadway geometry differs from existing conditions. New catch basins are also proposed where the new Independence Greenway Extension proposes a higher ground elevation than existing conditions and existing headwalls/culverts will no longer be utilized along North Shore Road. A stormwater SCM (infiltration trench) will be installed to help with peak rate attenuation at PDA-4. This project also includes the replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the former track bed. All proposed

drainage systems will maintain the historic drainage patterns, distributing runoff to the existing discharge points.

There are ten discharge points within the limit of work where stormwater leaves the project by overland flow or closed drainage along the roadway. These locations are the same in both Existing & Proposed Conditions and were analyzed as Discharge Points during the hydrologic analysis, as indicated on the attached Proposed Watershed Plan. Brief descriptions of each contributing area are below.

DRAINAGE AREA PDA-1
This area consists mostly of a pervious median adjacent to Essex Center Drive and the start of the Independence Greenway. This area also includes approximately 400' of the impervious path. Stormwater runoff travels the same as existing conditions via overland flow into a ditch on the south side of Essex Center Drive and discharges to the north through a culvert beyond the project limits to Wetland "A" at DP-1.

DRAINAGE AREA PDA-2
This area consists mostly of impervious roadway and sidewalk along Essex Center Drive, as well as portions of several parking lots and driveways abutting the roadway to the north. This area also includes one half of the bridge that connects Essex Center Drive with North Shore Road at the eastern project limit. Portions of grass medians and a gravel shoulder are also included in this area. Stormwater runoff travels the same as existing conditions via gutter flow along the curb into a closed drainage system. The closed drainage system discharges beyond the project limits to the north through a culvert to Wetland "A" at DP-2.

DRAINAGE AREA PDA-3
This area consists of the impervious westbound lane of North Shore Road, as well one half of the bridge that connects North Shore Road with Essex Center Drive (STA. 303+20 to 306+57). This area also includes pervious grass area within the median on the bridge and the area between North Shore Road and Route 128 to the north. The Independence Greenway extension is also proposed through this PDA. Stormwater runoff from the roadway travels the same as existing conditions via country drainage and discharges into a ditch on the south side of the roadway at DP-3. Stormwater runoff from the grass area adjacent to the roadway travels via overland flow into a proposed catch basin, which discharges to the ditch at DP-3.

DRAINAGE AREA PDA-4
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 306+57 to 314+97). The Independence Greenway extension is also proposed through this PDA. Stormwater runoff from the road travels the same as existing conditions via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a proposed infiltration trench SCM that discharges to a catch basin connected to the existing culvert at DP-4.

DRAINAGE AREA PDA-5
This area mostly consists of pervious grass area between North Shore Road and Route 128 and the impervious westbound lane of North Shore Road (STA. 314+97 to the project limit approximately 500 feet west). The Independence Greenway extension is also proposed through

this PDA. Stormwater runoff from the road travels the same as existing conditions via gutter flow along a curb into catch basins that discharge north into the grass area directly adjacent to the roadway. Stormwater runoff from the grass area travels via overland flow into a culvert at DP-5.

DRAINAGE AREA PDA-6
This area consists of the Independence Greenway extension starting perpendicular to the eastbound lane of North Shore Road that extends southwest (STA. 318+45 to 329+88). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north through a culvert at DP-6.

DRAINAGE AREA PDA-7
This area consists of the Independence Greenway extension that extends southwest (STA. 329+88 to 340+31). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. This area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-7.

DRAINAGE AREA PDA-8
This area consists of the Independence Greenway extension that extends southwest (STA. 340+31 to 346+35). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges south through a culvert at DP-8.

DRAINAGE AREA PDA-9
This area consists of the Independence Greenway extension that extends southwest (STA. 346+35 to 351+77). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, and loam & seed grass area. The area is approximately 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges north at DP-9.

DRAINAGE AREA PDA-10
This area consists of the Independence Greenway extension that extends southwest (STA. 351+77 to 359+02). This area includes the proposed path, a 2-foot crushed stone shoulder on either side of the path, loam & seed grass area, and a boardwalk over Proctor Brook that is approximately 440 feet in length. The area is approximately 15 to 20 feet wide along its entire length. Stormwater runoff from this area travels the same as existing conditions via overland flow into Proctor Brook which runs parallel to the drainage area. Stormwater that flows through Proctor Brook in this area discharges southwest through a culvert that crosses under Endicott Street at DP-10.

Table 4 presents the proposed drainage areas and their characteristics under proposed conditions. Figure 7 shows proposed drainage patterns and drainage area delineations by design point.

Table 4: Proposed Drainage Areas

Drainage Area	*Design Point*	*Area (acres)*	*Curve Number*
PDA-1	*DP-1*	*1.92*	*50*
PDA-2	*DP-2*	*2.81*	*83*
PDA-3	*DP-3*	*0.55*	*68*
PDA-4	*DP-4*	*1.46*	*51*
PDA-5	*DP-5*	*0.76*	*49*
PDA-6	*DP-6*	*0.88*	*74*
PDA-7	*DP-7*	*0.78*	*74*
PDA-8	*DP-8*	*0.29*	*78*
PDA-9	*DP-9*	*0.34*	*86*
PDA-10	*DP-10*	*0.29*	*88*

Table 5 lists the proposed SCMs and provides a description of each.

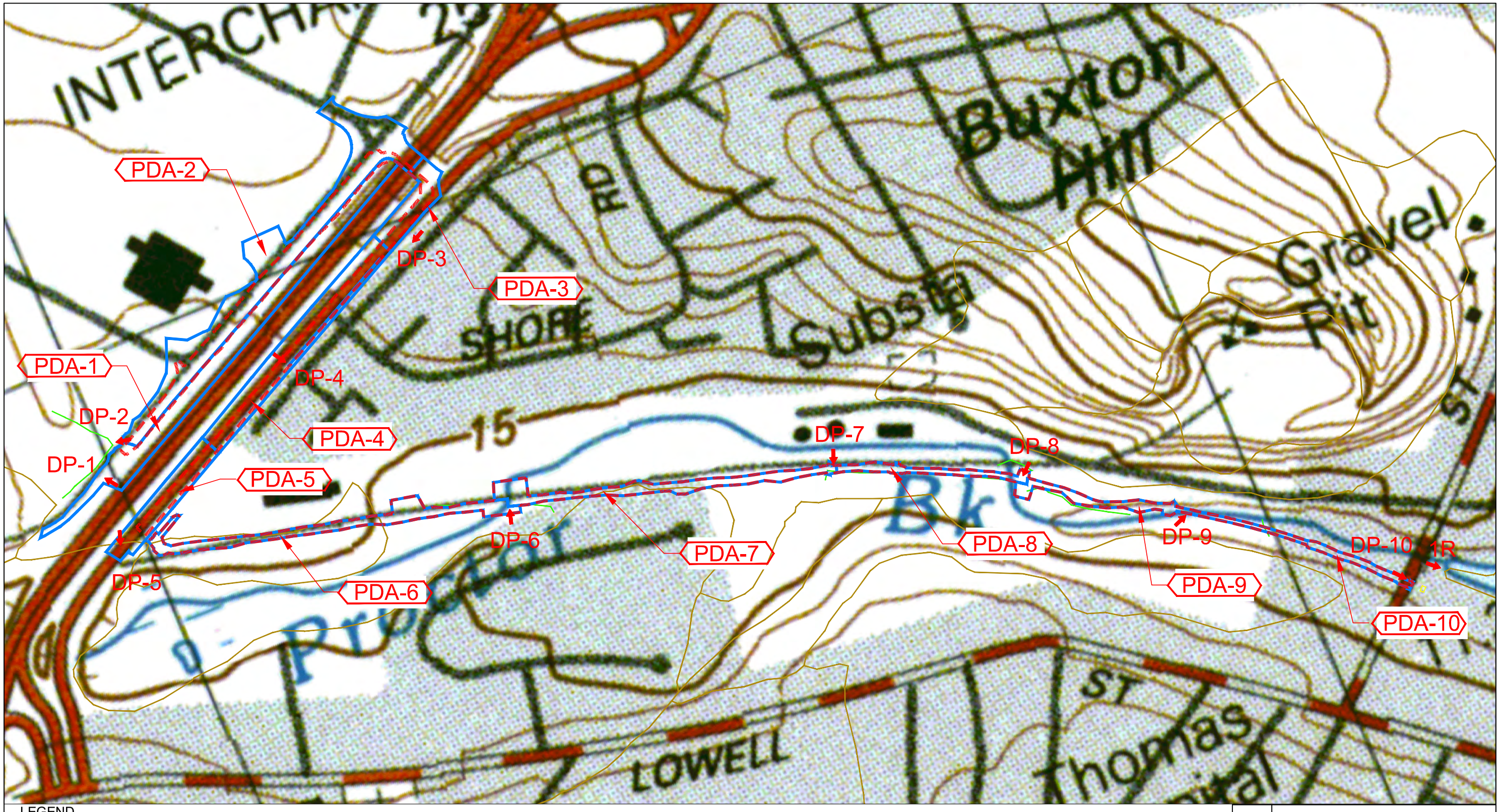
Table 5: Proposed SCMs

SCM	*Description*
Infiltration Trench	*Stormwater runoff from PDA-4 is directed to this infiltration trench, which discharges to the south into depressed farmland area at DP-4.*

See Figure 7 for the Proposed Watershed Plans.

Proposal No. 609211-132091

A00860 - 195



LEGEND

- LIMIT OF WORK
- WETLANDS
- NRCS SOIL SURVEY BOUNDARY
- PROPOSED WATERSHED BOUNDARY
- PROPOSED WATERSHED NUMBER — PDA-X
- DESIGN POINT — DP-X

0' 150' 300' 600'

1" = 300 FEET

DATE	REVISIONS

PEABODY, MASSACHUSETTS

INDEPENDENCE GREENWAY EXTENSION
PROPOSED WATERSHED PLAN

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 I F: (978) 399-0033 I WWW.GREENINTL.COM

SCALE 1" = 300'	DATE:	PROJECT NO. 17118
APPROVED: _____	DESIGNED BY: BV DRAWN BY: BV CHECKED BY: DS	FIGURE NO. 7

This Page is left Blank for Double Sided Printing

Impaired Waters and TMDLs

As described under the Proposed Conditions section, the Project will discharge to Proctor Brook (Segment ID MA93-39). Proctor Brook is impaired based on the MassDEP Year 2016 Integrated List of Waters, also known as the 303(d) list. The WQDF assists in the identification of impaired waters and TMDL requirements and quantifies the pollutant reduction provided by the Project's SCMs.

Table 6 lists the receiving water bodies that are impaired, if the water body is covered by a TMDL, and the TMDL's Waste Load Allocation (WLA) for MassDOT property.

Table 6: Impaired Waters and TMDL Information

Water Body	*MassDEP Category*	*303(d) list Impairments*	*TMDL*	*TMDL Pollutant*	*TMDL Name*	*Waste Load Allocation for MassDOT (lbs/yr)*
Proctor Brook	*5*	*E.coli, Fecal Coliform*	*Yes*	*227*	*E. Coli and Trash/Debris*	*N/A*

The proposed infiltration trench has been designed to meet the required water quality volume and TSS removal rates; however, it does not discharge to Proctor Brook. E. Coli is not a stormwater caused pollutant; therefore, TMDL removal calculations were not performed. See Standard 4 for more detailed water quality calculations and discussions.

Stormwater Management Standards

As demonstrated below, the proposed Project complies with the MassDEP Stormwater Management Standards (the Standards). The Project is considered a redevelopment project and only meets standards 2, 3, and 4 to the maximum extent practicable.

Standard 1: No New Untreated Discharges

No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The Massachusetts Stormwater Handbook, Standard 1, requires that the project demonstrates that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands.

Existing runoff discharges to adjacent wetlands and properties via overland flow or by an existing outfall that can be approximated as ten (10) discharge points, as shown on Figure 6 - Existing Watershed Plan. The runoff is conveyed by a combination of overland flow (country drainage), piped networks to outfalls, and culverts that cross the roadway and track bed. The proposed design adds catch basins in some areas to collect runoff, designed based on MassDOT standards, to increase drainage efficiency. Under proposed conditions, runoff will be conveyed through a combination of overland flow, a closed drainage system, and one infiltration trench.

To improve upon existing conditions, stormwater runoff contributing to one of the existing discharge points (DP-4) will have a portion of the catchment area routed to a treatment SCM prior to discharge. The SCM that discharges to DP-4 is an infiltration trench. The proposed catch basins will have deep sumps and hoods to provide additional treatment. The proposed outfalls are located at or near existing outfalls where there is an existing point source discharge.

All new culverts are designed with rip rap protection to prevent erosion to Proctor Brook. Appendix C provides supporting calculations for the outlet protection design.

Stormwater runoff will be treated by deep sump catch basins with hoods at DP-2, -3, and -4, as well as an infiltration trench at DP-4 before discharging. See Standard 4 for the water quality treatment provided by the Project.

There are no new untreated point source discharges created as a result of this project. This standard is fully met.

Standard 2: Peak Rate/Flood Control

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Standard 2 requires that the rates of flow be attenuated for the proposed development condition. This project is a redevelopment project and is required to meet Standard 2 to the maximum extent practicable. The Independence Greenway Extension will result in a net increase in impervious area.

The peak flow rates were calculated for the 2-, 10-, 25- and 100-year storm events under proposed conditions and compared to the existing peak flow rates. The proposed Independence Greenway Extension and minor geometry improvements result in an overall increase of 44,910 square feet in impervious area within the project limits. The increase in impervious area correlates to a minor overall increase in peak flow rates for the 2-, 10-, 25-, and 100-year storms.

There is an increase in peak flow rates for DP-2, DP-6, DP-7, DP-8, and DP-9 for all storm events due to the proposed increase in impervious area. The increase in peak rates for DP-2, which is the start of the Independence Greenway extension, ranges from 0.17 to 1.38 cfs (cubic feet per second), is minor and considered negligible. The other increases (DP-6,-7,-8, and -9) all occur due to the replacement of track bed with a paved shared use path. The increase of peak rates for DP-6 ranges from 0.96 to 3.21 cfs. The increase of peak rates for DP-7 ranges from 0.84 to 3.07 cfs. The increase of peak rates for DP-8 ranges from 0.41 to 1.77 cfs. The increase of peak rates for DP-9 ranges from 0.42 to 0.63 cfs. These four discharge points correspond to the four cross culverts under the track bed. DP-6 is where two twin 42” culverts that are obstructed are located. DP-7 is where the existing 6.4’ x 4’ box culvert has been washed away. Both areas have resulted in degraded track bed and overtopping of Proctor Brook. The proposed improvements will not only restore what was previously installed but also will enlarge the culverts to allow additional flow through the culverts rather than over the shared use pathway. DP-8 and DP-9 represent existing failed smaller culverts that will be replaced in kind that convey intermittent streams.

When the drainage areas (DP-6, -7, -8, and -9) that discharge to Proctor Brook are combined and compared to the overall peak rates of the Proctor Brook watershed, the increases are negligible. The project drainage area that directly discharges to Proctor Brook is 1.08 acres, with a net increase discharge rate of 8.71 cfs for the 100-year storm event under proposed conditions. Because the project site is located on the lower end of the watershed, the stormwater runoff from the path will reach its peak, prior to Proctor Brook (the combination of DP-6, 7, 8, 9, and 10) reaching its peak at DP-10, resulting in no increase in flood elevations for any storm event. This is demonstrated by adding the net increase in peak rates for the 100-year storm event from the HydroCAD model for DP-6,-7,-8,-9, and -10 (8.71 cfs), to the effective FEMA FIS 100-year peak discharge of 420 cfs for Proctor Brook for a total of 428.71 cfs. The hydraulic model resulted in no increase to the base flood elevation; thereby, demonstrating that the minor increase in peak rates from the project will not result in downstream flooding. A copy of the hydraulic study is included in Appendix D.

Therefore, no adverse impacts are anticipated by the increase in peak rates as a result of the project. The results of this analysis are presented in Appendix D of this report.

Per MassDOT Requirements, a proposed stormwater SCM must hold peak volumes up to the 10-year storm event. The proposed infiltration trench stormwater SCM fully meets this requirement.

Table 7 provides a summary of peak rates for each design point under existing and proposed conditions. Appendix D provides computations and supporting information regarding the hydraulic and hydrologic modeling.

Table 7: Peak Discharge Rates (cfs)

	Existing				*Proposed*			
Design Point	*2-year*	*10-year*	*25-year*	*100-year*	*2-year*	*10-year*	*25-year*	*100-year*
DP-1	*0.04*	*0.88*	*2.44*	*6.63*	*0.04*	*0.79*	*2.19*	*5.96*
DP-2	*4.90*	*9.24*	*12.74*	*20.06*	*5.07*	*9.72*	*13.51*	*21.44*
DP-3	*0.44*	*1.15*	*1.80*	*3.25*	*0.38*	*1.07*	*1.71*	*3.16*
DP-4	*0.14*	*1.18*	*2.43*	*5.64*	*0.00*	*0.00*	*1.13*	*4.62*
DP-5	*0.06*	*0.55*	*1.18*	*2.81*	*0.01*	*0.26*	*0.78*	*2.22*
DP-6	*0.01*	*0.31*	*0.92*	*2.60*	*0.97*	*2.25*	*3.37*	*5.81*
DP-7	*0.01*	*0.18*	*0.65*	*2.04*	*0.85*	*1.98*	*2.96*	*5.11*
DP-8	*0.00*	*0.00*	*0.04*	*0.32*	*0.41*	*0.87*	*1.26*	*2.09*
DP-9	*0.28*	*0.73*	*1.15*	*2.07*	*0.70*	*1.28*	*1.74*	*2.70*
DP-10	*0.64*	*1.13*	*1.51*	*2.31*	*0.64*	*1.13*	*1.51*	*2.31*
Proctor Brook (DP-6 through DP-10)	*0.92*	*2.28*	*4.20*	*9.32*	*3.57*	*7.51*	*10.85*	*18.03*

Standard 3: Recharge

Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the MassDEP Massachusetts Stormwater Handbook.

Standard 3 requires that three computations or demonstrations be fulfilled in order to satisfy the stormwater recharge requirements. They are as follows:

- Impervious Area
- Required Recharge Volume
- Bottom Area Sizing for Subsurface Infiltration Systems and Porous Pavement

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. This project has 119,834 square feet of total existing impervious area within the limit of work and results in an increase in impervious area by approximately 46,907 square feet due to the Independence Greenway extension and minor roadway geometry improvements. The required recharge volume for the total impervious area within the limit of work is 8,000 CF. The required recharge volume for the net increase in impervious area within the limit of work is 2,348 CF. The required recharge volume for the proposed SCM is 926 CF.

The project considered implementation of SCM's that would provide recharge throughout the project limits; however, there was only one feasible location within the project, which is close to DP-4. Given the limited space within the ROW, existing utilities, the crisscrossing of Proctor Brook under the track bed, close proximity to waterbodies and high groundwater throughout the majority of the project, it was not feasible to propose additional SCMs in all the drainage areas in the project.

The Soil Survey Analysis is included in Section 1.1 of this report, Figure 3 Soils Map, and Appendix B Soil Information. The infiltration trench is located near borings B-3 and B-4 taken by GZA. Boring B-3 did not encounter groundwater and boring B-4 encountered groundwater at 9.5' below the existing surface. The bottom of the proposed infiltration trench will have more than 2-feet of separation to ledge and/or seasonal high groundwater. The NRCS soil report for this area demonstrates that the soil type is 602, Urban Land, within the infiltration trench, which does not have a hydrologic soil group associated with it. The closest NRCS identified soil group to this area is 626, Merrimac urban land with HSG A. In addition, the Geotechnical Report developed by GZA in Appendix B describes the soils closest to the infiltration trench (borings B-3 and B-4) as fine to coarse sand, some silt, trace gravel, and trace ash, which is consistent with HSG A. Therefore, the SCM is determined to be comprised of HSG A soils and the required recharge calculations were made using HSG A soils. See Appendix C of this report for required recharge calculations.

For the infiltration trench SCM, the contributing impervious areas and its underlying Hydrologic Soil Group were used to estimate the recharge volume lost by the addition of impervious area, which was used as its required recharge volume. The combined storage provided by the proposed

infiltration trench is 1,415 CF. While the infiltration trench does not provide storage for the total proposed impervious area within the project limits, the storage volume meets the required volume determined by the impervious area that is routed to the SCM. Therefore, Standard 3 is met to the maximum extent practicable.

The SCM was designed using the static method, so that the storage available below the first overflow is equivalent or larger than the required recharge volume. Drawdown calculations were performed to show that the infiltration trench will drain within 72 hours. For this calculation, the RAWLs infiltration rates were used to estimate the recharge potential of each of the SCMs.

Table 8 provides the required recharge volume for the project, and Table 9 provides the provided recharge volumes for each design point.

Table 8: Required Recharge Volume for Project

	HSG A	*HSG B*	*HSG C*	*HSG D*	*Total*
Existing Impervious (sq. ft.)	119,834	-	-	-	119,834
Proposed Impervious (sq. ft.)	150,450	16,291	-	-	164,744
Net Impervious Area (sq. ft.)	30,616	16,291	-	-	46,907
Target depth, F (in)*	0.6	0.35	0.25	0.1	-
Total Required Recharge Volume, Rv (cf)	8,000				
Net Increase Required Recharge Volume, Rv (cf)	2,348				
Receiving Area Required Recharge Volume, Rv (cf)	926				

*Provided by the MassDEP Massachusetts Stormwater Handbook

Table 9: Provided Recharge Volumes by Design Point

	HSG A	*HSB B*	*HSG C*	*HSG D*	*Total*
DP-4 (Drainage Area PDA-4)					
Provided Recharge Volume (cf)	1,415	-	-	-	1,415

Appendix B provides soil evaluation information (including the geotechnical report), and Appendix C provides computations, drawdown calculations, and supporting information regarding recharge.

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2' separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points.

Standard 4: Water Quality Treatment

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

- *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the MassDEP Massachusetts Stormwater Handbook; and*
- *Pretreatment is provided in accordance with the MassDEP Massachusetts Stormwater Handbook.*

Standard 4 requires that all stormwater management systems be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The Massachusetts Stormwater Handbook states that this standard is met when:

- Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

As stated previously, this project is a redevelopment project and is required to meet Standard 3 to the maximum extent practicable. As mentioned in Section 5, there is an increase in impervious area and one (1) SCM is proposed as part of this project. It has been designed to provide water quality treatment for the area of impervious surface that it captures. The treatment practice is:

- (1) Infiltration Trench

The combination of an infiltration trench and deep sump catch basins with hoods provides 85% TSS removal for DP-4 only. This standard is met to the maximum extent practicable.

The project is not located within a stormwater critical area; therefore, Massachusetts Stormwater Regulations require a “Water Quality Depth” of half (1/2) inch. This project is considered a redevelopment project; one of the objectives of the proposed stormwater improvements is to improve upon the quality of discharged stormwater.

The proposed design aims to improve the water quality by installing a new infiltration SCM and catch basins with deep sumps and hoods where feasible. The required water quality volume for the total impervious area within the limit of work is 6,864 CF. The required water quality volume for the net increase in impervious area within the limit of work is 1,954 CF. The required water quality volume for the impervious area that the SCM receives is 772 CF. Though the proposed infiltration trench does not provide enough volume for the total or net increase of impervious area, it exceeds the water quality volume requirement for the area it was designed to hold, by providing 1,415 CF of storage. As a result, this standard will be met to the maximum extent practicable. See Appendix C for required water quality volume calculations.

The Project has been designed to comply with Standard 4. Stormwater control measures have been sized to treat the required water quality volume and remove required pollutant load to the maximum extent practicable.

The Project used the SCM WQ Curves, as provided by the WQDF, to determine the treatment depth based on the required TSS and/or TP removal percentage for each SCM. Table 10 shows the SCMs organized by design point with each SCM's corresponding treatment depth and TSS and/or TP treatment removal.

Table 10: Water Quality Treatment Required and Provided by Design Point

Design Point	*Pretreatment*	*Contributing Impervious Area (sf)*	*Treatment Depth (in)*	*% TSS Removal*
DP-1 (PDA-1)				
Untreated	*Untreated*	*3,997*	*-*	*-*
DP-1 Total				*-*
DP-2 (PDA-2)				
Catch Basin	*Deep Sump Catch Basin with Hood*	*86,729*	*0.5*	*25%*
DP-2 Total				*25%*
DP-3 (PDA-3)				
Catch Basin	*Deep Sump Catch Basin with Hood*	*11,089*	*0.5*	*25%*
DP-3 Total				*25%*
DP-4 (PDA-4)				
Infiltration Trench & Catch Basin	*Trench Storage & Deep Sump Catch Basin with Hood*	*18,524*	*0.5*	*85%*
DP-4 Total				*85%*
DP-5 (PDA-5A)				
Untreated	*Untreated*	*9,011*	*-*	*-*
DP-5 Total				*-*
DP-6 (PDA-6)				
Untreated	*Untreated*	*12,281*	*-*	*-*
DP-6 Total				*-*
DP-7 (PDA-7)				
Untreated	*Untreated*	*10,438*	*-*	*-*
DP-7 Total				*-*
DP-8 (PDA-8)				
Untreated	*Untreated*	*6,047*	*-*	*-*
DP-8 Total				*-*
DP-9 (PDA-9)				
Untreated	*Untreated*	*4,765*	*-*	*-*
DP-9 Total				*-*
DP-10 (PDA-10)				
Untreated	*Untreated*	*3,890*	*-*	*-*
DP-10 Total				*-*
Project Total				*24.4%*

Appendix C provides the MassDEP TSS Removal Calculation Worksheets.
The City of Peabody has an active MS4 permit which includes long term operation and maintenance. The project will be maintained by the City's current O&M plan. Appendix E includes the LTPPP for this project.

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2' separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another option was to use proprietary devices at each discharge point for stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

The project's water quality treatment provides a minimum of 25% removal where closed drainage only was provided, and up to 85% of removal where the infiltration trench is proposed. The shared-use pathway that will replace the former railroad bed will sheet flow runoff to vegetated/wooded areas. Standard 4 is met to the maximum extent practicable.

Standard 5: Land Uses with Higher Potential Pollutant Loads

For Land Uses with Higher Potential Pollutant Loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the MassDEP Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all LHPPLs cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the MassDEP Massachusetts Stormwater Handbook. Stormwater discharges from LUHPPLs shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Standard 5 does not apply to the Project. There are no land uses with higher potential pollutant loads within the Project area.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the MassDEP Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Standard 6 does not apply to this Project. There are no critical areas within the Project limits.

Standard 7: Redevelopment

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The Independence Greenway extension is considered Redevelopment; therefore, Standard 7 is applicable to this project. Standard 7 requires a redevelopment project to meet Standards 2, 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 and 6 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project provides an opportunity to improve the quality of stormwater runoff discharged to adjacent wetlands. The proposed stormwater enhancements are summarized below:

There is one SCM proposed as part of this project. A portion of the proposed drainage system has been designed to convey runoff to this SCM for water quality treatment, and attenuation prior to discharge to the surrounding environment. The proposed SCM is an infiltration trench.

Cath basins with sumps and hoods are also installed within the project where feasible, which provide additional treatment.

The reconstructed drainage system will utilize existing outfall locations and invert elevations where feasible.

A Redevelopment Stormwater Checklist is provided in Appendix A of this report which illustrates which standards have been met to the maximum extent practicable. The standards are listed below:

Standard 1: Fully Met

Standard 2: Maximum Extent Practicable

Standard 3: Maximum Extent Practicable

Standard 4: Maximum Extent Practicable

Standard 5: Fully Met

Standard 6: Not Applicable

Standard 7: Fully Met

Standard 8: Fully Met

Standard 9: Fully Met

Standard 10: Fully Met

Standard 8: Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The implementation of erosion and sediment controls (ESC) during construction is considered a standard practice for all MassDOT projects. ESC will be installed before any land disturbance begins for the Project and will remain in place for the duration of the project. Construction period pollution prevention and erosion and sedimentation control measures will be implemented at the project site to control construction related impacts during construction and land disturbance activities. The General Contractor for the project will be responsible for implementation of the construction period controls.

The project will disturb more than one acre of land during the construction process and will require a NPDES Construction General Permit issued by the Environmental Protection Agency. As a result, the General Contractor will be required to prepare a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP document will satisfy the requirements of the Construction General Permit and the construction period erosion, sedimentation and pollution prevention plan requirements outlined in Standard 8 of the Massachusetts Stormwater Handbook. A SWPPP has not been prepared for inclusion with this stormwater report; however, one will be prepared prior to any construction activities at the site by the General Contractor.

Without proper erosion and sediment control measures, grading, filling and installing new structures may cause erosion and sedimentation, resulting in temporarily increased turbidity and suspended solid loads. Runoff from construction sites may also transport sediment to downstream watercourses, where sediment deposition and accumulation will occur as flow velocities decrease.

Erosion and sedimentation controls will be employed to prevent the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

Below is a description of some of the erosion and sediment control measures that will be employed at the project and that will be included in the SWPPP.

Minimize Disturbed Area and Protect Natural Features and Soil

The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance and limiting the size and length of the tributary drainage areas to the worksite and drainage structures. These fundamental principles will be the key factors in the Contractor's control of erosion on the project site. If appropriate, the Contractor will construct temporary diversion swales and settling basins or use a settling tank. If additional drainage or erosion control measures are needed, they will be located up-gradient from the compost filter tubes and sedimentation fences when possible.

The Contractor is responsible for the maintenance and repair of all on-site erosion control devices. All erosion control devices will be regularly inspected. At no time will silt-laden water be allowed to enter sensitive areas (wetlands, streams, and drainage systems). Any runoff from disturbed surfaces

will be directed through a sedimentation process prior to being discharged to the existing on-site drainage system.

The contractor will establish a staging area(s) on areas to be disturbed for the overnight storage of equipment and stockpiling of materials.

In the staging area, the Contractor will have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials will include, but are not limited to, compost filter tubes, sedimentation fence, erosion control matting and crushed stone. As mentioned previously, erosion and sedimentation controls will be employed to minimize the erosion and transport of sediment into resource areas during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

The Contractor is responsible for erosion control on the site and will utilize erosion control measures where needed, regardless of whether the measures are specified on the construction plans or in supplemental plans prepared for the Stormwater Pollution Prevention Plan (SWPPP).

Primary erosion control techniques proposed include compost filter tubes, sedimentation fence barriers, and a stabilized construction entrance. A detailed description of each technique is discussed below.

Best Management Practices (BMPs)

COMPOST FILTER TUBES AND SEDIMENTATION FENCE

Erosion control barriers such as compost filter tubes and/or sedimentation fence or similar will be installed where required prior to the start of construction. These barriers will remain in place until all tributary surfaces have been fully stabilized.

DRAINAGE SYSTEM PROTECTION

Sediment filters (silt sacks) will be installed at all existing and proposed drainage structures and maintained and cleaned as required to maintain their effectiveness. Catch basins, drainage manholes and storm drain pipes will be cleaned of sediment and debris after the completion of construction. Sediment collected in structures will be disposed of properly and covered, if stored on-site. The following construction measures will be implemented to prevent the transport of sediment through the drainage system.

The Project disturbs one or more acres of land; therefore, the project contractor will request coverage under the NPDES Construction General Permit (CGP) and develop a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP follows the requirements of this standard and will be in compliance with the latest NPDES CGP.

Standard 9: O&M Plan

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The City of Peabody is responsible for implementing the O&M Plan within their jurisdiction. Appendix E includes the O&M Plan for this project.

Standard 10: Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. As stated in the handbook, "The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater."

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system.

Standard 10 also states that "The Illicit Discharge Compliance Statement must be accompanied by a site map that is drawn to scale and that identifies the location of any systems for conveying stormwater on the site and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. The site map shall identify the location of any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater management system." Included with the Notice of Intent Submission are construction plans that displays the location of all of the stormwater management components as well as other utilities (existing and proposed) on the project site and conforms to requirements of a "site map" to accompany the Illicit Discharge Compliance Statement.

An Illicit Discharge Compliance Statement is included in Appendix E – Illicit Discharge Compliance Statement of this Report.

Where a new, closed drainage system will be constructed, there will be no connections to sanitary sewer. In other areas, stormwater runoff discharges via overland flow.

The design plans submitted with this report have been designed in full compliance with Standard 10. The project area does not have any known illicit connections.

Appendix A: MassDEP Checklist for Stormwater Report

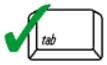
- Massachusetts Stormwater Report Checklist
- Redevelopment Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

2/2/2023
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Infiltration Trench

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☒ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Checklist for Redevelopment Projects

Redevelopment Location:
The entire work within the limit of disturbance is considered redevelopment.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. Standards that are fully met are checked and do not require additional explanation.

☒ Standard 1: (Untreated discharges)
No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

☐ Standard 2: (Peak rate control and flood prevention)
Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

The peak flow rates were calculated for the 2-, 10-, 25- and 100-year storm events under proposed conditions and compared to the existing peak flow rates. The proposed Independence Greenway extension and minor geometry improvements result in an overall increase in square feet of impervious area within the project limits.

Though there is an increase in peak flow rates for DP -2, -6, -7, -8, and -9 for all storm events, additional studies were done to demonstrate there will be no adverse impacts. See page 16 in the Stormwater Report for additional information.

Implementations of Stormwater Control Measures (SCMs) for peak rate attenuation were used for one discharge point, but are not feasible for all discharge points due to the limited space within the existing Right-Of-Way (ROW), high groundwater, close proximity to resource areas and existing utilities.

☐ Standard 3: (Recharge to Ground water)
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The project considered implementation of SCM's that would provide recharge throughout the project limits; however, there was only one feasible location in the project close to DP-4. Given the limited space within the ROW, existing utilities, the crisscrossing of Proctor Brook under the track

bed, close proximity to waterbodies and high groundwater throughout the majority of the project, it was not feasible to propose SCMs in all the drainage areas in the project.

For the SCM, the contributing impervious areas and their underlying Hydrologic Soil Groups were used to estimate the recharge volume lost by the paved shared use path, which was used as the required recharge volume for the given SCM. The recharge volume provided by the SCM is 1,415 CF. While the infiltration trench does not provide storage for the total proposed impervious area within the project limits, the storage volume meets the required volume determined by the impervious area that is routed to the SCM. Therefore, Standard 3 is met to the maximum extent practicable.

☐ Standard 4: (80% TSS Removal)

Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained;*
b. *Stormwater BMPs are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Infiltration SCMs were considered for the project, but only one location was feasible due to limited space in the ROW, seasonal high groundwater elevation, existing utilities, and close proximity to wetlands. Drywells were considered but provide very little stormwater treatment volume, require 2' separation from the bottom of the drywell to groundwater, which in most cases is infeasible, and the large number of drywells required would be impractical for all design points. Another option was to use proprietary devices at each discharge point for stormwater treatment volume, but due to the majority of the site discharging runoff via overland flow, these systems are not practical for this project.

The infiltration trench at DP-4 will be able to achieve 85% TSS removal with the crushed stone shoulder forebay and the catch basins with deep sump and hood providing pretreatment.

The project's water quality treatment provides a minimum of 25% removal where closed drainage only was provided, and up to 85% of removal where the infiltration trench is proposed. The shared-use pathway that will replace the former railroad bed will sheet flow runoff to vegetated/wooded areas. Standard 4 is met to the maximum extent practicable.

☒ Standard 5 (Higher Potential Pollutant Loads (HPPL)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific stormwater BMPs determined by the Department to be suitable for such use as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Not Applicable.

☒ Standard 6 (Critical Areas)
Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters or Special Resource Waters shall be set back from the receiving water and receive the highest and best practical method of treatment. A "stormwater discharge," as defined in 314 CMR 3.04(2)(a)1. or (b), to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of the public water supply.

Not Applicable.

☒ Standard 8: (Erosion, Sediment Control)
A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented.

☒ Standard 9: (Operation and Maintenance)
A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.

☒ Standard 10 (Illicit Discharges)
All illicit discharges to the stormwater management system are prohibited.

Appendix B: Soils and FEMA Information

- NRCS Soil Survey Information
- On-Site Subsurface Investigations by GZA
- FEMA Flood Insurance Rate Map (FIRM)
- Flood Insurance Study (FIS)

Proposal No. 609211-132091

A00860 - 229

Hydrologic Soil Group—Essex County, Massachusetts, Southern Part

Map Scale: 1:11,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 19, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Proposal No. 609211-132091

A00860 - 230

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		2.7	0.5%
38A	Pipestone loamy fine sand, 0 to 3 percent slopes	A/D	2.4	0.4%
43A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	7.0	1.3%
51A	Swansea muck, 0 to 1 percent slopes	B/D	3.9	0.7%
52A	Freetown muck, 0 to 1 percent slopes	B/D	1.8	0.3%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	3.5	0.6%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	2.4	0.4%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	D	10.4	1.9%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	5.3	1.0%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	C	3.1	0.6%
301C	Montauk fine sandy loam, 8 to 15 percent slopes, very stony	C	9.1	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	5.3	1.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	6.0	1.1%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	6.8	1.2%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	3.7	0.7%
602	Urban land		277.1	50.4%
616A	Fluvaquents, frequently flooded, 0 to 3 percent slopes	B/D	19.8	3.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
622C	Paxton-Urban land complex, 3 to 15 percent slopes	C	61.9	11.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	63.0	11.5%
628C	Canton-Urban land complex, sloping		0.4	0.1%
651	Udorthents, smoothed		47.9	8.7%
724C	Hollis-Urban land-Rock outcrop complex, sloping		6.0	1.1%
Totals for Area of Interest			**549.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

GEOTECHNICAL ENGINEERING REPORT

for

Proposed Peabody Bikeway – Phase II
Peabody, MA

April 19, 2021
File No. 01.0174019.00

PREPARED FOR:
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue | Norwood, MA 02062

31 Offices Nationwide
www.gza.com

Known for excellence.
Built on trust.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781.278.3700
F: 781.278.5701
F: 781.278.5702
www.gza.com

April 19, 2021
File No. 01.0174019.00

Mr. Adel Shahin, P.E.
Green International Affiliates, Inc.
239 Littleton Road, Suite 3
Westford, MA 01886

Re: Geotechnical Engineering Report
Proposed Peabody Bikeway – Phase II
Peabody, Massachusetts

Dear Adel:

In accordance with our Agreement dated December 20, 2018, GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this geotechnical engineering report for the proposed Peabody Bikeway project located in Peabody, Massachusetts. The objectives of our services were to evaluate subsurface conditions and develop geotechnical design and construction recommendations to support the 25% design of proposed structural features of the project.

The proposed Peabody Bikeway Phase II project is part of the overall 5.3-mile Independence Greenway that extends from the Ipswich River Trailhead in Middleton, MA to the North Shore Mall Trailhead in Peabody, MA. The Peabody Bikeway Phase II Segment is an approximately 1.3-mile-long segment of trail that extends from the North Shore Mall Trailhead (STA 290+00) to Endicott Street in Peabody (STA 359+43).

This report supersedes our Preliminary Geotechnical Engineering Report dated April 22, 2019. The report was updated to reflect changes to the structural design and structural elements to the project. Specifically, the two retaining walls previously proposed between the Route 128 northbound highway embankment and the existing sidewalk of North Shore Road have been eliminated from the project. In addition, we understand that the proposed stream crossing structure located off Warren Street extension crossing Proctor Brook will consist of an approximately 438-foot-long elevated boardwalk rather than an 80-foot-long prefabricated steel truss bridge.

Elevations herein are in feet and referenced to the National American Vertical Datum of 1988 (NAVD 88). This report is subject to the Limitations set forth in **Appendix A** and the Terms and Conditions of our Agreement.

BACKGROUND

Our understanding of the project is based on:

- Discussions and email correspondence with Green International Affiliates Inc. (Green);
- Aerial photograph with proposed boring locations selected by Green at each structural feature;

- Construction Plans and Profiles along the Bikeway, Sheets 32 through 39, prepared by Green dated "fiscal year 2005";
- Site visits and observations of subsurface explorations at the site;
- CAD file of project base map provided by Green on January 15, 2019;
- MassDOT 25% Submittal Plan and Profile of Independence Greenway Extension, provided by Green on January 23, 2019;
- In-progress Sketch Plans entitled "Proposed Bridge Peabody Independence Greenway Extension over Proctor Brook", prepared by Green, with print date April 9, 2021.
- In-progress Construction Plans and Profiles, with print date April 5, 2021 and Bikeway Cross Sections, with print date April 7, 2021, prepared by Green.
- Readily available on-line surficial geology information, as well as on-line aerial photographs and topographic maps.

Existing Conditions

The Peabody Bikeway Phase II site starts from a previously completed portion of the Independence Greenway located near the southbound Route128 roadway and the North Shore Shopping Mall in Peabody, MA (Begin Bikeway STA 289+66). The bikeway extends east about 1,200 feet roughly parallel to the Route 128 roadway, then crosses under the southbound and northbound Route 128 roadways (at the existing Route 128 bridge over the entrance to the shopping mall), extends west about 1,400 feet along North Shore Road, crosses North Shore Road, and then follows an existing abandoned railroad right-of-way in an easterly direction roughly following Proctor Brook and terminating at about Endicott Street (End Bikeway STA 369+30) for about 4,100 feet. A site Locus is presented as **Figure 1**.

Route 128 Southbound Roadway Embankment Segment

The segment of the bikeway along the southbound Route 128 roadway (shopping mall side of the bikeway) will consist of an approximately 4-foot-wide trail. There are no structural features required to support the bikeway along this portion of the alignment.

North Shore Road Segment

The North Shore Road segment of the bikeway alignment is the existing highway embankment along the northbound side of Route 128. The embankment is grass covered with vegetation, overgrown bushes and small-diameter trees. There are several drainage basins and culverts within the embankment.

Photograph A: Embankment Slope looking Southwest at Route 128 Northbound Roadway adjacent to North Shore Road.

The embankment slope is approximately 1.5 horizontal to 1 vertical (1.5H:1V) at the northern end underpass and becomes flatter towards the west (**Photograph A**). The existing grade ranges from approximately elevation (El.) 53 to El. 68 feet along North Shore Road to about El. 52 to El. 75 at Route 128 - Northbound. The segment of the bikeway along the North Shore Road will consist of an approximately 10-foot-wide trail. There are no structural features required to support the bikeway along this portion of the alignment. However, earthwork with cuts up to about 5 feet at a maximum 2H:1V side slope and fills up to about 5 feet at a maximum 4H:1V side slope will be required to construct the bikeway along the existing embankment.

Existing Abandoned Railroad Right-of-Way Segment

The proposed bikeway alignment extends east from North Shore Road along an existing railroad right-of-way through a wooded area located between and roughly parallel to Lowell Street to the south and Warren Street Extension to the north. The railroad alignment approximately follows Proctor Brook. This portion of the site is heavily wooded with wetland vegetation. Existing site grades range from approximately El. 50 to El. 38.

There are four existing culvert crossings along the existing rail bed:

- a 36-inch and a 42-inch-diameter culvert at about STA 329+85
- a 30-inch-diameter culvert at about STA 340+10
- a 24-inch-diameter culvert at about STA 342+25
- a stone culvert of unknown size at about STA. 346+20.

There is also a former stream crossing over Proctor Brook at about STA. 351+60 (**Photograph B**).

Photograph B: Former Stream Crossing at Proctor Brook. Also, location of proposed pedestrian boardwalk.

An existing 42-inch-diameter sewer main also crosses through the right-of-way between Warren Street Extension and Endicott Street. The sewer main is reported to be about 12 feet below grade.

Proposed Construction

Proposed structural features for the bikeway include two box culverts and a stream crossing structure consisting of an elevated boardwalk.

Culverts

Two precast concrete, single-cell box culverts will be constructed to replace two of the existing culverts along Proctor Brook. One culvert is located at about STA 329+85 and is proposed to be 2.5-feet high by 6-feet wide by 24-feet long and the other culvert is located at about STA. 346+20 and is proposed to be 3-feet high by 7-feet wide and 18-feet long. Each culvert will include precast wing walls set at 45 degrees at both ends of the box culvert.

Stream Crossing Structure

The proposed stream crossing structure will consist of an elevated boardwalk located off the west end of Warren Street Extension that crosses over Proctor Brook and extends through wetland areas adjacent to the brook between approximately STA. 351+09 and STA. 355+47, terminating about 300 feet west of Endicott Street. The boardwalk will consist of composite wood decking with a clear width of 12 feet and piers (bents) generally spaced at 8-feet on-center. Helical piles are proposed for support of the boardwalk. The Sketch Plans show a timber wingwall at the abutments at the west and east ends of the boardwalk. The height of the boardwalk is generally within about 3 feet above existing

grade and extends locally up to about 3.75 feet above existing grade. The stream crossing structure will be designed to accommodate light-duty H-5 truck loading conditions.

SUBSURFACE EXPLORATIONS

Subsurface explorations included geotechnical test borings at each of the proposed structural features along the proposed bikeway alignment and sediment sampling for laboratory testing to provide data for scour analyses and completion of a 401 Water Quality Certification by others for the stream crossing structure.

Geotechnical Test Borings

GZA engaged New England Boring Contractors, Inc. (NEBC) of Derry, New Hampshire to perform eight test borings, including four borings (B-1 through B-4) along the highway embankment adjacent to North Shore Road for the previously proposed retaining walls (which are now planned to be a cut/fill slopes); two borings (B-5 and B-6) at the proposed culvert replacement locations, and two borings (B-7 and B-8) at the proposed pedestrian crossing as planned in 2018. It is noted that test boring B-5 was not performed due to accessibility issues but may be drilled at a later date as a confirmation boring during construction. The locations of several of the other borings had to be relocated from the originally proposed locations due to lack of access or the presence of overhead electrical wires. Approximate locations of the completed borings are shown on **Figure 2**. The original proposed boring locations were located in the field with a Trimble GPS unit and relocated borings using tape measurements from existing topographic features. Exploration locations should be considered accurate to the degree implied by the method used.

The test borings were performed between January 2 and 15, 2019 with an ATV-mounted drill rig using either 2-¾-inch inner diameter (I.D.) hollow stem augers or drive-and-wash drilling techniques to depths ranging from about 10 to 36 feet below ground surface (bgs). Split-spoon samples were collected and Standard Penetration Tests (SPTs) were generally taken continuously through the fill, and then at approximate 5-foot intervals thereafter. The samples were obtained in general accordance with ASTM D1586. The SPT method consists of driving a 1-⅜ I.D. split-spoon sampler 24 inches with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler from 6 to 18 inches is the SPT blow count (N-value), which is a commonly used indicator of soil density and consistency. An NX-sized, 10-foot-long rock core was obtained at borings B-7 and B-8 to confirm the type and quality of bedrock. Water levels were recorded at the completion of drilling, however, may not represent stabilized groundwater levels due to the introduction of drilling fluids. Upon completion of drilling, all borings were backfilled with drill cuttings and surficial soils.

A GZA representative was present during drilling to observe the borings and visually classify the soil samples using the Modified Burmister Soil Classification System and rock cores using the International Society of Rock Mechanics (ISRM) System. Boring logs prepared by GZA are attached in **Appendix B**. Photographs of the rock cores obtained from the borings are presented in **Appendix C**.

Sediment Sampling

GZA collected ten (10) shallow soil samples to a depth of up to 2 feet below the bottom of the brook for laboratory gradation testing for use in scour analysis by others and the 401 Water Quality Certification.

Six shallow soil/sediment samples were collected at the pedestrian bridge (as previously proposed in 2018) at locations specified by Green including, three samples approximately 72 feet upstream of the bridge (distance from the bridge equal to the length of the bridge crossing over the brook): one sample from the left bank on land, one sample from the right bank

on land, and one in the channel; and three samples at the bridge: one sample at the left abutment on land in front of the abutment, one sample at the right abutment on land in front of the abutment, and one in the channel.

Two (2) shallow sediment samples were also collected at each of the two proposed box culverts (total of 4 samples). The samples were obtained at the upstream opening of the existing culvert and at a distance upstream from the culvert equal to the length of the box culvert spanning over the brook; in this case one culvert is 24 feet wide and the other 18 feet wide.

The samples were collected using a hand shovel and a hand auger. The sediment material submitted for laboratory testing was a composite of material collected over the depth of sampling. Locations of the samples were made using tape measurements to existing topographical features.

LABORATORY TESTING

Geotechnical Laboratory Testing

Four soil samples from the geotechnical borings were submitted to Thielsch Laboratories in Cranston, Rhode Island for sieve analyses (ASTM D 422) to confirm field classifications, evaluate soil properties across the site, and evaluate the potential for soil re-use. Geotechnical laboratory test results are attached as **Appendix D**.

The ten (10) sediment samples obtained from the pedestrian bridge and replacement culvert locations were submitted to Thielsch Laboratories for sieve analyses for use in scour analyses by others and for 401 Water Quality Certification. Geotechnical laboratory test results of the sediment are attached as **Appendix D**.

Environmental 401 Water Quality Certification Testing

Four sediment samples were submitted to ESS Laboratory in Cranston, Rhode Island for environmental laboratory testing to evaluate parameters specified in the MassDEP BRP WW 08 Dredging Application and in accordance with MassDEP Policy No. Comm 97-001 Reuse and Disposal of Contaminated Soil at Massachusetts Landfills. Soil that is generated during the removal of sediment form the bottom of the brook and during excavation for the bridge abutments which is considered to be excess to the project must be managed in accordance with the MassDEP Massachusetts Contingency Plan (MCP) regulations and to evaluate whether the excavated material can meet the criteria for disposal at a Massachusetts landfill, if required. The testing also included analytes to satisfy criteria listed in 314 CMR 9.07 Criteria for Evaluation of Applications for Dredging and Dredged Materials Management. Analyses included:

<u>BRP WW 08 (assuming minor dredging):</u>

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)
- EPA Method 8100 Polycyclic Aromatic Hydrocarbons (PAHs)
- EPA Method 8080 Polychlorinated Biphenyls (PCBs)
- MassDEP Extractable Petroleum Hydrocarbons (EPH) ranges
- Total Petroleum Hydrocarbons (TPH)
- Volatile Solids (percent)
- Water (percent)
- Grain Size (performed as part of geotechnical laboratory testing above)

Additional testing performed not covered by BRP WW 08, but needed for MassDEP and Massachusetts dredging, included:

MassDEP Policy No. Comm 97-001:

- EPA Method 8270 Semi-Volatile Organic Compounds (SVOCs)
- EPA Method 8260 Conductivity

314 CMR 9.07(2):

- EPA Method 8240 Volatile Organic Compound (VOCs)
- Total Organic Carbon

In addition, testing was performed for pesticides and herbicides, reactive sulfide and cyanide, pH, and flashpoint, since these tests are often required for certain disposal facilities.

Results of the environmental laboratory testing are summarized on **Table 1** and contained in **Appendix E**. As indicated on **Table 1**, the laboratory test results indicate levels for chromium in two samples (one at the bridge from boring B-7 and one at a culvert from boring B-6 exceeds the MassDEP MCP CMR 40.1600 Reportable Concentration (RC) S-1 standards. Reporting Category RC S-1 means "the category of criteria listed in CMR 40.1600 applicable to soil samples obtained at or within 500 feet of a residential dwelling, a residentially-zoned property, school, playground, recreational area or park; or within the geographic boundaries of a groundwater resource area categorized as RC GW-1". Excess soils generated during construction may be disposed at a Massachusetts landfill, but additional sampling and testing may be required by the disposal facility at the time of construction.

SUBSURFACE CONDITIONS

Subsurface conditions encountered in the borings generally consisted of fill underlain by natural granular soil deposits and bedrock. The strata encountered in the borings are described below in order of increasing depth and are summarized on **Table 2**. The depths, thicknesses, and elevations referenced herein should be considered approximate. Refer to the borings logs for more detailed subsurface conditions at specific exploration locations. A general description of the subsurface conditions encountered in the borings from the ground surface down follows:

North Shore Road Embankment Segment (B-1 through B-4)

This section provides a general description of the primary stratigraphic units encountered in the borings along the North Shore Road embankment segment.

Fill – Underlying approximately 6 to 12 inches of topsoil, granular fill was encountered to depths ranging from about 3 to 8 feet bgs. The fill generally consisted of dark brown to brown, fine to coarse sand with up to 30 percent silt and up to 15 percent gravel, root fibers, and ash particles. SPT N-values within the fill varied between 4 and greater than 100 blows per foot (bpf). The higher SPT N-values are likely due to the presence of gravel.

Natural Granular Soil Deposits – Natural granular soil/glacial deposits were encountered below the fill in borings B-1 through B-4 and ranged from about 6.5 to 13.5 feet in thickness before the split-spoon sampling was terminated on refusal within this deposit. The glacial deposits generally consisted of medium dense to very dense, brown to gray, fine to coarse sand with up to 50 percent gravel and up to 30 percent silt. The SPT N-values within the glacial deposits layer ranged from 15 to greater than 100 bpf. The higher SPT N-values are likely due to the presence of gravel or possibly, refusal on the top of bedrock.

Bedrock – Borings B-1 through B-4 were terminated upon reaching refusal to either or both advancement of the split-spoon and/or auger on possible top of bedrock at depths ranging from about 10.5 to 17 feet bgs. The refusal on bedrock was not confirmed by coring.

Existing Abandoned Railroad Right-of-Way Segment (B-6 through B-8)

This section provides a general description of the primary stratigraphic units encountered in the borings along the existing abandoned railroad right-of-way and elevated boardwalk segment. A generalized subsurface profile along the alignment of the proposed is presented on **Figure 3**. It should be noted that the borings along the Proctor Brook stream crossing were located based on the previous 80-foot-long prefabricated steel truss bridge crossing rather than the 438-foot-long elevated boardwalk, which is why there were no borings taken at the east end of the boardwalk.

Fill – Underlying topsoil, fill was encountered to depths ranging from about 2 to 4 feet bgs. The fill generally consisted of dark brown to brown, fine to medium sand with up to 35 percent silt and up to 20 percent gravel, root fibers, and wood fragments. The fill in boring B-8 was predominantly dark brown, organic Clay & Silt with up to 35 percent sand and up to 20 percent gravel. SPT N-values within the fill varied between 5 and 32 bpf.

Natural Granular Soil Deposits – The natural granular soil deposit in boring B-6 was predominantly fine to coarse sand with SPT N-values ranging from 11 to 36 bpf. The natural granular soil deposit in boring B-6 was encountered at a depth of about 2 feet bgs and extended to a depth of about 26 feet where the split-spoon sampling was terminated on possible bedrock. “Blow-in” was observed while drilling boring B-6 at around 10 to 12 feet bgs.

The natural granular soil deposits in borings B-7 and B-8 performed for the proposed pedestrian crossing differed from the other borings drilled for the bikeway. The natural granular soil deposits were further classified into sand and gravel, silt & clay, and a glacial deposit, each layer generally described as follows:

Sand and Gravel: encountered underlying the fill at approximately 4 feet bgs. The Sand and Gravel layer ranged from about 13.5 feet thick (B-7) to 15 feet thick (B-8) and generally consisted of medium dense to dense, brown to light brown fine to medium sand with up to 35 percent gravel and up to 15 percent silt. The SPT N-values within the Sand and Gravel layer ranged from 6 to 33 bpf. The SPT N-values in boring B-7 appeared to generally be lower than in boring B-8.

Silt & Clay – A relatively thin (approximately 2 to 3 feet thick) layer of Silt & Clay was observed in borings B-7 and B-8 at depths ranging from 17 to 22 feet bgs and generally consisted of brown to gray, Silt & Clay with up to 10 percent sand and gravel. One SPT N-value obtained in this layer indicated 12 bpf indicating stiff consistency.

Glacial Deposits – Glacial deposits were encountered underlying the Silt & Clay in borings B-7 and B-8 ranging from about 19 to 22 feet bgs. The glacial deposits generally consisted of dense to very dense, brown to gray, fine to coarse sand with up to 30 percent silt and up to 30 percent gravel. The SPT N-values based on two samples obtained from this layer were 40 bpf (B-8) and 44 bpf B-7).

Bedrock – It appears that the top of bedrock may include a relatively thin layer of weathered bedrock overlying more competent rock. In each boring, a layer of gravel and refusal to the split-spoon was encountered. The weathered rock appears to range from about 6 to 12 inches thick. Bedrock was not confirmed by coring in boring B-6, however, bedrock was confirmed with rock coring in borings B-7 and B-8 starting at 26 feet and 31 feet bgs, respectively. These depths correspond to approximately El. 13 and El. 8, respectively. Less than 100 feet north of Proctor Brook on the opposite side of Warren Street Extension bedrock outcrops are present.

The bedrock, based on the cores obtained from borings B-7 and B-8, generally consists of gray, hard, slightly weathered, medium to coarse grained GRANITE. **Table A** summarizes the rock recovery percentages and the Rock Quality Designation (RQD) values (the sum of the lengths of NX-sized core pieces that are greater than 4 inches in length divided by the length of the core run) for each core run. As noted in the table, the RQD values in boring B-8 were very poor. The rock core barrel jammed during coring the rock in boring B-8.

Table A: Summary of Rock Core Data

Boring Number	Core Run	Core Depth Below Ground Surface (ft)	Approximate Elevation (ft)	Recovery (%)	RQD (%)
B-7	C-1	26 – 31	13.5 – 8.5	93	20
	C-2	31 – 36	8.5 – 2.5	100	35
B-8	C-1	31 – 36	7.8 – 2.8	70	0
	C-2	36 – 41	2.8 – -3.2	100	0

GROUNDWATER

Groundwater levels were measured in the borings after completion of drilling, prior to backfilling and therefore, are not considered to be representative of stabilized groundwater levels. Measured levels are indicated on **Table 2** and summarized below:

- The groundwater levels along the Northshore Road segment ranged from approximately 6 to 10 feet bgs, corresponding to elevations ranging from 42 to 62.
- The groundwater level at the culvert at STA 346+20 (boring B-6) was encountered at about 3.5 feet bgs, corresponding to about El. 37.
- The groundwater levels at the elevated boardwalk ranged from 3 to 6 feet bgs, corresponding to about El. 32 to El. 36.

Note that fluctuations in groundwater levels are expected to occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements.

The bikeway is located within the 100-year flood zone based on FEMA FIRM 25009C0412F dated July 3, 2012. The 100-year base flood ranges from about El. 47 at North Shore Road to El. 39.5 feet at Endicott Street. We understand that the stream level within Proctor Brook is relatively shallow and runs west to east. A summary of stream levels based on the hydraulic study performed by others for the project site is provided in **Table B**.

Table B: Summary of Stream Levels at the Proctor Brook Stream Crossing Structure

Return Period	Elevation (ft)
Ordinary High Water	37.88
10-year Design Flood	39.33
25-year Scour Design Flood	39.53
50-year Scour Check Flood	39.82
100-year Base Flood	40.19

KEY GEOTECHNICAL ISSUES

The primary geotechnical issues associated with the design and construction of the proposed culverts and elevated boardwalk include:

- Relatively Shallow Groundwater Within the Existing Abandoned Railroad Segment. Being that the Proctor Brook is a wetland area, groundwater is shallow, and significant portions of the proposed bikeway are prone to flooding. Construction dewatering and possibly temporary cofferdams will likely be required during excavations for the culvert and approach embankments for the elevated boardwalk.

- Working within the Wetland to Construct the Culverts and Stream Crossing Structure. Limiting disturbance to the wetland areas surrounding the rail alignment associated with excavation in the wetlands needs to be considered when selecting foundation types to limit excavation quantities and access for construction equipment. In addition, construction equipment will only be able to access the bikeway from limited locations. Therefore, tracked and/or small- to medium-sized construction equipment would allow for installation of foundations that limit disturbance. Also, contractors will need to be aware of restrictions from the Conservation Commission with regard to removal of brush.

- Existing Granular Soils at the Elevated Boardwalk. The soils at the elevated boardwalk structure are relatively "clean" and are susceptible to scour during the design scour flood event and the check scour flood event due to water velocity. Based on hydraulic analyses by others, the scour depth at the abutments is 1.95 feet and at the piers is 1.17 feet during the Design Scour (25-year flood) event and scour depth at the abutments is 2.28 feet and at the piers is 1.22 feet during the Check Scour (50-year flood) event.

- Existing Cobbles/Boulders at Ground Surface. Clearing of the existing surficial cobbles/boulders will be required prior to installation of foundations for the elevated boardwalk structure.

- Existing Sewer Line. The existing sewer line extends between Warren Street Extension and Endicott Street and is close to the elevated boardwalk. The closest point occurs at the west side of the boardwalk, where the sewer line is located within less than 5 feet laterally of the proposed foundations. In order to avoid imposing load on the existing sewer, foundations for the stream crossing will need to extend into the natural soils below the bottom elevation of the sewer. Construction methods used to install foundations for the stream crossing will need to consider and mitigate potential construction impacts (i.e., ground movement and vibrations) to the existing sewer line.

GEOTECHNICAL RECOMMENDATIONS

This section presents the geotechnical recommendations for the proposed culverts and elevated boardwalk structure. These recommendations are subject to the limitations contained in **Appendix A**. Recommendations for the culverts and wing walls for the elevated boardwalk are based on foundation design provisions of the AASHTO LRFD Bridge Design Specifications, 8th Edition (2017 AASHTO LRFD), 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, with 2015 Interim Revisions (2015 AASHTO LRFD Seismic), and the MassDOT LRFD Bridge Manual, 2020. Recommendations for the foundations for the elevated boardwalk are based on helical piles and allowable stress design and the International Code Council Evaluation Services (ICC-ES) Acceptance Criteria AC358 for Helical Systems and Devices.

1. CULVERTS AND CULVERT WING WALLS

Type of Culvert

The proposed box culverts specified by Green for this project are single-cell, precast box sections and the wing walls at the ends of the culverts will also be precast sections. Criteria for loads and live load distributions should be in accordance with Section 3.3.4.4 of the MassDOT LRFD Bridge Manual. As specified in that section of the Manual, earth pressure should be based on a minimum and maximum equivalent fluid pressure of 30 pcf and 60 pcf, respectively. Lateral earth pressure from weight of earth above and adjacent to a box section should be taken as 0.5 times the vertical pressure. Load factors on the lateral earth pressures should follow the recommendations in Section 3.3.4.4.

We anticipate that the box culverts and wing walls can be installed by cut and cover methods in excavated trenches. The length of the trenches may need to be limited to help control in-flow of groundwater but will need to be long enough to accommodate the lengths of the precast box sections.

Based on the subsurface conditions indicated in boring B-6 (boring B-5 is pending), the box culvert will bear on relatively clean granular soil consisting of medium dense to dense fine to medium or fine to coarse sand with up to 10 percent silt and up to 10 percent gravel. These natural granular soil deposits are considered suitable for support of the box culverts provided the subgrade can be adequately dewatered to allow the subgrade to be recompacted and remain firm and stable when proof compacted.

If organic soils, loose or otherwise unstable or disturbed soils are encountered at subgrade level, those soils should be excavated and replaced with Gravel Borrow or ¾" crushed stone wrapped in non-woven filter fabric to the top of the naturally deposited inorganic soils below, or to a maximum depth of 3 ft below the bottom of culvert. Where compacted Gravel Borrow or ¾" crushed stone is placed for support of the box culvert, the lateral limits of the fill should be defined as a line extending horizontally outward and downward at a 1H:1V slope from the bottom of the culvert. Controlled density fill may be used in lieu of Gravel Borrow or crushed stone.

Culvert Bedding

The box culvert sections should be placed on a bedding of at least 12 inches of Gravel Borrow or ¾" crushed stone wrapped in Mirafi 180N, or equivalent, non-woven filter fabric.

Trench Backfill

Material placed against the culverts should consist of Gravel Borrow, Type C. Sidesway of the structure may be ignored in the design of the culverts provided that the fill placed around the structure is placed on both sides to approximately the same elevations at the same time.

2. ELEVATED BOARDWALK STRUCTURE

Boardwalk – Helical Pile Foundations

We recommend the boardwalk be supported on helical piles deriving their support in the natural granular soil deposits below the existing fill. Helical piles are a steel foundation system consisting of a central shaft with one or more helix-shaped bearing plates, welded to a lead section. Extension shafts are used to extend the pile into competent load-bearing soils. Helical piles will derive their support primarily in bearing of the helices within the

natural granular soil deposits. Helical piles are advanced by rotating the pile into the ground with the application of torque.

Helical piles are available as both round and square shafts with a range of shaft diameters and helix configurations (number of helices, helix diameters and helix spacing), depending on the design loads and installation considerations and vary by the manufacturer

Due to special requirements for installation of helical piles and the requirements for proper performance of the structural system, helical piles, including bracket assemblies should be designed and installed by a specialized helical pile Contractor. In addition, each Contractor typically works with a specific manufacturer and engineer. Thus, the size of the helical pile shaft, the number and diameter of the helices, and the overall design will vary depending on the manufacturer selected by the Contractor. Therefore, performance design criteria need to be specified on the Contract Bid Drawings and Specifications in sufficient detail to enable a Contractor to design and install piles for support of the proposed boardwalk.

To evaluate the feasibility of using helical piles to support the elevated boardwalk, a preliminary helical pile design was performed using geometry and the design loads provided by Green on April 6, 2021, which are summarized in **Table C**. Based on our evaluation, Chance™ RS2875.276 helical piles with a 10-, 12-, and 14-inch diameter helix lead section is considered a feasible helical pile option. The estimated pile embedment of the top helix is 11 feet below existing ground surface, or about 9 feet below the scoured ground surface. The preliminary helical pile calculations are provided in **Appendix F**.

Table C: Helical Pile Loads for Proposed Elevated Boardwalk

Load Type	Design Load (kips)
Vertical – Compression	25.0
Vertical – Tension	10.0
Lateral – Transverse (every bent)	7.5
Lateral – Longitudinal (every third bent)	5.0 (each way)

Note: The design compression, tension and lateral design loads are the ultimate load divided by a factor or safety of 2.0.

The following design criteria are presented for the helical pile foundation system:

- The structural design of the decking is based on 8-foot bent (longitudinal) spacing.
- Two vertical helical piles and one inclined (battered) pile are specified at each bent to resist axial compression/tension and horizontal (transverse direction) loads in compression/tension. The inclined helical anchor at each bent should alternate lateral directions from bent to bent.
- Two inclined piles are specified at every third bent of the boardwalk to resist longitudinal loading.
- The Contractor should determine the required angle of inclination for inclined piles so that the angle is no greater than 45 degrees and no less than 25 degrees from vertical.
- Design of the helical piles should be based on Allowable Stress Design (ASD) and should use a factor of safety of 2.0.

- Helical piles should be designed to provide allowable geotechnical capacity greater than the design loads presented in **Table C**.
- Static load testing should be performed in accordance with ASTM D1143 for compression and ASTM D3689 for tension.
- Helical piles should be designed so that the helices derive support entirely in the natural sand and gravel deposits underlying the existing fill stratum.
- The helical piles should be designed for tension during the design scour (25-year) flood. The maximum scour occurs at the abutments, therefore the piles should be designed for 1.95 feet of scour.
- The top helix should extend at least 11 feet below ground surface to provide sufficient overburden weight for the tension load (note that this will also provide more than the 4 feet of embedment required for frost protection).
- Helical piles in close proximity to the existing sewer line will need to be installed such that the top helix is located below the zone of influence on the pipe. The zone influence for the purpose of loading is defined as a 1H:1V plane from the springline of the pipe. The utility plans should be reviewed to confirm the sewer location and minimum depth to the top helix during final design.
- Design and installation of helical piles should conform to the manufacturer's recommendations.

These design criteria, as well as further specifics for design and installation of the helical piles should be provided in the Helical Pile performance specification. Further requirements regarding connection details will be presented on the structural drawings to be prepared by Green. Also, refer to the Construction Recommendations presented herein for additional requirements.

Abutments and Wingwalls

The Sketch Plans show timber abutments and wingwalls. In order to protect the existing sewer line, we have assumed the abutment and wingwalls will consist of crib walls constructed using pressured treated timber. Additional types of retaining walls should be considered for design and construction of the abutment and wing walls including mechanically stabilized earth, cast-in-place concrete, precast concrete, and other proprietary walls types such as Redi-Rock or similar. Selection of the final wall type should consider type of equipment that can readily access the wall locations and using construction methods that result in the least amount of disturbance to the wetland.

Bearing Resistance & Settlement

The factored geotechnical bearing resistance for the new abutment and wingwalls were evaluated using the following parameters and assumptions based on the methodology of 2017 AASHTO LRFD Section 10.6.3.1.2a:

- Effective footing widths (B') ranging from 2 to 6 feet
- Eccentricity (e) is less than or equal to 1/3 of the footing width
- Estimated footing lengths (L) of 10, 15, and 20 feet

- Minimum footing embedment depth (Df) of 4 feet below check scoured ground surface which will provide a minimum of 4 feet of embedment for frost protection even after the scour check event.
- Design groundwater elevation at proposed scoured streambed
- Footings are assumed to bear in the existing fill or natural granular soils. The presence of the Crushed Stone stabilization layer is neglected.
- Estimated friction angle (ϕ) of the footing bearing soils of 32 degrees
- Unit weight of the bearing soils of 120 pounds per cubic foot (pcf)
- Resistance factor for bearing resistance (ϕb) of 0.45 in accordance with 2017 AASHTO LRFD Table 10.5.5.2.2-1.

As required by MassDOT LRFD Section 3.2.10, the stability and bearing resistance of the footings under scour conditions is required to be considered.

Bearing resistance design charts to facilitate the selection of a footing size for the abutment and wingwalls based on factored bearing pressures (strength limit state) and tolerable settlement (service limit state) are provided in **Appendix F**. The charts are based on the effective footing width, B', where B'=B-2e (B is the footing width and e is the eccentricity of the loading on the footing). The factored bearing pressures shown in the charts in **Appendix F** are based on a resistance factor of 0.45, which is conservative for the wingwalls. The net bearing pressure for service limit state should be used to estimate footing settlement on the chart. Settlement is anticipated to be elastic and the majority of settlement will occur during construction (i.e., from the bridge dead loads).

Sliding and Overturning

The abutments and wingwalls need to be designed for sliding and overturning. The overturning analyses should be based on limiting the eccentricity to no more than one-third the footing dimension, B/3 (2017 AASHTO LRFD Section 10.6.3.3). Sliding analyses should be performed in accordance with Section 10.6.3.4 of 2017 AASHTO LRFD utilizing a resistance factor of 0.9 (Table 10.5.5.2.2-1) and a friction factor (tan δ) of 0.625 for soil-to-soil contact assuming the crib walls are filled with granular material.

We recommend that the passive soil resistance on the front side of the wingwalls and abutments be ignored when evaluating sliding.

Lateral Earth Pressure

The following backfill parameters/assumptions are recommended for the design of the abutment and wingwalls backfilled using compacted Gravel Borrow:

- Estimated soil friction angle (ϕ) of 34 degrees.
- A moist soil unit weight of 125 pounds per cubic foot (pcf) above the groundwater level and a saturated unit weight of 130 pcf below the groundwater level.
- Horizontal backfill slope behind the wall (walkway grade).
- Design groundwater at the top of the abutment assuming the area is prone to flooding.

- Based on Section 3.1.6 of the 2013 MassDOT LRFD Bridge Manual, for walls greater than 5 feet, the lateral earth pressure should be based on active earth pressure (K_a) conditions. Walls should be designed an active earth pressure coefficient of 0.26 for Gravel Borrow.

Additional lateral pressures due to traffic surcharge loads should be applied as required by 2017 AASHTO LRFD. However, based on Section 3.3.1.3 of the 2013 MassDOT LRFD Bridge Manual, if approach slabs are used, the AASHTO live load surcharge load on the abutment can be ignored.

The ends of the elevated boardwalk will be relatively hard points in comparison to the adjacent at-grade trail. We recommend an approach slab similar to that used for a bridge abutment or a cantilever end segment of boardwalk be used. The approach slab or cantilever segment should be structurally tied to the abutment or last pier and be free to rotate. The intent is to avoid any abrupt differential settlement between the boardwalk and approach embankment, which could cause a tripping hazard.

When considering fill in front of the wall, passive resistance should be neglected in determining wall stability in accordance with the 2013 MassDOT LRFD Bridge Manual.

3. ELEVATED BOARDWALK APPROACH EMBANKMENTS

Approach embankments up to about 5 feet above the current grade will be required at the ends of the elevated boardwalk. The approach embankments will be graded to a 3.1% slope or less. The approach embankments will be 14-feet wide with 2H:1V side slopes down to existing grade. The approach embankment fill should consist of Gravel Borrow (M.1.03.0, Type B) compacted to 95% of the maximum dry density. If project hydraulic studies indicate that erosion of the side slopes of the approach embankment is a concern, protection of the slope surface by armoring with stones (such as a modified rock fill underlain by non-woven filter fabric), a permanent turf reinforcement mat (TRM), or other material acceptable to the conservation agency will need to be constructed.

The approach embankment, including base course should be constructed as soon as practical and at least 2 months prior to binder course construction. Placement of the final wearing course of pavement should be held off to the degree practical to allow for any settlement of the new embankment to occur during construction.

Prior to placement of embankment fill, the subgrade embankment areas should be prepared and proof-compacted as recommended herein.

4. GEOTECHNICAL SEISMIC DESIGN PARAMETERS

Seismic Site Class

A Seismic Site Class analysis was performed using SPT N-values from the borings in accordance with Section 3.10.3.1 of 2017 AASHTO. Based on the results of our analysis we recommend Site Class D be used for design.

The design response spectrum parameters are based on the 1,000-year return period, corresponding to a non-critical, non-essential structure. In accordance with 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, with 2015 Interim Revisions (AASHTO 2015 Seismic), for Site Class D, we recommend the following design response spectra parameters:

A_s = 0.133g S_{DS} = 0.263g S_{D1} = 0.096g

where:

A_s is the short period acceleration based on Site Class D
S_{DS} is the design spectral acceleration coefficient at 0.2-second period
S_{D1} is the design spectral acceleration coefficient at 1.0-second period

Seismic Design Category

Based on the 1-second period design spectral acceleration for this site and in accordance with Table 3.5-1 of AASHTO Guide Specifications for LRFD Seismic Bridge Design, the elevated boardwalk structure may be assigned to Seismic Design Category (SDC) A.

Liquefaction

In accordance with Section 3.5 of the 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design, no liquefaction evaluation is required for bridges assigned to SDC A. Furthermore, based on the SPT N-values obtained from the borings, the soils are judged to be not considered susceptible to liquefaction.

5. ADDITIONAL SUBSURFACE EXPLORATIONS

During design development, the length of the stream crossing structure presented in the Bridge Type Selection Worksheet was increased from about 70 feet to about 438 feet. Thus, we recommend that additional explorations be performed prior to final design for the elevated boardwalk. Four borings should be performed between boring B-8 and the east abutment/transition ramp. The borings should be advanced to a depth of 25 feet bgs, or refusal, whichever is shallower. Split-spoon samples and SPTs are recommended to be taken continuously from 10 to 20 feet bgs and at standard 5-foot intervals to complete the boring to the specified depth. The borings will provide confirmatory information for the east end of the alignment where there is currently no subsurface information available.

CONSTRUCTION CONSIDERATIONS

1. HELICAL PILES

Contractor Qualifications

A specialty contractor should be engaged by the Contractor to install the helical piles who is capable of demonstrating successful completion of design, installation, and testing of helical piles with similar load capacity and similar subsurface conditions. The design of the helical piles and load tests should be prepared and stamped by a Professional Engineer Registered in the Commonwealth of Massachusetts. In addition to the design calculations, the Contractor's submittal should include a description of the load test set-up, equipment, and procedures.

Helical Pile Load Testing

The helical pile geotechnical capacity should be confirmed with load tests. We recommend performing a compression and tension load test on at least two piles. Load testing should be in accordance with ASTM D1143 for compression testing, and ASTM D3689 for tension testing. Locations of the load test piles should be agreed upon by the Contractor and geotechnical engineer. Tension load testing may be performed on the same pile that compression testing is performed.

QA/QC During Installation of Helical Piles

Observation of helical pile testing and production helical pile installation should be made by experienced geotechnical personnel. The depth, final installation torque, advancement rate, number and diameter of helices, diameter of extension shafts, and alignment should be verified and documented for each helical pile.

Obstructions

Removal of surficial cobble/boulders along the will be required prior to helical pile installation. Pre-drilling may be required to penetrate the cobbles and boulders. If, after pre-drilling, foundations are not able to be installed at anticipated locations, the structural engineer should be prepared to relocate and/or add additional helical piles to provide the required geotechnical resistance to support the proposed structures.

2. SUBGRADE PREPARATION FOR EMBANKMENTS

Remove all existing topsoil/subsoil within proposed fill areas to construct embankments (e.g., along North Shore Road and for the approaches to the elevated boardwalk). Perform final excavation using a smooth-edged bucket to limit disturbance to the exposed final subgrade. Proof-roll final subgrade areas prior to placement fill with at least ten (10) passes of a large vibratory plate compactor or walk-behind vibratory drum roller. If work is performed during periods of wet weather and groundwater is near the subgrade proof-rolling should be performed at the discretion of the Geotechnical Engineer and should be performed using static (non-vibratory) equipment. Weak, unstable or saturated areas that are observed during proof-rolling should be overexcavated and replaced with compacted Gravel Borrow (or crushed stone wrapped in non-woven geotextile fabric if greater than 4 inches in thickness).

Subgrade preparation for the culverts and culvert wing walls was described in Design Section 2 above.

Fill for embankments, footings for the culvert wingwalls as well as bedding for the culverts and culvert wingwalls should not be placed in water or on frozen ground.

3. GROUNDWATER AND SURFACE WATER CONTROL

Proctor Brook is a wetland and it is prone to flooding. The Contractor should be prepared to divert, manage, and control infiltrating groundwater during excavations for foundations and culverts, as well as control surface water from entering excavations to provide a dry and stable subgrade. The method of diverting water and dewatering excavations will depend on several factors, including localized soil conditions encountered, time of year performed, size of the open excavation and the length of time the excavation is left open. The Contractor should be responsible for selecting diversion, management and dewatering methods based on his proposed methods and equipment used for excavation in order to achieve the desired objectives (that is, maintaining a dry condition at the bottom of the excavation during installation of structures, preparation of stable subgrades, etc.). Temporary portable cofferdams, sandbags, supersacks or berms with bypass culverts or pumps may be required to mitigate surface water inflow. If utilized, local sump pumps should be surrounded by ¾-inch Crushed Stone wrapped in non-woven

filter fabric and well points should utilize properly graded filter material to limit migration of fines. Dewatering discharge must satisfy requirements of local, state and federal environmental and conservation authorities.

4. EXCAVATIONS / PROTECTION OF EXISTING UTILITIES

We anticipate that the excavations can be made using conventional earthmoving equipment. Most excavations are expected to be less than about 5 feet deep and should not require excavation support systems but will likely require dewatering to maintain stable side slopes and bottom subgrade. Where open excavations are constructed, the side slopes should be designed and sloped in accordance with OSHA regulations. Where excavation support is used, the Contractor's engineer should design the excavation support system.

Excavations should not extend into the zone of influence of any utility or structure. The zone of influence is defined as a line extending 2 feet beyond the bottom exterior edge of the foundation or springline of the utility then down and away at a one horizontal to one vertical (1H:1V) slope. Undermining of existing foundations or utilities must not occur.

5. BACKFILL AND COMPACTION

Embankment fill and fill placed behind the abutments should be in accordance with Sections 150 and M of MassDOT Standard Specifications for Highways and Bridges. Reference is also made to **Table F**.

Table F: Backfill Material Specification & Recommended Use

Borrow Material	MassDOT Spec. No.	Use
Ordinary Borrow	M1.01.0	General Fill
Special Borrow	M1.02.0	Drainage, Stabilization Fill
Gravel Borrow	M1.03.0, Type B	Behind abutments and wingwalls and as embankment fill
Crushed Stone	M2.01.4	Drainage

Fill should be placed in loose layers not more than 12 inches thick and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). In confined areas, place only 6-inch layers and compact with manually operated, powered vibratory compactor acceptable to the geotechnical engineer. Crushed Stone should be placed in lifts no greater than 12-inches-thick with each lift compacted to an unyielding surface. Crushed Stone placed in layers greater than 4 inches should be wrapped all-around in non-woven geotextile fabric. Fill should be free of frost and not be placed over frozen soil. Subgrades should be protected against frost during and after construction.

6. REUSE OF EXCAVATED MATERIALS

Based on the soil descriptions on the boring logs, it is not expected that the existing on-site soils will meet the gradation requirements for the borrow materials presented in **Table F**, except ordinary borrow. Excavated soil that cannot be reused on-site or on other portions of the project should be removed from the site in accordance with applicable local, state and federal regulations.

FINAL DESIGN, CONTRACT DOCUMENTS AND CONSTRUCTION MONITORING

GZA will continue to support you with preparation of specifications and review of near final plans for conformance with our geotechnical recommendations. We also recommend that during construction GZA provide review of contractor submittals related to foundations and earthwork, and construction QA/QC observation and testing services during the earthwork and helical pile installation phases of the project. Construction services may include verification of subgrade soils, observation of proof-rolling operations and placement of fill, performance of field density tests, observation of helical pile testing and production installation, and in general, observe compliance with recommendations in this report and the Contract Documents. This construction oversight is considered an important part of obtaining quality site improvements.

CLOSING

We trust the information presented herein is sufficient for your use in preliminary design of the proposed Peabody Bikeway structures. We look forward to working with you as you advance the project through Final Design. Please contact the undersigned with any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Michael P. Smith, P.E.
Senior Project Manager

Andrew R. Blaisdell, P.E.
Consultant/Reviewer

Terese M. Kwiatkowski, P.E.
Principal

Attachments: Tables
Figures
Appendix A – Limitations
Appendix B – GZA Boring Logs
~~Appendix C – Rock Core Photographs~~
Appendix D – Geotechnical Laboratory Test Results
~~Appendix E – Environmental Laboratory Test Results~~
~~Appendix F – Calculations~~

\\gzanor\jobs\170,000-179,999\174019\174019-00.MPS\Report\text & PDF 4-16-2021\0174019 Peabody Bikeway_Geotech Report 4-19-2021.docx

Tables

File No. 01.0174019.00
March 2019

Peabody Bikeway - Phase II
Peabody, Massachusetts

TABLE 1
SUMMARY OF ANALYTICAL TESTING RESULTS

	Left Bank at Bridge 0-2'		Right Bank at Bridge 0-2'		Boring B-5 - Culvert 0-2'		Boring B-6 - Culvert 0-2'		MCP RCS-1	MA Unlined Landfill	MA Lined Landfill	Asphalt Batch Facility	401 WQC Parameters
Volatile Organic Compounds (mg/kg) EPA Method 8260	ND		ND		0.036		0.0933		4	4	10	30 to 1800 (Variable)	0.1
Semi-Volatile Organics (mg/kg) EPA Method 8270													
Phenanthrene	0.647		ND		ND		ND		10				
Anthracene	ND		ND		ND		ND		1000				
Fluoranthene	1.41		ND		ND		1.14		1000				
Pyrene	0.955		ND		ND		1.01		1000				
Benzo [a] Anthracene	0.573		ND		ND		0.459		7				
Chrysene	0.647		ND		ND		0.666		70				
Benzo [b] Fluoranthene	0.577		ND		ND		0.684		7				
Benzo [k] Fluoranthene	ND		ND		ND		ND		70				
Benzo [a] Pyrene	0.518		ND		ND		0.499		2				
Indeno [1,2,3-cd] Pyrene	ND		ND		ND		ND		7				
Benzo [g,h,i] Perylene	ND		ND		ND		0.488		1000				
Total SVOCs	*5.3*		*0.0*		*0.0*		*0.0*			*100*	*100*		
Extractable Petroleum Hydrocarbons (mg/kg) MADEP													
Unadjusted C11-C22 Aromatic	29.6		ND		ND		57.0		1000				25
C9-C18 Aliphatic Fraction	ND		ND		ND		ND		1000				
C19-C36 Aliphatic Fraction	ND		ND		ND		40.5		3000				
C11-C22 Aromatic Fraction	26.7		ND		ND		49.4		1000				
Total Petroleum Hydrocarbons (mg/kg)	41.4		12.9		29.2		43.4		1000	2,500	5,000	5,000 to 60,000 (Variable)	
Organochlorine Peticides (mg/kg) EPA 8081	ND		ND		ND		ND						
Polychlorinated Biphenyls (mg/kg) EPA Method 8082	ND		ND		ND		ND			<2	<2	<2	0.01
Herbicides (mg/kg) EPA 8151	ND		ND		ND		0.126						
Total Metals (mg/kg) EPA 6010C													
Arsenic	5.53		3.05		2.66		4.84		20	40	40	30	0.5
Cadmium	0.73		ND		0.31		0.48		2	30	80	11 to 30 (Var.)	0.1
Chromium	130.0	§	18.5		14.9		96.7	§	30	1,000	1,000	500	1
Copper	NS		NS		NS		NS		1,000				1
Mercury	0.098		0.045		0.011		0.085		20	10	10	3 to 10 (Var.)	0.02
Nickel	NS		NS		NS		NS		20				1
Lead	110		15		17		51		300	1,000	2,000	1,000	1
Zinc	NS		NS		NS		NS		2500				1
Reactivity (mg/kg) EPA 7.3.3, 7.3.4													
Cyanide	ND		ND		ND		ND						
Sulfide	ND		ND		ND		ND						
Conductivity (uS/cm) EPA 9050A	306		170		240		262			4,000	8,000		
Flashpoint (° F) EPA 1010	>200		>200		>200		>200						
Total Organic Carbon (%) EPA 9060	5.42		1.29		5.33		6.01						0.10
Water Content (%) SM 2540 G	48.5		19.6		23.7		94.9						
Total Volatile Solids (%) SM 2540G	NS		NS		NS		NS						
pH (mg/kg) EPA 9045	6.68		6.63		6.38		6.70						
TCLP Lead (mg/l) EPA 1311/6010B	N/A		N/A		N/A		N/A						

Notes:

1. Samples collected on January 4, 2019 by GZA personnel. Analyses performed by ESS Laboratory in Cranston, RI except for Grain Size Analysis which was subcontracted to Thielsch Engineering in Cranston, RI.
2. ND = Not Detected, NS = Not Sampled, NA = Not Applicable.
3. Massachusetts Contingency Plan (MCP) RC S-1 standards as per MCP CMR 40.1600; MA Lined & Unlined Landfill Criteria per Massachusetts State DEP Policy # COMM-97-001; Asphalt Batch Criteria per Massachusetts State DEP Policy # WSC 94-400.
4. Where RCS-1, MA Landfills, and Asphalt Batch Facility columns are blank, no limiting criteria has been established.
5. VOC and SVOC constituents that were not detected were omitted from this table.
6. TPH taken as sum of EPH fractions, in accordance with MassDEP guidance.
7. § = reported concentration exceeds the Massachusetts Contingency Plan (MCP) RC S-1 standards as per MCP CMR 40.1600
8. Bold text indicates that the reported concentration exceeds the disposal criteria for a MA Unlined Landfill.
9. Bold italicized text indicates that the reported concentration exceeds the disposal criteria for a MA Lined Landfill.
10. Asphalt batching facility criteria will vary, especially at out-of-state locations.

Peabody Bikeway - Phase II
Peabody, Massachusetts

TABLE 2
SUMMARY OF SUBSURFACE CONDITIONS

Boring No.	Boring Location[7]	Approximate Ground Surface Elevation[1,2] (ft)	Thickness of Fill/Topsoil (ft)	Depth / El. Top of Naturally Deposited Soil (ft)		Depth / El. Top of Bedrock[3] (ft)		Depth / El. Bottom of Boring (ft)		Depth / El. of Groundwater[4,5] (ft)	
B-1	North Shore Road Segment	68.6	5.3	5.3	63.3	15.3	53.3	15	53	6.5	62.1
B-2		68.4	4.0	4.0	64.4	10.5	57.9	11	58	10.0	58.4
B-3		62.3	8.0	8.0	54.3	14.7	47.6	15	48	NE	NE
B-4		51.8	3.5	3.5	48.3	17.0	34.8	17	35	9.5	42.3
B-5	Box Culverts	Not Yet Drilled									
B-6		40.5	2.0	2.0	38.5	25.9	14.6	26	15	3.5	37.0
B-7	Pedestrian Bridge	38.5	4.0	4.0	34.5	23.8	14.7	36	3	2.8	35.7
B-8		37.8	4.0	4.0	33.8	31.0	6.8	41	-3	5.8	32.0

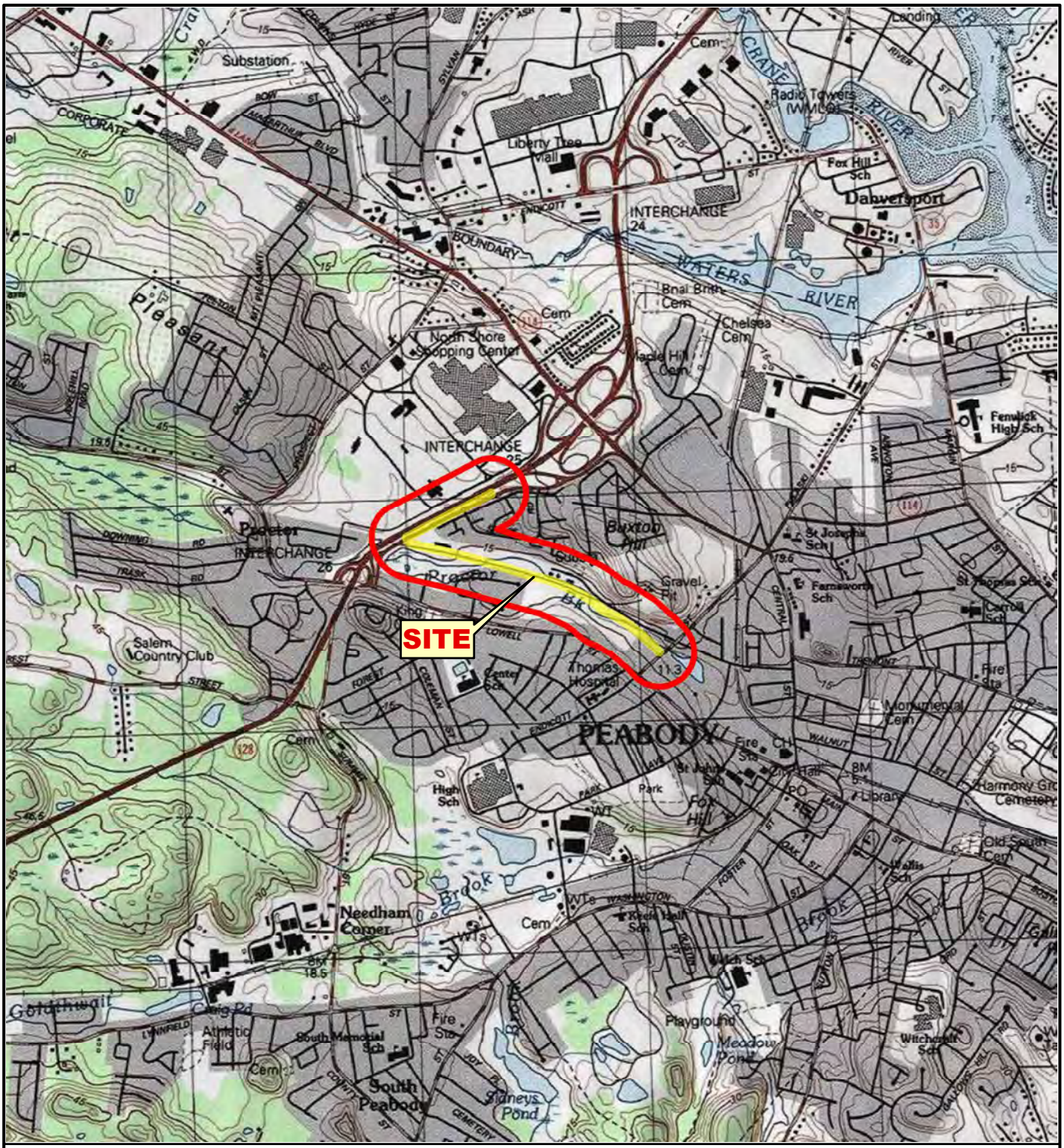
Notes:

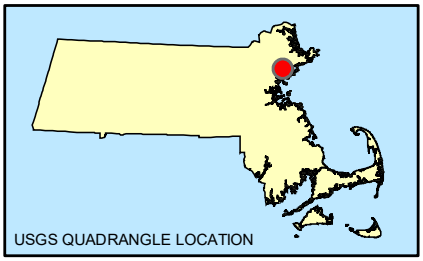
1. Ground surface elevation estimated from electronic plan entitled Peabody Bike Path 2018 Merge Basempap-Final.DWG", provided by Green on 1/16/2019.
2. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).
3. Depth to top of bedrock for borings B-1 through B-6 is based on refusal to the split-spoon or auger. Rock coring not performed in these borings. Depth to bedrock for borings B-7 and B-8 was confirmed by rock coring. Top of rock noted in boring B-7 is top of competent rock. An approximate 1.2 feet of weathered rock was encountered prior to the start of rock coring.
4. NE = Not Encountered.
5. Refer to the boring logs for additional notes and stabilization times at the time of the measurement.

Proposal No. 609211-132091

A00860 - 255

Figures





SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED SEPTEMBER 26, 2018 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

PROJ. MGR.: MPS
DESIGNED BY: ZSM
REVIEWED BY: TMK
OPERATOR: EMD

DATE: 01-30-2019

SITE LOCUS PLAN

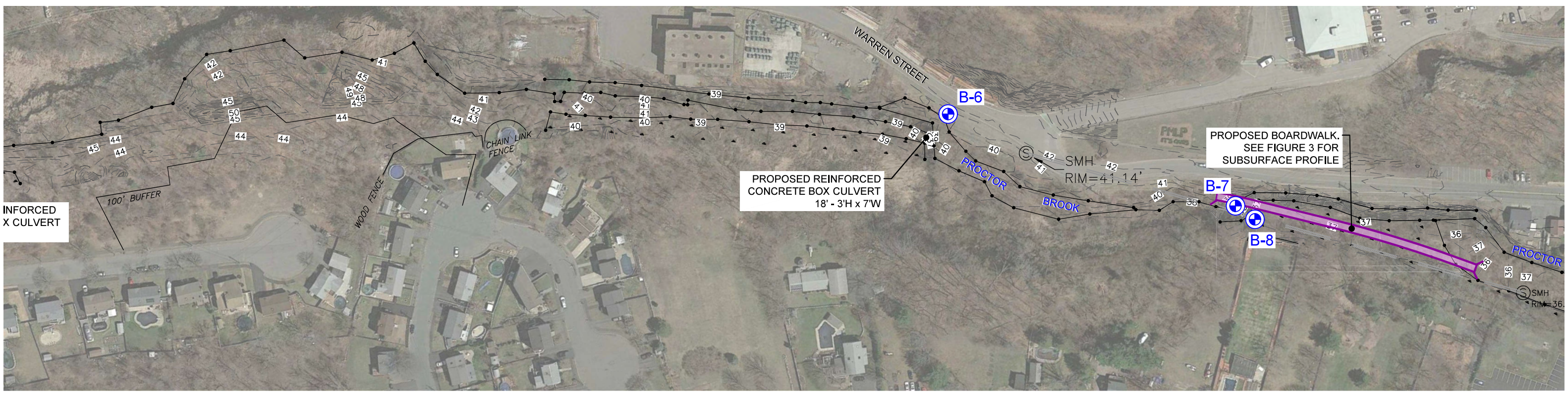
PEABODY BIKEWAY - PHASE II
PEABODY, MASSACHUSETTS

JOB NO. 01.0174019.00

FIGURE NO. 1

© 2019 - GZA GeoEnvironmental, Inc., J:\170,000-179,999\174019\174019-00.MPS\Figures_GIS\174019_SiteLocus_PeabodyBikePath_FIG1.mxd, 1/30/2019, 10:43:13 AM, elaine.donohue

NORTH SHORE ROAD BASE PLAN



AN

4000

LE IN FEET

LEGEND

SOIL BORING

PROCTOR BROOK BASE PLAN

0 75 150 300

BASEMAP SCALE IN FEET

NOTES:

1. THE BASEMAP WAS DEVELOPED FROM ELECTRONIC CAD FILE PLANS "Peabody Bike Path 2018 Merge Basemap-Final.DWG" PROVIDED BY GREEN INTERNATIONAL INC., ON 01/16/2019.
2. BORINGS WERE PERFORMED BY NEW ENGLAND BORING COMPANY OF DERRY, NEW HAMPSHIRE BETWEEN JANUARY 2 AND 15, 2019.
3. LOCATIONS OF BORINGS WERE LOCATED IN THE FIELD USING A TRIMBLE GPS UNIT. SEVERAL BORING LOCATIONS WERE MOVED IN THE FIELD DURING THE DRILLING PROGRAM BASED ON SITE ACCESS. REVISED LOCATIONS WERE BASED ON TAPED MEASUREMENTS FROM MARKED LOCATIONS. EXPLORATION LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.
4. TEST BORING B-5 WAS NOT PERFORMED DUE TO ACCESSIBILITY ISSUES BUT MAY BE DRILLED AT A LATER DATE AS A CONFIRMATION BORING DURING CONSTRUCTION.

NO.	DATE	ISSUE/DESCRIPTION	BY	REV'D	CHK'D
1	4/16/21	REVISE BRIDGE TO BOARDWALK / REMOVE WALLS	MPS	TMK	ARB

UNLESS SPECIFICALLY STATED BY WRITTE
GEOENVIRONMENTAL, INC. (GZA). THE INFO
CLIENT OR THE CLIENT'S DESIGNATED REPRE
THE DRAWING. THE DRAWING SHALL NOT BE
USE AT ANY OTHER LOCATION OR FOR ANY
TRANSFER, REUSE, OR MODIFICATION TO THE
EXPRESS CONSENT OF GZA, WILL BE AT TH

PEABODY
PEABODY

EXPLORATI

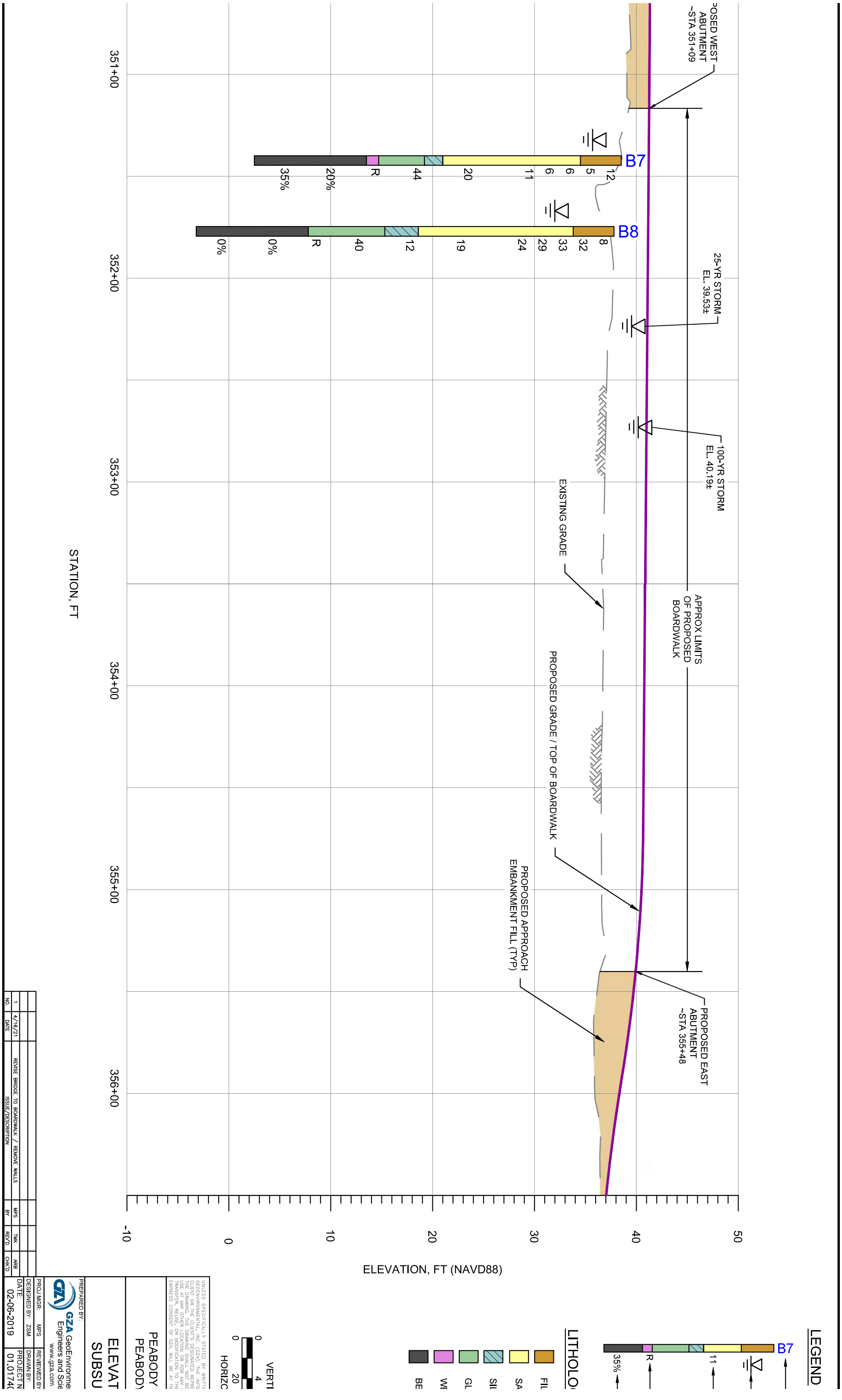
PREPARED BY:

GZA GeoEnvironme
Engineers and Scie
www.gza.com

PROJ MGR: MPS	REVIEWED BY
DESIGNED BY: ZSM	DRAWN BY:
DATE: 02-06-2019	PROJECT N 01.0174(

Proposal No. 609211-132091

A00860 - 258


LEGEND
B7
11
R
35%
LITHOLO
FIL
SA
SI
GL
WI
BE
VERTI
0
4
0
20
HORIZC
PEABODY
PEABODY
ELEVAT
SUBSU
PREPARED BY:
GZA GeoEnvironme
Engineers and Scie
www.gza.com
PROJ MGR: MPS
REVIEWED BY
DESIGNED BY: ZSM
DRAWN BY:
DATE: 02-06-2019
PROJECT N
01.0174(
NO. DATE ISSUE/DESCRIPTION BY REV'D CHK'D
1 4/16/21 REVISE BRIDGE TO BOARDWALK / REMOVE WALLS MPS TMK ARB
PROPOSED EAST ABUTMENT ~STA 355+48
PROPOSED APPROACH EMBANKMENT FILL (TYP)
PROPOSED GRADE / TOP OF BOARDWALK
APPROX LIMITS OF PROPOSED BOARDWALK
EXISTING GRADE
25-YR STORM EL. 39.53±
100-YR STORM EL. 40.19±
PROPOSED WEST ABUTMENT ~STA 351+09
B7
B8
5 6 6 11 20 44 R 20% 35%
12 8 32 33 29 24 19 12 40 R 0% 0%
351+00
352+00
353+00
354+00
355+00
356+00
STATION, FT
50
40
30
20
10
0
-10
ELEVATION, FT (NAVD88)

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of Green International Affiliates, Inc. (Green) for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in the Report) at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

COMPLIANCE WITH CODES AND REGULATIONS

9. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

ADDITIONAL SERVICES

10. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – GZA Boring Logs

Modified Burmister Soil Classification

Soil samples are visually classified by the Modified Burmister System using the following format and order:

1. Density or Consistency
2. Color
3. MAJOR SOIL TYPE
4. Minor Components
5. Special Components

Density or Consistency – Density or consistency estimates are based on the measured N-Values obtained from the Standard Penetration Test (SPT). For granular soils (sand, gravel, silt), density is reported. For plastic soils, consistency is reported. Broken gravel, if encountered at the tip of the spoon, is indicated on the log and will affect the measured SPT N-Value.

Table A-1: Density and Consistency of Soils

Granular Soils		Plastic Soils	
SPT N-Value	Relative Density	SPT N-Value	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

Color - The color of the soil matrix is estimated in the field by the engineer or geologist observing the borehole.

Major Soil Type - The soil type is determined by the major component of the soil that comprises 50% or more of the sample by weight. The major component in the description is capitalized (e.g. SAND, GRAVEL, SILT).

Table A-2: Soil Types/Components

Sieve Size	Description	Visual Description
Passing No. 200	SILT	No grains, cannot roll into thread
	Clayey SILT	Can roll into 1/4" thread*
	SILT & CLAY	Can roll into 1/8" thread*
	CLAY & SILT	Can roll into 1/16" thread*
	Silty CLAY	Can roll into 1/32" thread*
	CLAY	Can roll into 1/64" thread*
No. 200 – No. 40	Fine SAND	Finest Visible Particles
No. 40 – No. 10	Medium SAND	1/64 to 1/16"
No. 10 – No. 4	Coarse SAND	1/16 to 1/4"
No. 4 – 3/4 Inch	Fine GRAVEL	1/4 to 3/4"
3/4 Inch – 3 Inch	Coarse GRAVEL	
3 Inch – 6 Inch	Cobbles	
>6 Inch	Boulders	

* May need to moisten sample to determine thread diameter

Table A-3: Expanded Sand/Gravel Soil Descriptions

Granular Description	Proportions of Component
Fine	Less than 10% coarse and medium
Medium	Less than 10% coarse and fine
Fine to Medium	Less than 10% coarse
Medium to Coarse	Less than 10% fine
Fine to Coarse	All greater than 10%

Minor Components – Minor components are described after the major component in order of decreasing percentages. Only the first letter of the minor component is capitalized, except if "and" is used (e.g. trace Silt).

Table A-4: Definition of Proportional Terms

Proportional Term	Percent by Weight of Total Sample
and	35-50
some	20-35
little	10-20
trace	<10

Special Components – anthropogenic materials encountered in the fill such as Glass, Brick fragments, etc. Proportional terms used are occasional (<15% by weight) and frequent (15% or more by weight).

Modified ISRM Rock Classification

Rock cores are visually classified by the Modified ISRM System using the following format and order: Field hardness, weathering, grain size, color, ROCK TYPE, foliation thickness, foliation dip angle, foliation joint/fracture shape and roughness, foliation joint/fracture spacing, dip angle of other joints and fractures, condition of joint surfaces, other features such as minerals.

FIELD HARDNESS:
Very Hard – Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologists pick.
Hard – Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Medium – Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows from the point of a geologist's pick.
Soft – Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft – Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING:
Fresh – Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Slight – Rock generally fresh, joints stained, and discoloration and weathering effects. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate – Significant portions of rock show discoloration and weathering effects. In granitoid rock, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Severe – All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Complete – Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or Stringers.

GRAIN SIZE:
Fine Grained – Barely seen with naked eye.
Coarse Grained: 1/8 in. to 1/4 in.
Amorphous: Too small to be seen with naked eye.
Medium Grained: Barely seen with naked eye to 1/8 in.
Very Coarse Grained: >1/4 in.

DISCONTINUITIES:
Healed Joint – A partial or incomplete fracture.
Joint/Fracture – A simple fracture along which no shear displacement has occurred. May form sets.
Shear – A zone of fractures along which differential movement has taken place parallel to the surface sufficient to produce slickensides, striations, or polishing. May be accompanied by a zone of fractured rock up to a few inches wide.
Fault – A fracture along which there has been displacement and accompanying slickensides, striations, or polishing by gouge and/or severely fractured adjacent zone.
Shear or Fault Zone – A band or zone of parallel, closely spaced shears or faults accompanied by gouge, maylonite, and breccia.

Table A-5: Fractures and Foliation Spacing and Attitude

Fractures	Foliation	Spacing	Attitude	Angle
Very close	Very thin	Less than 2 in.	Horizontal	0° - 5°
Close	Thin	2 in. - 1 ft.	Subhorizontal	5° - 35°
Moderately close	Medium	1 ft. - 3 ft.	Moderately dipping	35° - 55°
Wide	Thick	3 ft. - 10 ft.	Subvertical	55° - 85°
Very Wide	Very thick	More than 10 ft.	Vertical	85° - 90°

Table A-6: Condition of Joint/Fracture Surfaces

Descriptive Term	Conditions
Planar	A flat surface
Curved	A curved surface
Irregular	Multi-curved surface
Slick	A polished and striated surface indicating sliding along a plane; also referred to as slickensided.
Smooth	Few irregularities, but no obvious indication of sliding; adjacent pieces of core can be slid past on another with relative ease.
Rough	Many irregularities; difficult to slide adjacent pieces of core by each other.

GZA reports the total core recovery and rock quality designation for each core run* on the boring logs. The definitions of these terms are as follows:

TOTAL CORE RECOVERY (REC)

$$\textbf{REC (\%)} = \frac{\text{Sum of Recovered Core}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\textbf{RQD (\%)} = \frac{\text{Sum of Lengths of intact Core with Full Diameter in Pieces 4 in. and Longer}}{\text{Length of Core Run}} \times 100$$

The RQD is in general accordance with methodology described by Deere and Deere (1988). In addition, significant vertical to sub-vertical foliation/cross-foliation joints/fractures occur within the rock mass and influence ground behavior. The length of core exhibiting the vertical to sub-vertical joints/fractures has been deducted from the RQD, which is consistent with the "pieces of intact rock core" criteria. The vertical to sub-vertical joints/fractures have been identified on the rock core or the upside divider in the core box with permanent "dots" spaced every 0.1 feet apart. These dots have been counted and entered in the fractures per foot column on the boring log.

* - RQD not reported for severely and/or completely weathered rock or core runs with length of 2.0 feet or less.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 68.6	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 15.3	
		Date Start - Finish: 1/2/2019 - 1/2/2019	**V. Datum:** NAVD88

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon		
I.D/O.D.(in): 2.75/5.75	**I.D./O.D. (in.):** 1.375/2		
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140		
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30		
Other: -	**Other:** Auto Hammer		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1030	6.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	1 2 2 3	4	S-1: (Top 7") Dry, dark brown, fine SAND and SILT, trace Roots. (TOPSOIL) (Bottom 7") Dry, brown, fine SAND, some Silt, trace Roots. (SUBSOIL)	1 2			FILL	
5		S-2	5-7	24	13	8 19 86 22	R	S-2: (Top 3") Moist, brown, fine to medium SAND, some Silt. (FILL) (Bottom 10") Moist, brown, fine to coarse SAND, little Silt, trace Gravel. (Piece of gravel stuck in tip of spoon.)			5.3		63.3'
		S-3	7-9	24	10	38 42 45 50	87	S-3: Very dense, wet, brown/gray, GRAVEL, some fine to coarse Sand, trace Silt.	3				
10		S-4	9-11	24	7	25 30 13 36	43	S-4: Dense, wet, brown, fine to medium SAND, some Silt, some Gravel.	4			GLACIAL DEPOSIT	
15		S-5	15-15.1	1	1	100/1"	R	S-5: Very dense, wet, brown/gray, GRAVEL, trace Silt. (Fragment of possible bedrock stuck in tip of spoon.)	5 6		15.3		53.3'
								Bottom of boring at 15.3 feet.					
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Borehole relocated approximately 25 feet from staked location due to access.
3. Driller noted increased drilling resistance at 6.5 feet below ground surface (bgs).
4. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 11 feet bgs.
5. Auger refusal at 15.3 feet bgs on possible bedrock. Borehole terminated.
6. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 68.4	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 10.5	
		Date Start - Finish: 1/2/2019 - 1/2/2019	**V. Datum:** NAVD88

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 2.75/5.75	**I.D./O.D. (in.):** 1.375/2	
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30	
Other: -	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1230	10	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	1 4 27 36	31	S-1: (Top 10") Dry, dark brown, fine SAND, some Silt, trace Roots. (TOPSOIL) (Bottom 8") Dry, dark brown/black, fine to medium SAND, little Silt, trace Gravel.	1			FILL	
		S-2	2-4	24	20	30 56 40 36	96	S-2: Very dense, moist, black/gray, fine to coarse SAND, little Silt, trace Gravel.			4		64.4'
5		S-3	4-6	24	9	28 11 19 17	30	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.					
		S-4	6-8	24	14	70 25 20 20	45	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.	2			GLACIAL DEPOSIT	
10		S-5	10-10.3	3	0	100/3"	R	S-5: No recovery. (Fragments of possible bedrock stuck in tip of spoon.)	3 4		10.5		57.9'
								Bottom of boring at 10.5 feet.					
15													
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 6.5 feet below ground surface (bgs).
3. Auger refusal at 10.5 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 62.3	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 14.7	
		Date Start - Finish: 1/3/2019 - 1/3/2019	**V. Datum:** NAVD88

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 2.75/5.75	**I.D./O.D. (in.):** 1.375/2	
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30	
Other: -	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19		Not encountered		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	2 3 11 14	14	S-1: Medium dense, dry, dark brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots. (TOPSOIL)	1				
		S-2	2-4	24	18	14 35 72 69	R	S-2: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.				FILL	
5		S-3	4-6	24	14	27 11 12 14	23	S-3: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
		S-4	6-8	24	10	12 14 5 3	19	S-4: Very dense, moist, black with brown, GRAVEL and fine to coarse SAND, trace Silt, trace Ash.			8		54.3'
		S-5	8-10	24	9	3 6 9 14	15	S-5: Medium dense, moist, brown, fine to coarse SAND, little Gravel, trace Silt.				GLACIAL DEPOSIT	
10													
15		S-6	14.5-14.7	2	0	100/2"	R	S-6: No recovery.	2 3		14.7		47.6'
								Bottom of boring at 14.7 feet.					
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Auger refusal at 14.5 feet below ground surface (bgs) on possible bedrock. Advanced split spoon. Split spoon refusal at 14.7 feet bgs. Borehole terminated.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 51.8	
Logged By: Zachary Morris	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 17	**V. Datum:** NAVD88
		Date Start - Finish: 1/3/2019 - 1/3/2019	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 2.75/5.75	**I.D./O.D. (in.):** 1.375/2	
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30	
Other: -	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1145	9.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	9	3 2 3 2	5	S-1: Loose, dry, dark brown, fine to medium SAND, some Silt, trace Roots.	1				
		S-2	2-4	24	6	2 3 3 14	6	S-2: Loose, moist, brown, fine to coarse SAND, trace Gravel, trace Silt.				FILL	
											3.5		48.3'
5		S-3	4-6	24	14	12 15 23 17	38	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-4	6-8	24	13	13 20 19 19	39	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	6	15 21 30 21	51	S-5: Very dense, wet, brown, fine to coarse SAND, some Gravel, little Silt.	2			GLACIAL DEPOSIT	
15		S-6	15-16.9	23	12	12 18 69 100/5"	87	S-6: Very dense, wet, brown/gray, fine to coarse SAND, some Gravel, little Silt. (Possible bedrock fragments stuck in tip of spoon.)			17		34.8'
								Bottom of boring at 17 feet.	3 4				
20													
25													
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Driller noted increased drilling effort at 9 feet below ground surface (bgs).
3. Auger refusal at 17 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 40.5	
Logged By: Zachary Morris	**Drilling Method:** HSA/D&W	**Final Boring Depth (ft.):** 25.9	
		Date Start - Finish: 1/3/2019 - 1/3/2019	**V. Datum:** NAVD88

Auger/Casing Type: HSA/HW	**Sampler Type:** Split Spoon
I.D/O.D.(in): 2.75/5.75 & 4.0/4.5	**I.D./O.D. (in.):** 1.375/2
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30
Other: Safety Hammer	**Other:** Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1530	3.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	13	4 4 11 5	15	S-1: Medium dense, dry, dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1			FILL	
		S-2	2-4	24	14	9 6 5 6	11	S-2: Medium dense, wet, brown, fine to medium SAND and SILT, trace Gravel.			2		38.5'
5		S-3	4-6	24	14	4 8 10 14	18	S-3: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt.					
		S-4	6-8	24	19	13 16 17 16	33	S-4: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
10		S-5	10-12	24	16	6 11 19 28	30	S-5: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.	2				
15		S-6	14-16	24	7	4 5 6 6	11	S-6: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.				SAND AND GRAVEL	
20		S-7	19-21	24	8	5 6 5 5	11	S-7: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
25		S-8	24-25.9	22	10	16 14 22 100/2"	36	S-8: Dense, wet, brown/gray, fine to coarse SAND and GRAVEL, trace Silt. (Possible bedrock fragments stuck in tip of spoon.)			25.9		14.6'
								Bottom of boring at 25.9 feet.	3				
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Hole appears to have blown in prior to sampling S-5. Blow counts at S-5 may be inaccurate. Driller removed augers and offset 4 feet southeast of staked location and continued hole with 4-inch casing. Samples S-6 through S-8 obtained using drive and wash drilling methods.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-6

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 1 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 38.5	
Logged By: Doug Maguire	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	
		Date Start - Finish: 1/4/2019 - 1/4/2019	**V. Datum:** NAVD88

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375/2	
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30	
Other: Safety Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/4/19	1300	2.8	24	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	2 5 7 4	12	S-1: Medium dense, dark brown, fine to coarse SAND, little Gravel, little Silt, trace Wood, trace Roots.	1 2			FILL/TOPSOIL	
		S-2	2-4	24	9	2 2 3 1	5	S-2: Loose, gray-brown to dark brown, fine to medium SAND, little Silt, little Gravel, trace Roots.	3		4		34.5'
5		S-3	4-6	24	9	3 2 4 4	6	S-3: Loose, gray-brown, fine to medium SAND, little Gravel, little Silt, 3/4" seam of Clayey Silt 4" from bottom.					
		S-4	6-8	24	12	2 3 3 3	6	S-4: (Top 5") Brown, fine to coarse SAND, some Silt, little Gravel. (Bottom 7") Gray, fine to medium SAND, little Gravel, little Silt.					
		S-5	8-10	24	12	5 5 6 6	11	S-5: Medium dense, brown to gray with orange, fine to medium SAND, some Gravel, little Silt. Silt observed 5-6" from bottom.				SAND AND GRAVEL	
10													
		S-6	14-16	24	9	6 9 11 11	20	S-6: Medium dense, light brown, fine to medium SAND, some Gravel, little (-) Silt.	4 5				
15											17.5		21.0'
		S-7	19-21	24	14	21 23 21 22	44	S-7: (Top 3") Light brown, SILT & CLAY, trace fine Sand, trace Gravel. (Bottom 11") Light brown, fine to medium SAND, some Gravel, some Silt.	6			SILT & CLAY	
20											19.3		19.2'
												GLACIAL DEPOSIT	
		S-8	24-24.2	2	2	100/2"	R	S-8: Very dense, gray, GRAVEL, little fine Sand, little Clayey Silt.	7		23.8		14.7'
25											25	WEATHERED BEDROCK	13.5'
	min/ft 2:00 1:30 2:30	C-1	26-31	60	56			C-1: Hard to medium hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, subhorizontal to subvertical joints/fractures. RQD=20%	8			BEDROCK	
30	2:30												

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 5.5 feet south of staked location due to restricted access and overhead wires.
3. Continuous sampling performed from sampling depths 0 to 10 feet below ground surface (bgs). Driller advanced 4-inch casing down as sampling advanced. The casing was advanced to 14 feet bgs following sampling of S-5.
4. Standard sampling performed from sample depths 14 to 24.2 feet bgs.
5. Driller advanced 4-inch casing from 14 to 24 feet bgs.
6. Clayey Silt observed in drill cuttings from 17.5 to 19 feet bgs.
7. Weathered Bedrock fragments and increased drill effort observed at 23.8 feet bgs.
8. Cored bedrock with a downward pressure of 500 psi at 1,350 rpm in 3rd gear using an NX core barrel.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 2 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
35	2:45 2:30 2:45 3:00 3:00 2:45	C-2	31-36	60	60			C-2: Hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, moderately dipping to subvertical joints/fractures. RQD=35%				BEDROCK	
											36		2.5'
								Bottom of boring at 36 feet.	9				
40													
45													
50													
55													
60													
65													

REMARKS

9. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 1 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** NAD83
Foreman: Matt Soucy	**Rig Model:** Soil Scout	**Ground Surface Elev. (ft.):** 37.8	
Logged By: Doug Maguire	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 41	
		Date Start - Finish: 1/15/2019 - 1/15/2019	**V. Datum:** NAVD88

Auger/Casing Type: HW	**Sampler Type:** Split Spoon
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375/2
Hammer Weight (lb.): 300	**Sampler Hmr Wt (lb):** 140
Hammer Fall (in.): 24	**Sampler Hmr Fall (in):** 30
Other: Safety Hammer	**Other:** Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/15/19	1520	5.8	29.5	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	11	6 4 4 6	8	S-1: (Top 6") Brown to light brown, fine to medium SAND, some Gravel, trace Silt, trace Roots.	1 2				
		S-2	2-4	24	5	21 18 14 28	32	(Bottom 5") Dark brown, Organic CLAY & SILT, some fine to medium Sand, little Brick, trace Roots, trace Glass.	3			FILL	
								S-2: Hard, dark brown, CLAY & SILT, some fine to medium Sand, little Gravel, trace Roots.			4		33.8'
5		S-3	4-6	24	7	18 15 18 12	33	S-3: Dense, gray-brown, fine to coarse SAND, some Gravel, some Clayey Silt.					
		S-4	6-8	24	15	17 16 13 14	29	S-4: Medium dense, light brown to gray, fine to coarse SAND, some Clayey Silt, some Gravel.					
		S-5	8-10	24	8	16 11 13 13	24	S-5: Dense, light brown, fine to medium SAND, some Gravel, little Silt.					
10												SAND AND GRAVEL	
15		S-6	14-16	24	7	6 10 9 10	19	S-6: Medium dense, light brown, fine to medium SAND, little Silt, trace (+) Gravel.					
											19.2		18.6'
20		S-7	19-21	24	12	6 6 6 7	12	S-7: (Top 2") Light brown, fine to medium SAND, little Silt.					
								(Bottom 10") Brown-gray, SILT & CLAY, trace fine Sand.				SILT & CLAY	
											22.5		15.3'
25		S-8	24-26	24	6	26 22 18 23	40	S-8: Dense, gray-brown, fine to coarse SAND, some Silt, some Gravel.				GLACIAL DEPOSIT	
30		S-9	29-29.4	5	5	100/5"	R	S-9: Very dense, gray, GRAVEL, some fine to coarse Sand, little (-)			30		7.8'

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 3.5 feet south due to restricted access.
3. Advanced boring using 4-inch casing from sample depths 0 to 29 feet below ground surface (bgs).
4. Consistent coarse sand-sized rock fragments observed in drill cuttings from sample depths 30 to 31 feet bgs.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 2 of 2
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
	min/ft							Silt.	4				
	3:00	C-1	31-36	60	42			C-1: Hard, slightly to moderately weathered, coarse to medium grained, gray with purple, GRANITE, rough, irregular to planar, very close, subvertical to subhorizontal joints/fractures. RQD=0%	5				
	3:45												
	4:30												
35	5:15												
	4:15								6			BEDROCK	
	4:45	C-2	36-41	60	60			C-2: Hard, slightly weathered, coarse to medium grained, gray with pink and purple, GRANITE, rough, irregular to planar, very close, subhorizontal to subvertical joints/fractures. RQD=0%					
	5:15												
	4:30												
40	4:30												
	3:30										41		-3.2'
								Bottom of boring at 41 feet.	7				
45													
50													
55													
60													
65													

REMARKS

5. Drill rig did not have a downward pressure or RPM gauge. Cored bedrock in 3rd gear using an NX core barrel.
6. Core barrel jammed with no loss of water at sample depths 35.1 and 38.3 feet bgs.
7. Borehole backfilled to approximate ground surface with drill cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

Appendix D – Geotechnical Laboratory Test Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/16/2019

LABORATORY TESTING DATA SHEET

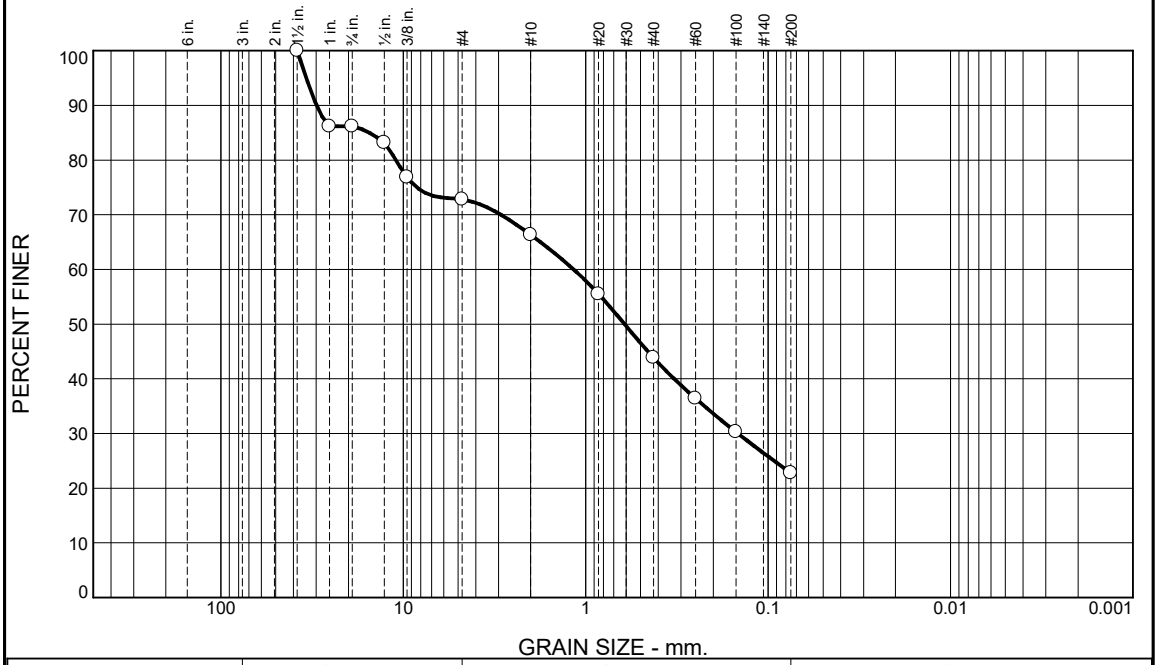
Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
B-2	S-3	4-6	S-9				27.2	50.0	22.8											Brown f-c SAND, some f-c Gravel, some Silt
B-3	S-4	6-8	S-10				53.6	41.3	5.1											Dark Brown f-c GRAVEL and f-c SAND, trace Silt
B-6	S-4	6-8	S-11				6.8	84.5	8.7											Light Brown f-c SAND, trace Silt, trace fine Gravel
B-7	S-5	8-10	S-12				27.9	61.1	11.0											Dark Brown f-m SAND, some fine Gravel, little Silt

Reviewed By _____

01.16.2019

Proposal No. 609211-132091
A00860 - 276

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.8	13.4	6.5	22.4	21.1	22.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	86.2		
3/4"	86.2		
1/2"	83.2		
3/8"	76.9		
#4	72.8		
#10	66.3		
#20	55.5		
#40	43.9		
#60	36.4		
#100	30.3		
#200	22.8		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, some Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 29.8357 D_{85}= 15.3436 D_{60}= 1.1650
D_{50}= 0.6121 D_{30}= 0.1465 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 4-6' **Date Sampled:**
Sample Number: B-2 / S-3

Thielsch Engineering Inc.

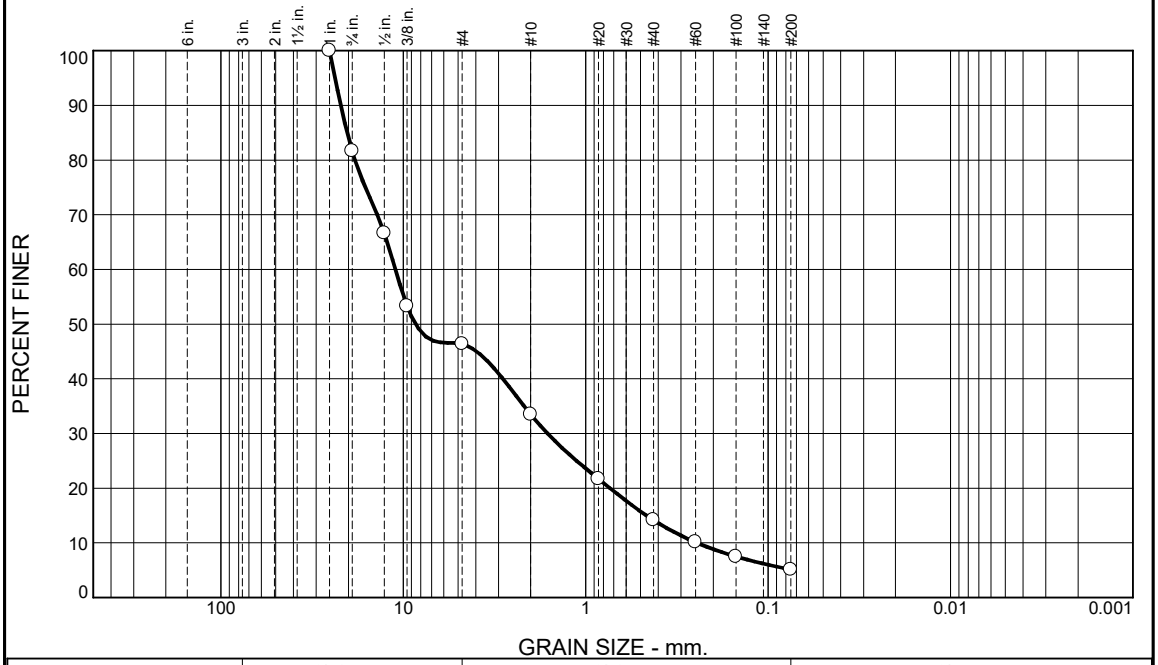
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.3	35.3	12.9	19.3	9.1	5.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	81.7		
0.5"	66.6		
0.375"	53.3		
#4	46.4		
#10	33.5		
#20	21.7		
#40	14.2		
#60	10.1		
#100	7.5		
#200	5.1		

* (no specification provided)

Material Description

Dark Brown f-c GRAVEL and f-c SAND, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GP-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 21.9730 D_{85}= 20.2661 D_{60}= 11.0467
D_{50}= 8.5608 D_{30}= 1.6167 D_{15}= 0.4639
D_{10}= 0.2452 C_u= 45.05 C_c= 0.97

Remarks

Sample contains asphalt and urban debris.

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 6-8' **Date Sampled:**
Sample Number: B-3 / S-4

Thielsch Engineering Inc.

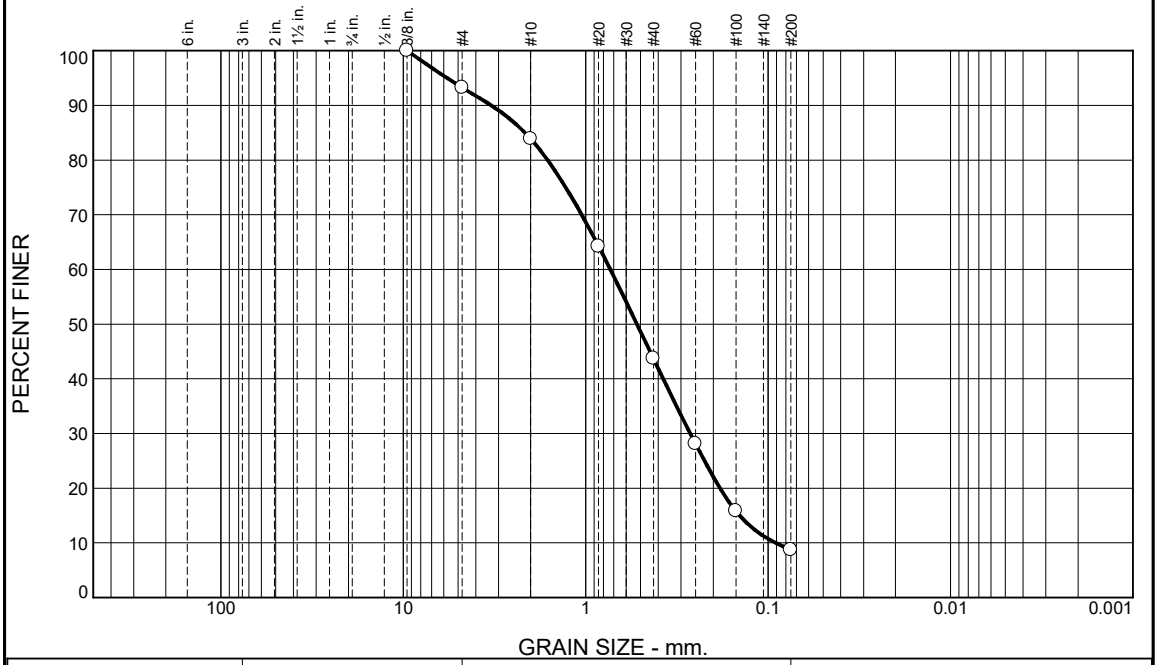
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.8	9.3	40.2	35.0	8.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	93.2		
#10	83.9		
#20	64.2		
#40	43.7		
#60	28.1		
#100	15.8		
#200	8.7		

* (no specification provided)

Material Description

Light Brown f-c SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 3.3007 D_{85}= 2.1523 D_{60}= 0.7332
D_{50}= 0.5236 D_{30}= 0.2672 D_{15}= 0.1431
D_{10}= 0.0909 C_u= 8.07 C_c= 1.07

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 6-8' **Date Sampled:**
Sample Number: B-6 / S-4

Thielsch Engineering Inc.

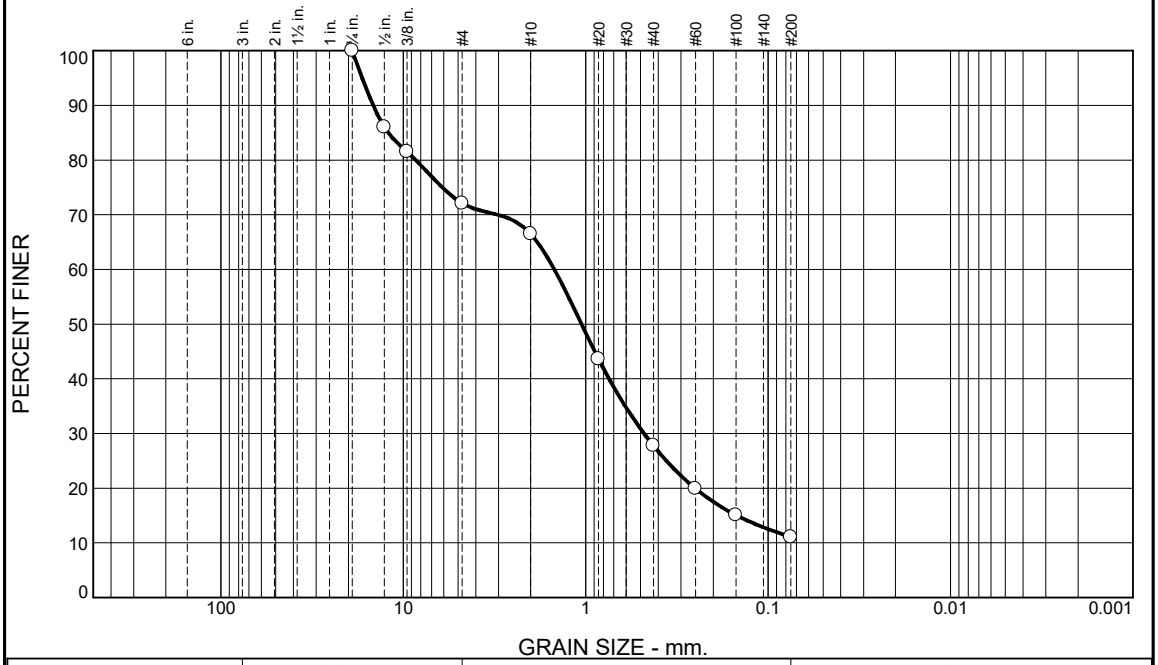
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	27.9	5.6	38.7	16.8	11.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	86.0		
0.375"	81.5		
#4	72.1		
#10	66.5		
#20	43.6		
#40	27.8		
#60	19.9		
#100	15.1		
#200	11.0		

* (no specification provided)

Material Description

Dark Brown f-m SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.6216 D_{85}= 12.1017 D_{60}= 1.4842
D_{50}= 1.0542 D_{30}= 0.4789 D_{15}= 0.1486
D_{10}= C_u= C_c=

Remarks

Date Received: 1.10.19 **Date Tested:** 1.16.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 8-10' **Date Sampled:**
Sample Number: B-7 / S-5

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-12

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Mike Smith
Assigned By: Zach Morris
Collected By: Client

Project Information:
Greenway Extension - Peabody Bikeway
Peabody, MA
GZA Project Number: 01.0174019.00
Summary Page: 1 of 1
Report Date: 1/14/2019

LABORATORY TESTING DATA SHEET

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge - Left Bank	Grab-1	0-2	S-1				15.6	67.4	17.0											Brown f-c SAND, little Silt, little fine Gravel
Bridge - Center Brook	Grab-2	0-2	S-2				32.6	65.8	1.6											Brown m-c SAND, some fine Gravel, trace Silt
Bridge - Right Bank	Grab-3	0-2	S-3				30.3	60.7	9.0											Brown f-c SAND, some fine Gravel, trace Silt
Upstream of Bridge - Left Bank	Grab-4	0-2	S-4				4.7	67.2	28.1											Brown f-m SAND, some Silt, trace fine Gravel
Upstream of Bridge - Center Brook	Grab-5	0-2	S-5				0.6	94.3	5.1											Brown f-m SAND, trace Silt, trace fine Gravel
Upstream of Bridge - Right Bank	Grab-6	0-2	S-6				0.0	24.3	75.7											Brown SILT, some fine Sand
Upstream from Culvert near B-5	Grab-7	0-2	S-7				47.2	50.3	2.5											Brown f-c SAND and fine GRAVEL, trace Silt
Upstream from Culvert near B-6	Grab-8	0-2	S-8				23.2	61.5	15.3											Brown f-c SAND, some f-c Gravel, little Silt

Reviewed By _____ 01.14.2019

Proposal No. 609211-132091
A00860 - 281

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Michael Smith
Assigned By: Michael Smith
Collected By: Glenn LaRose, Zach Morris

Project Information:
Peabody Bikeway
Peabody, MA
ESS Project Number: 1901077
Summary Page: 1 of 1
Report Date: 1.10.19

LABORATORY TESTING DATA SHEET

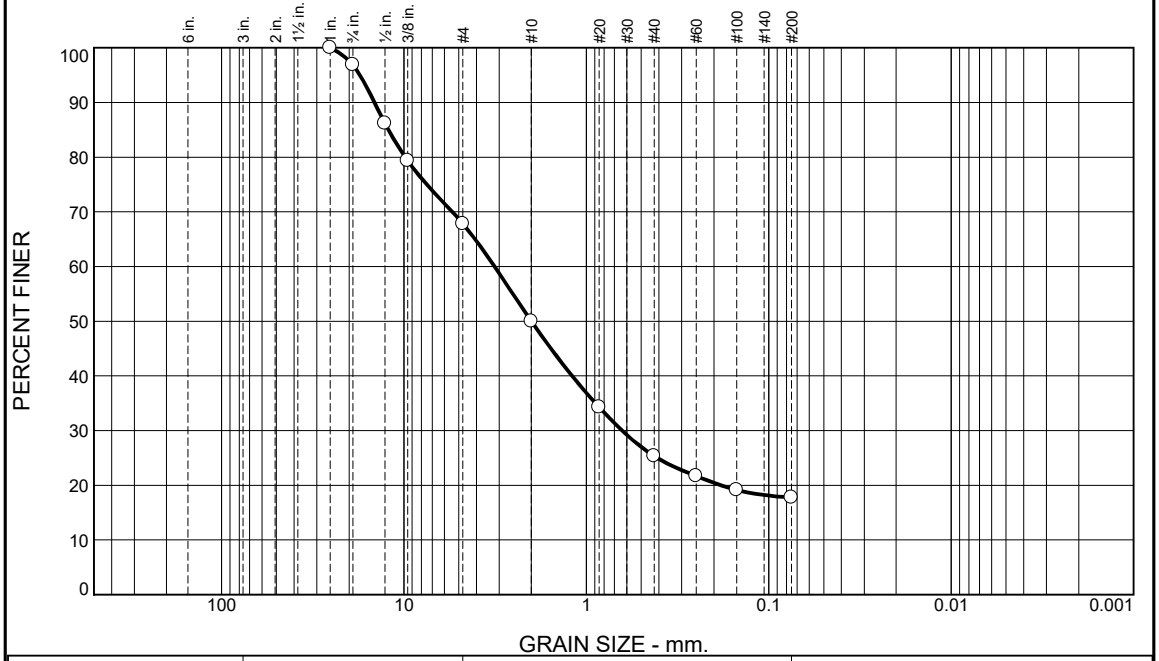
Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability (cm/sec)	
				D2216	D4318		D6913			D2874	D854			D1557			D1883			
Bridge	Left Bank	0-2	19-S-013	48.5						10.7										Organic Only
Bridge	Right Bank	0-2	19-S-014	19.6						1.8										Organic Only
B-5	Culvert	0-2	19-S-015	23.7			32.2	50.1	17.7	1.8										Black Organic f-c SAND, some fine Gravel, little Silt
B-6	Culvert	0-2	19-S-016	94.9			40.9	44.0	15.1	10.2										Black Organic f-c SAND and f-c GRAVEL, little Silt

Reviewed By Sth Ao

01.14.2019

Proposal No. 609211-132091
A00860 - 282

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	29.1	17.8	24.6	7.7	17.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.9		
0.5"	86.2		
0.375"	79.3		
#4	67.8		
#10	50.0		
#20	34.3		
#40	25.4		
#60	21.7		
#100	19.1		
#200	17.7		

* (no specification provided)

Material Description

Black Organic f-c SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.5059 D_{85}= 12.1566 D_{60}= 3.1859
D_{50}= 2.0007 D_{30}= 0.6368 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B5 / Culvert

Thielsch Engineering Inc.

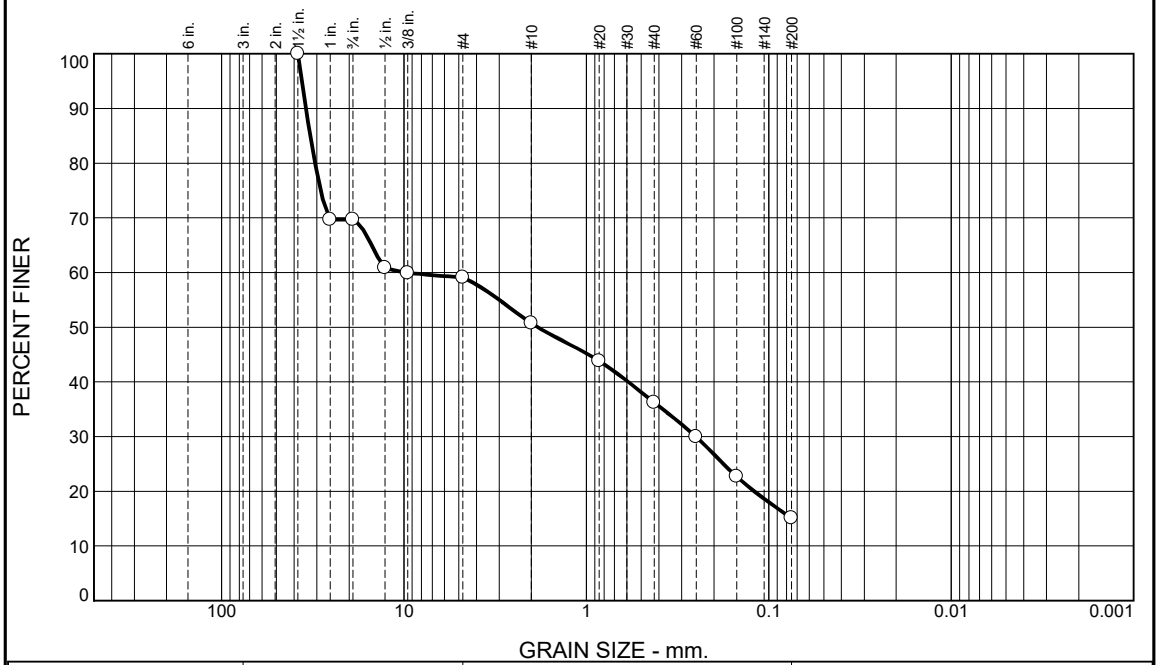
Cranston, RI

Client: ESS

Project: Peabody Bikeway
Peabody, MA

Project No: 1901077 **Figure** 1901077-03

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.3	10.6	8.4	14.5	21.1	15.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	69.7		
3/4"	69.7		
1/2"	60.8		
3/8"	59.9		
#4	59.1		
#10	50.7		
#20	43.8		
#40	36.2		
#60	29.9		
#100	22.7		
#200	15.1		

* (no specification provided)

Material Description

Black Organic f-c SAND and f-c GRAVEL, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 34.4095 D_{85}= 32.5903 D_{60}= 9.8653
D_{50}= 1.8449 D_{30}= 0.2513 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1.8.19 **Date Tested:** 1.10.19

Tested By: MN

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 0-2' **Date Sampled:** 1.4.19
Sample Number: B6 / Culvert

Thielsch Engineering Inc.

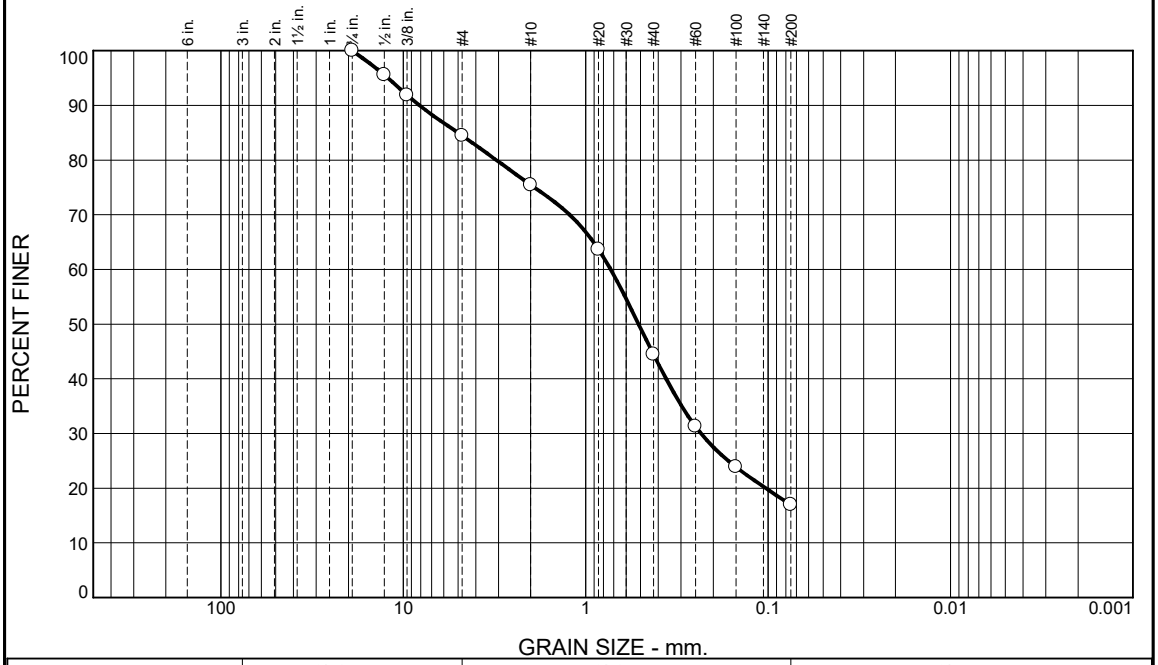
Cranston, RI

Client: ESS

Project: Peabody Bikeway
Peabody, MA

Project No: 1901077 **Figure** 1901077-04

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.6	8.9	31.0	27.5	17.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	95.6		
0.375"	91.9		
#4	84.4		
#10	75.5		
#20	63.6		
#40	44.5		
#60	31.3		
#100	23.9		
#200	17.0		

* (no specification provided)

Material Description

Brown f-c SAND, little Silt, little fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 8.1481 D_{85}= 5.0207 D_{60}= 0.7300
D_{50}= 0.5128 D_{30}= 0.2334 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 1

Thielsch Engineering Inc.

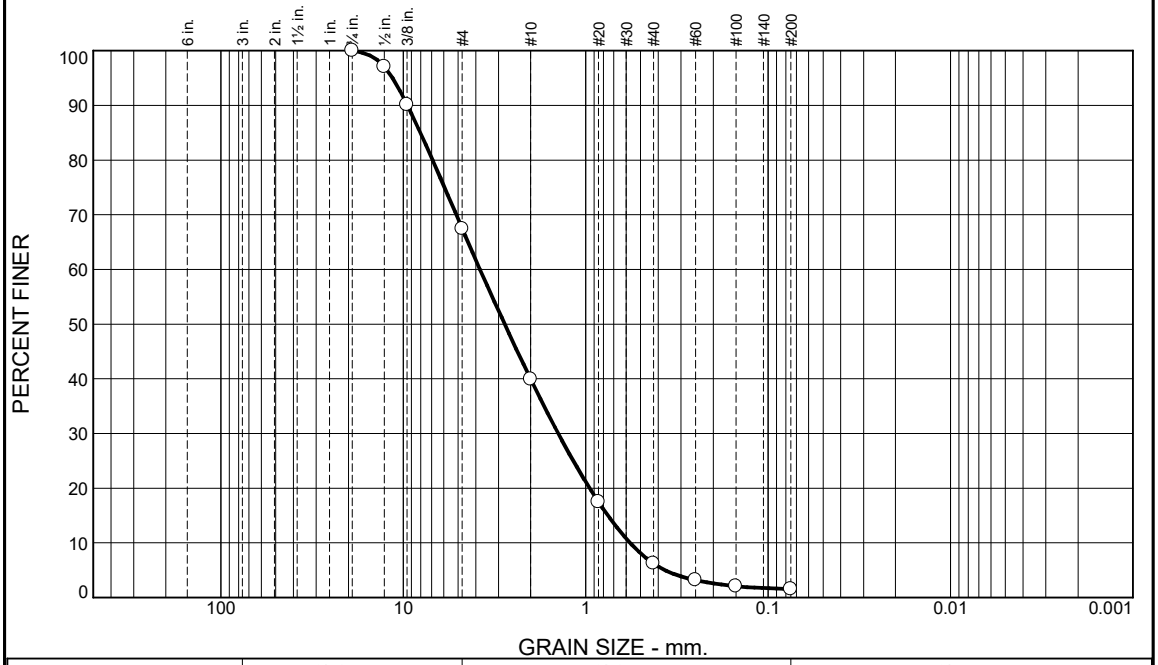
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	32.6	27.5	33.7	4.6	1.6	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.1		
0.375"	90.1		
#4	67.4		
#10	39.9		
#20	17.5		
#40	6.2		
#60	3.2		
#100	2.1		
#200	1.6		

* (no specification provided)

Material Description

Brown m-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 9.4954 D_{85}= 8.0567 D_{60}= 3.7970
D_{50}= 2.7818 D_{30}= 1.4137 D_{15}= 0.7552
D_{10}= 0.5709 C_u= 6.65 C_c= 0.92

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 2

Thielsch Engineering Inc.

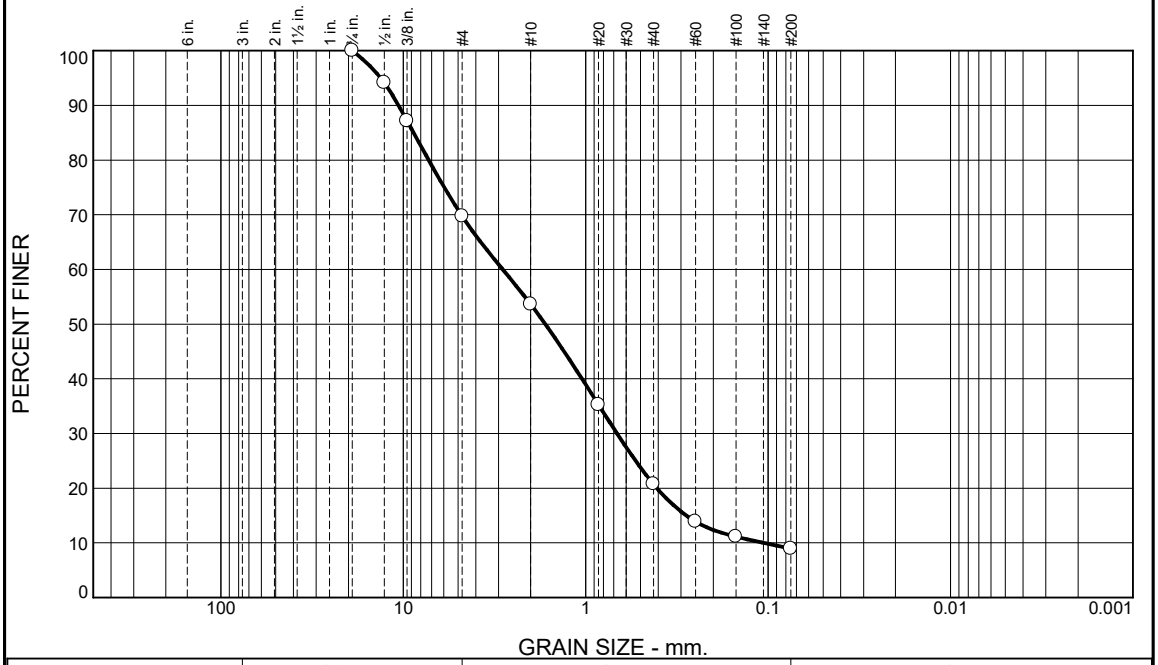
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.3	16.1	32.9	11.7	9.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.1		
0.375"	87.2		
#4	69.7		
#10	53.6		
#20	35.2		
#40	20.7		
#60	13.9		
#100	11.1		
#200	9.0		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 10.6243 D_{85}= 8.7796 D_{60}= 2.8502
D_{50}= 1.6634 D_{30}= 0.6736 D_{15}= 0.2815
D_{10}= 0.1064 C_u= 26.78 C_c= 1.50

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 3

Thielsch Engineering Inc.

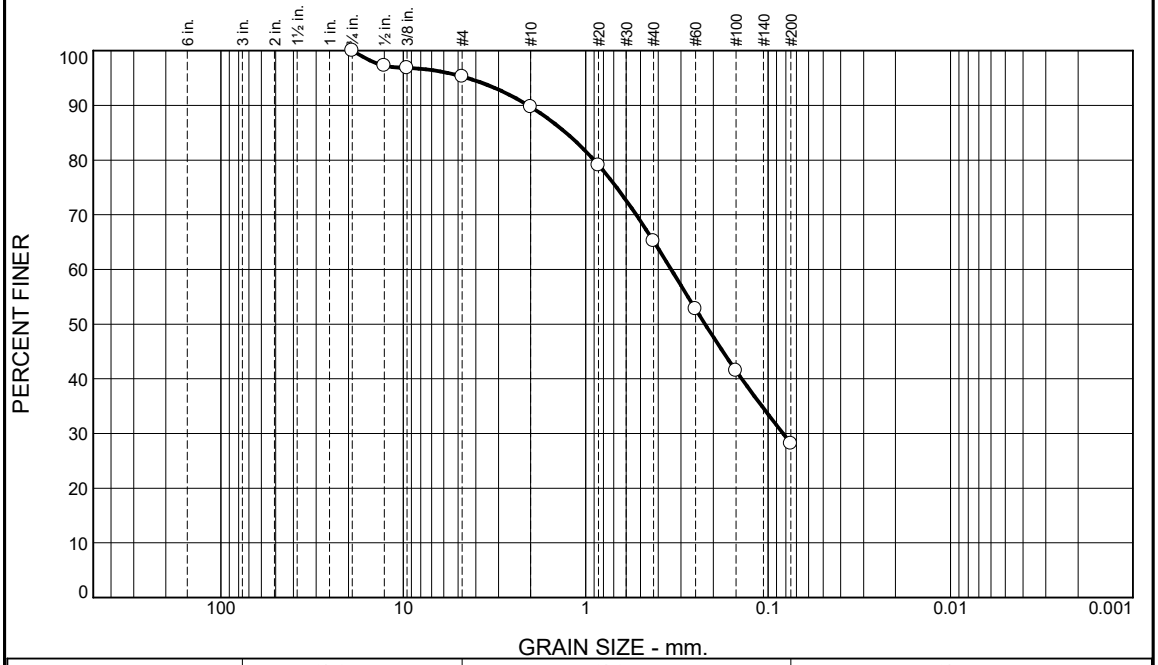
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.7	5.6	24.5	37.1	28.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.2		
0.375"	96.9		
#4	95.3		
#10	89.7		
#20	79.0		
#40	65.2		
#60	52.8		
#100	41.5		
#200	28.1		

* (no specification provided)

Material Description

Brown f-m SAND, some Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 2.0671 D_{85}= 1.2838 D_{60}= 0.3397
D_{50}= 0.2216 D_{30}= 0.0829 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 4

Thielsch Engineering Inc.

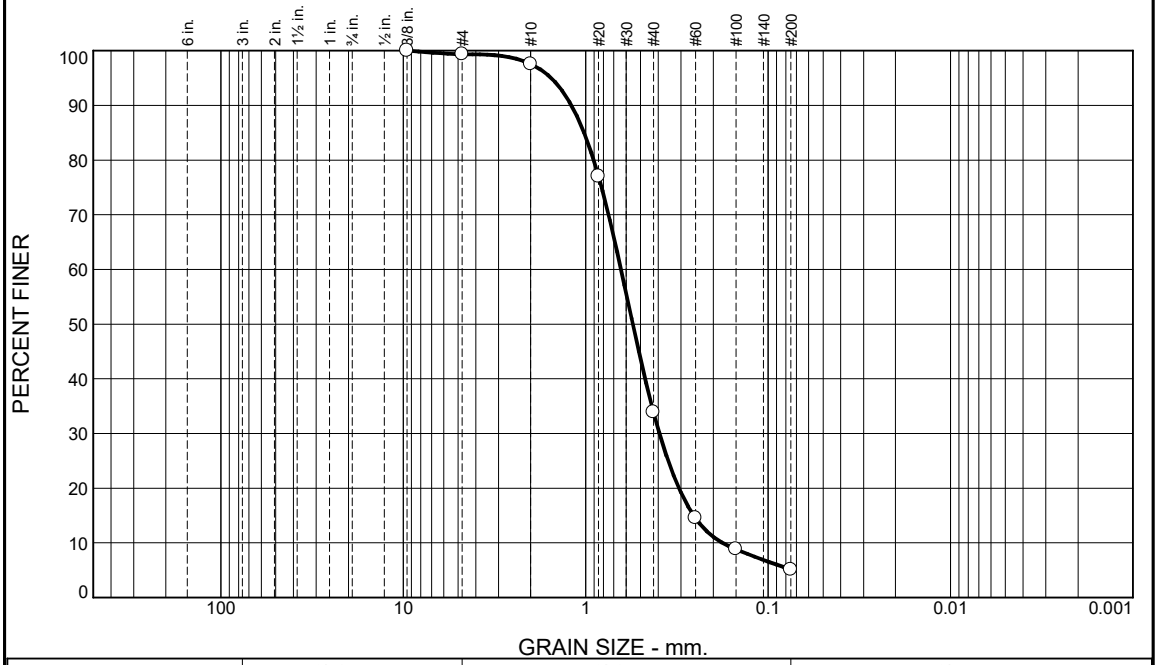
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	1.9	63.6	28.8	5.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.4		
#10	97.5		
#20	77.0		
#40	33.9		
#60	14.5		
#100	8.8		
#200	5.1		

* (no specification provided)

Material Description

Brown f-m SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 1.1977 D_{85}= 1.0207 D_{60}= 0.6404
D_{50}= 0.5512 D_{30}= 0.3941 D_{15}= 0.2556
D_{10}= 0.1779 C_u= 3.60 C_c= 1.36

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 5

Thielsch Engineering Inc.

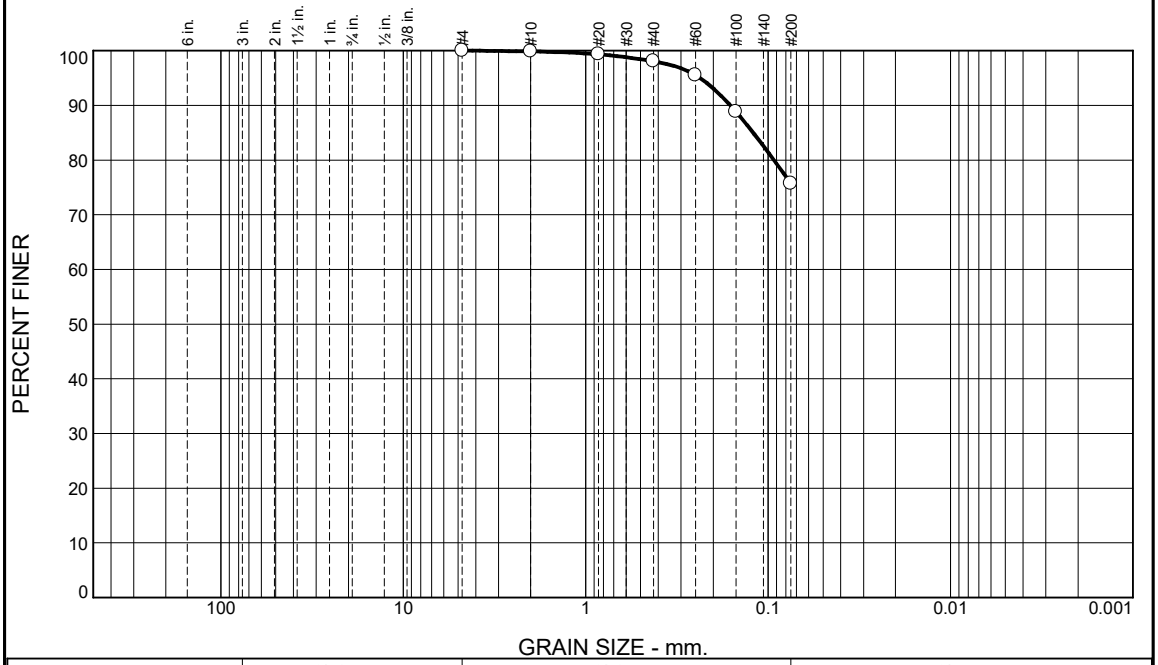
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.9	22.3	75.7	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.3		
#40	98.0		
#60	95.5		
#100	88.8		
#200	75.7		

* (no specification provided)

Material Description

Brown SILT, some fine Sand

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.1612 D_{85}= 0.1207 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 6

Thielsch Engineering Inc.

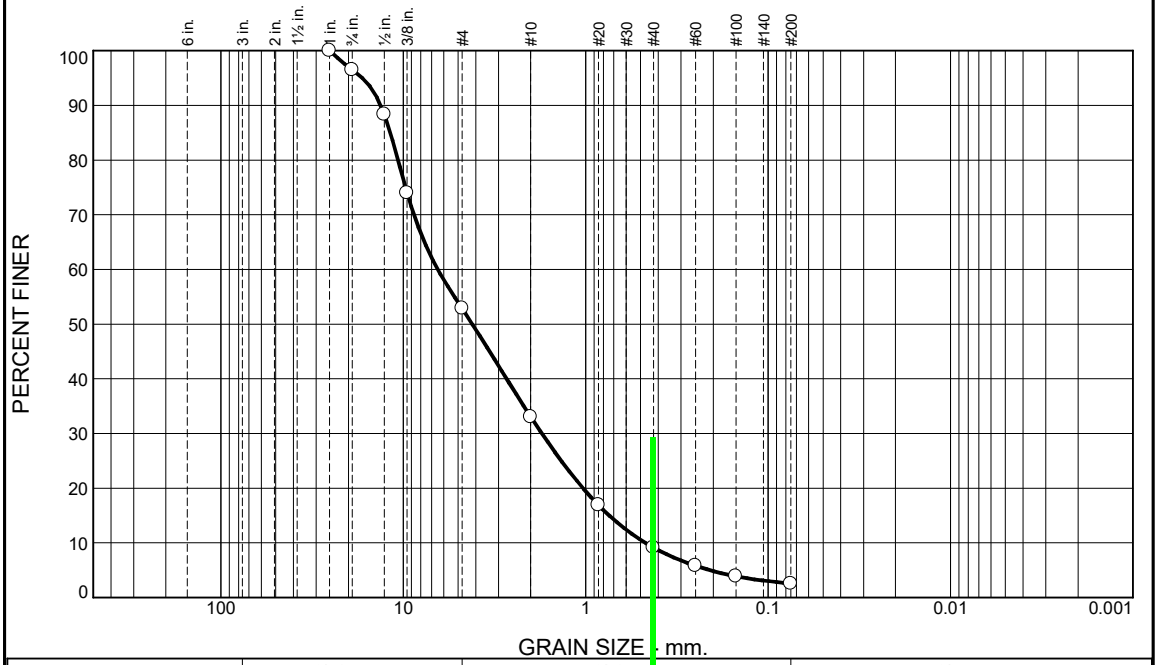
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	43.7	19.8	23.9	6.6	2.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.5		
0.5"	88.3		
0.375"	74.0		
#4	52.8		
#10	33.0		
#20	16.9		
#40	9.1		
#60	5.8		
#100	3.9		
#200	2.5		

* (no specification provided)

Material Description

Brown f-c SAND and fine GRAVEL, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 13.2913 D_{85}= 11.7790 D_{60}= 6.4677
D_{50}= 4.1824 D_{30}= 1.7381 D_{15}= 0.7425
D_{10}= 0.4702 C_u= 13.75 C_c= 0.99

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 7

Thielsch Engineering Inc.

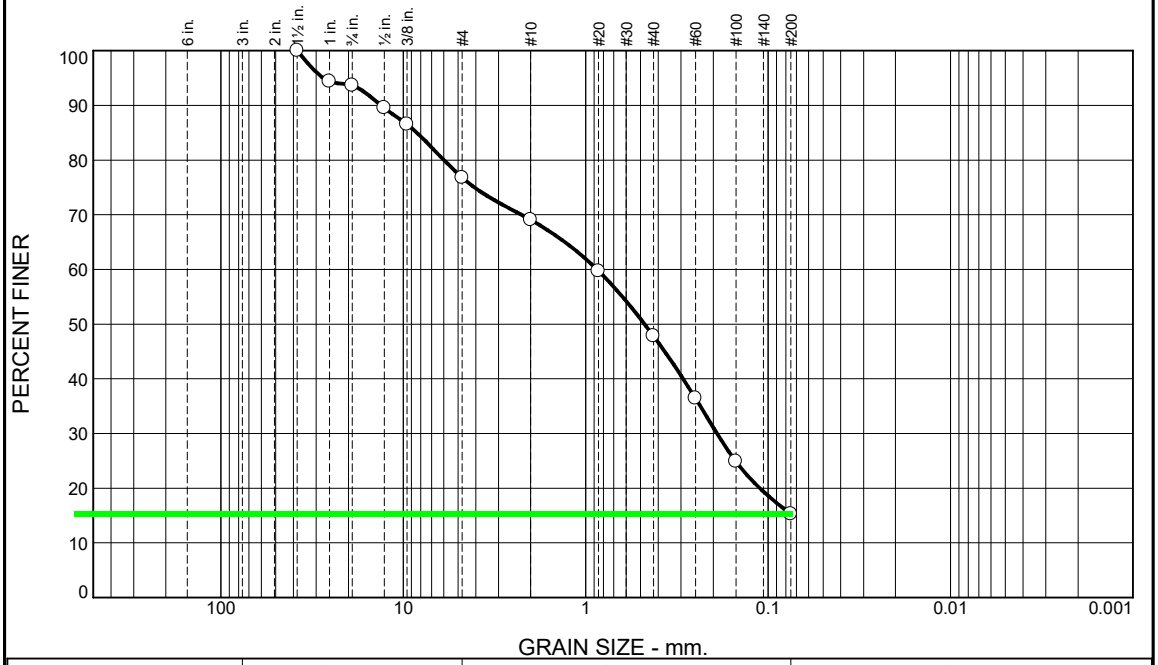
Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.4	16.8	7.7	21.3	32.5	15.3	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	94.4		
0.75"	93.6		
0.5"	89.5		
0.375"	86.5		
#4	76.8		
#10	69.1		
#20	59.7		
#40	47.8		
#60	36.4		
#100	24.9		
#200	15.3		

* (no specification provided)

Material Description

Brown f-c SAND, some f-c Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 13.2491 D_{85}= 8.4302 D_{60}= 0.8673
D_{50}= 0.4754 D_{30}= 0.1904 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/4/19 **Date Tested:** 1/10/19

Tested By: AV

Checked By: Rebecca Roth

Title: Laboratory Coordinator

Source of Sample: Grabs **Depth:** 0-2' **Date Sampled:**
Sample Number: Grab - 8

Thielsch Engineering Inc.

Cranston, RI

Client: Green International, Inc.

Project: Greenway Extension - Peabody Bikeway
Peabody, MA

Project No: 01.0174019.00 **Figure** S-8

GZA GeoEnvironmental, Inc.

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography provided by the Massachusetts Geographic Information System. This information was created from photography dated 2005.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A: Cross section line
- 23 — 23: Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4989000 M — 1000-meter ticks: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection
- 4689000mN — 1000-meter Universal Transverse Mercator grid values, zone 19N
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 3, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0412F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 412 OF 600
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DANVERS, TOWN OF	250079	0412	F
PEABODY, CITY OF	250099	0412	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25009C0412F
EFFECTIVE DATE
JULY 3, 2012

Federal Emergency Management Agency

Proposal No. 609211-132091
A00860 - 204

TABLE 6 – SUMMARY OF DISCHARGES-continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
unnamed Tributary downstream of Abandoned dam					
NORTH BEVERLY DRAINAGE DITCH					
Upstream of Boston and Maine Railroad embankment in	1.16	174	253	290	393
NORTH RIVER AND PROCTOR BROOK					
At Salem corporate Limits	9.96	640	990	1,140	1,620
Upstream of Strongwater Brook	8.86	580	880	1,030	1,470
Upstream of Goldthwaite Brook	3.52	240	360	420	610
Upstream of State Route 128	2.52	170	260	310	450
Upstream of Downing Road	2.10	150	240	280	420
150 feet upstream of Downing Road	1.48	140	220	260	380
Downstream of Albert Road	1.22	130	200	230	340
NORTH TRIBUTARY BROOK					
At Pikes Bridge Road	1.35	70	125	150	170
PARKERS RIVER(TOWN OF BOXFORD)					
At downstream Corporate Limits	3.60	170	270	325	460

Appendix C: Supporting Calculations

- Recharge Volume Calculations
- Water Quality Calculations
- TSS Removal Calculations
- Pretreatment Calculations
- HydroCAD Storage Table
- Rip Rap Sizing for Culverts

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

RECHARGE VOLUME CALCULATIONS

Date: October 11, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Recharge Volume Design

Objective: Size infiltration BMPs that will approximate the annual recharge from the existing conditions.

Methodology: MA Department of Environmental Protection (DEP) Massachusetts Stormwater Handbook (Vol.3, Ch.1)

Design Criteria: Required recharge volume equals a depth of runoff corresponding to the soil type times the increase in impervious areas covering that soil type at the post-development site.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Grou	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Essex County of Massachusetts. The site is comprised of 'A' and 'B' soils.

Required Drawdown Time: Maximum of 72 Hours using the following equation:

$$\text{Drawdown Time} = \frac{R_v}{(K x A_{Bot})}$$

R_v = Required Recharge Volume
K = Permeability
A_{Bot} = Bottom area of trench

Calculation Results:

Designation	Total Volume Required (cf)	Net Increase Volume Required (cf)	Receiving Volume Required (cf)	Volume Provided (cf)
Infiltration Trench 1	**8,000**	**2,348**	**926**	**1,415**

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

Recharge Volume
Required: **Total Impervious Area Recharge Required for Entire Projecct**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	3.455	0.60	7,525
B	0.374	0.35	475
C	0.000	0.25	0
D	0.000	0.10	0
Total	3.829		**8,000**

Recharge Volume
Required: **Net Increase Impervious Area Recharge Required**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	1.078	0.60	2,348
B	0.000	0.35	0
C	0.000	0.25	0
D	0.000	0.10	0
Total	1.078		**2,348**

Recharge Volume
Required: **Receiving Impervious Area Required**

Hydrologic Soil Group	Impervious Area (Acres)	Target Depth	Volume Required (cf)
A	0.425	0.60	926
B	0.000	0.35	0
C	0.000	0.25	0
D	0.000	0.10	0
Total	0.425		**926**

Recharge Volume
Provided: **METHOD USED:** STATIC

Drainage Area to Infiltration Trench

R_v = storage below lowest outlet (weir) = **1,415** cf (Elev. 51.20'*)
A_{Bot} = bottom area (irregular) = 1,600 sf (Elev. 48.52'*)
*See HydroCAD

R_v cf	K in/hr	A_{Bot} sf	Drawdown Time Hours		
926	2.41	1,600	**2.88**	<	**72 Hours**

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

WATER QUALITY CALCULATIONS

Date: October 11, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Objective: To determine the required Water Quality Volume (WQV) for adequate stormwater treatment

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 3, Ch. 1)

Design Criteria: Volume to be treated =0.5" x Post Development Impervious Area

Critical Areas (include ORW, ACEC, recharge areas for public water supplies (Zone Is, Zone IIs and Interim Wellhead Protection Areas for ground water sources and Zone As for surface water sources), bathing beaches, cold water fisheries, shellfish growing areas and LUHPPL's

The project is not within a critical area; therefore,

Volume to be treated = 0.5" x Receiving Impervious Area

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Infiltration Trench 1	**6,864**	**1,415**

Volume to be Treated:

Total proposed receiving impervious area including outside of LOW: **164,744** sf
Total Treatment volume required: **6,864 cf**

WQv = storage provided below lowest outlet = **1,415 cf**

0
0

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Peabody Independence Greenway Extension DP-4

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Trench	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 17118
Prepared By: BV
Date: 1/25/2023

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Proposal No. 609211-132091

A00860 - 302

GREEN INTERNATIONAL AFFILIATES, INC.
100 AMES POND DRIVE, SUITE 200 TEWKSBURY, MA 01876
T: (978) 923-0400 | F: (978) 399-0033 | WWW.GREENINTL.COM

PRETREATMENT CALCULATION

Date: February 2, 2023
Revised:
Project: Peabody - Independence Greenway Extension
Project No: 17118
Location: Peabody, MA

Prepared By: BV
Checked By: DHS

Objective: To determine the required pretreatment Volume for adaqute stormwater treatment. This project is a redevelopment and is required to meet this Standard (4) to the maximum extent practicable.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 2, Ch. 2)

Design Criteria: Volume to be treated = (0.1" x Required Water Quality Volume)

Calculation results:

Designation	Volume Required (cf)	Volume Provided (cf)
Impervious Area to Infiltration Trench 1	**154**	**251**

Volume to be Treated:

Impervious Area to Infiltration Trench 1

Total Proposed Impervious Area: 18,524 sf
Total Treatment Volume: **154 cf**

Volume Provided:

Pretreatment volume of Crushed Stone Shoulder

Top Elevation = 51.52 Area of contour = 1,670 sf
Bottom Elev = 51.02 Area of contour = 1,670 sf Storage Volume*: **251**

Dewatering check:

Volume cf	K in/hr	A_{Bot} sf	Time Hours		
251	2.41	1,670	**0.75**	<	**72 Hours**

*Assumes 30% voids within crushed stone shoulder for pretreatment

Stage-Area-Storage for Pond 2P: Infiltration Trench (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
50.60	1,600	1,098
50.61	1,600	1,104
50.62	1,600	1,109
50.63	1,600	1,114
50.64	1,600	1,119
50.65	1,600	1,125
50.66	1,600	1,130
50.67	1,600	1,135
50.68	1,600	1,140
50.69	1,600	1,146
50.70	1,600	1,151
50.71	1,600	1,156
50.72	1,600	1,162
50.73	1,600	1,167
50.74	1,600	1,172
50.75	1,600	1,177
50.76	1,600	1,183
50.77	1,600	1,188
50.78	1,600	1,193
50.79	1,600	1,199
50.80	1,600	1,204
50.81	1,600	1,209
50.82	1,600	1,214
50.83	1,600	1,220
50.84	1,600	1,225
50.85	1,600	1,230
50.86	1,600	1,236
50.87	1,600	1,241
50.88	1,600	1,246
50.89	1,600	1,251
50.90	1,600	1,257
50.91	1,600	1,262
50.92	1,600	1,267
50.93	1,600	1,272
50.94	1,600	1,278
50.95	1,600	1,283
50.96	1,600	1,288
50.97	1,600	1,294
50.98	1,600	1,299
50.99	1,600	1,304
51.00	1,600	1,309
51.01	1,600	1,315
51.02	1,600	1,320
51.03	1,600	1,325
51.04	1,600	1,331
51.05	1,600	1,336
51.06	1,600	1,341
51.07	1,600	1,346
51.08	1,600	1,352
51.09	1,600	1,357
51.10	1,600	1,362
51.11	1,600	1,368
51.12	1,600	1,373
51.13	1,600	1,378
51.14	1,600	1,383
51.15	1,600	1,389
51.16	1,600	1,394
51.17	1,600	1,399
51.18	1,600	1,404
51.19	1,600	1,410
51.20	1,600	1,415
51.21	1,600	1,420
51.22	1,600	1,426
51.23	1,600	1,431
51.24	1,600	1,436
51.25	1,600	1,441
51.26	1,600	1,447
51.27	1,600	1,452
51.28	1,600	1,457
51.29	1,600	1,463
51.30	1,600	1,468
51.31	1,600	1,473
51.32	1,600	1,478
51.33	1,600	1,484
51.34	1,600	1,489
51.35	1,600	1,494
51.36	1,600	1,500
51.37	1,600	1,505
51.38	1,600	1,510
51.39	1,600	1,515
51.40	1,600	1,521
51.41	1,600	1,526
51.42	1,600	1,531
51.43	1,600	1,536
51.44	1,600	1,542
51.45	1,600	1,547
51.46	1,600	1,552
51.47	1,600	1,558
51.48	1,600	1,563
51.49	1,600	1,568
51.50	1,600	1,573
51.51	1,600	1,579
51.52	1,600	**1,584**

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 329+85		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.97	ft
g=	32.2	ft/s^2
Q=	277	cfs
TW=	0.9	ft
D_{50}=	0.61	ft
	7.36	in
	186.90	mm

Use Class 2 Dumped RipRap

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length= 4.00 x 5.97 = 24 ft

Apron Depth= 3.30 x 0.61 = 2.0 ft

Apron Width= 34 ft
(Figure 10.4)

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 340+10		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	2.50	ft
g=	32.2	ft/s^2
Q=	55	cfs
TW=	1	ft
D_{50}=	0.49	ft
	5.85	in
	148.51	mm

Use Class 1 Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length= 4.00 x 2.50
10 ft

Apron Depth= 3.50 x 0.49
1.7 ft

Apron Width= 14 ft
(Figure 10.4)

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 342+25		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	2.00	ft
g=	32.2	ft/s^2
Q=	49	cfs
TW=	1	ft
D_{50}=	0.70	ft
	8.44	in
	214.29	mm

Use Class 2 Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Apron Length= 4.00 x 2.00 = 8 ft

Apron Depth= 3.30 x 0.70 = 2.3 ft

Apron Width= 11 ft
(Figure 10.4)

GREEN INTERNATIONAL AFFILIATES, INC.
Civil & Structural Engineers
100 Ames Pond Drive, Suite 200
Tewksbury, MA 01876

JOB	17118		
SHEET NO.	1	OF	1
CALCULATED BY	JRM	DATE	1/27/2023
CHECKED BY	AF	DATE	1/27/2023
DESCRIPTION	Culvert @ Station 346+20		
SCALE			

Hydraulic Engineering Circular No. 14, Third Edition

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

D=	5.53	ft
g=	32.2	ft/s^2
Q=	134	cfs
TW=	1	ft
D_{50}=	0.25	ft
	3.01	in
	76.37	mm

Use Class 1 Stone for Pipe Ends

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

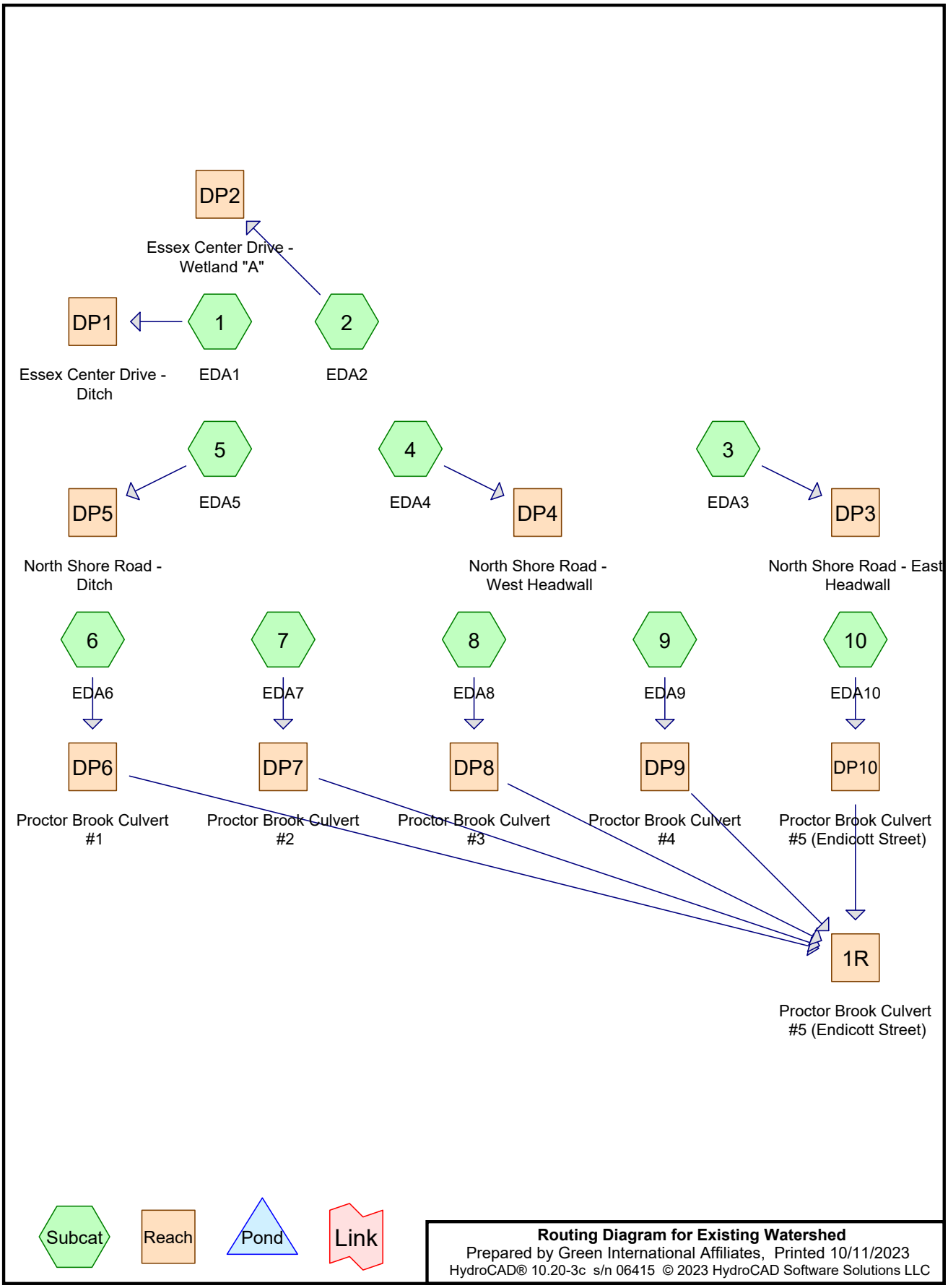
Apron Length= 4.00 x 5.53 = 22 ft

Apron Depth= 3.50 x 0.25 = 1 ft

Apron Width= 31 ft
(Figure 10.4)

Appendix D: Hydraulic and Hydrologic Data

- Existing Conditions HydroCAD Calculations
- Proposed Conditions HydroCAD Calculations
- Proctor Brook StreamStats
- Proctor Brook Culvert Hydraulic and Scour Analysis Summary Report


DP2
Essex Center Drive - Wetland "A"
DP1
1
2
Essex Center Drive - Ditch
EDA1
EDA2
5
4
3
DP5
EDA5
EDA4
DP4
EDA3
DP3
North Shore Road - Ditch
North Shore Road - West Headwall
North Shore Road - East Headwall
6
7
8
9
10
EDA6
EDA7
EDA8
EDA9
EDA10
DP6
DP7
DP8
DP9
DP10
Proctor Brook Culvert #1
Proctor Brook Culvert #2
Proctor Brook Culvert #3
Proctor Brook Culvert #4
Proctor Brook Culvert #5 (Endicott Street)
1R
Proctor Brook Culvert #5 (Endicott Street)
Subcat
Reach
Pond
Link
Routing Diagram for Existing Watershed
Prepared by Green International Affiliates, Printed 10/11/2023
HydroCAD® 10.20-3c s/n 06415 © 2023 HydroCAD Software Solutions LLC

Existing Watershed

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.15	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.83	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.16	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.94	2

Existing Watershed

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.066	49	50-75% Grass cover, Fair, HSG A (1, 3, 4, 5)
0.584	39	>75% Grass cover, Good, HSG A (2)
0.084	76	Gravel roads, HSG A (2)
2.751	98	Unconnected pavement, HSG A (1, 2, 3, 4, 5)
0.200	98	Water Surface, HSG A (7, 9, 10)
1.190	32	Woods/grass comb., Good, HSG A (6, 7, 8)
1.195	69	Woods/grass comb., Good, HSG B/D (6, 7, 8, 9, 10)
10.070	**63**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.875	HSG A	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
1.195	HSG B	6, 7, 8, 9, 10
0.000	HSG C	
0.000	HSG D	
0.000	Other	
10.070		**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=0.12"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.04 cfs 0.021 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=1.64"
Tc=6.0 min CN=84 Runoff=4.90 cfs 0.355 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=70 Runoff=0.44 cfs 0.036 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=0.24"
Tc=6.0 min UI Adjusted CN=55 Runoff=0.14 cfs 0.029 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=0.21"
Tc=6.0 min UI Adjusted CN=54 Runoff=0.06 cfs 0.013 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=0.10"
Tc=6.0 min CN=49 Runoff=0.01 cfs 0.007 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=0.07"
Tc=6.0 min CN=47 Runoff=0.01 cfs 0.004 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=70 Runoff=0.28 cfs 0.023 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=1.95"
Tc=6.0 min CN=88 Runoff=0.65 cfs 0.047 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.92 cfs 0.081 af
Outflow=0.92 cfs 0.081 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.04 cfs 0.021 af
Outflow=0.04 cfs 0.021 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.65 cfs 0.047 af
Outflow=0.65 cfs 0.047 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=4.90 cfs 0.355 af
Outflow=4.90 cfs 0.355 af

Reach DP3: North Shore Road - East Headwall Inflow=0.44 cfs 0.036 af
Outflow=0.44 cfs 0.036 af

Reach DP4: North Shore Road - West Headwall Inflow=0.14 cfs 0.029 af
Outflow=0.14 cfs 0.029 af

Reach DP5: North Shore Road - Ditch Inflow=0.06 cfs 0.013 af
Outflow=0.06 cfs 0.013 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.01 cfs 0.007 af
Outflow=0.01 cfs 0.007 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.01 cfs 0.004 af
Outflow=0.01 cfs 0.004 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.28 cfs 0.023 af
Outflow=0.28 cfs 0.023 af

Total Runoff Area = 10.070 ac Runoff Volume = 0.535 af Average Runoff Depth = 0.64"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af, Depth= 0.12"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af, Depth= 1.64"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af, Depth= 0.80"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af, Depth= 0.24"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af, Depth= 0.21"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af, Depth= 0.10"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af, Depth= 0.07"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af, Depth= 0.80"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 1.95"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 0.38" for 2-Year event
Inflow = 0.92 cfs @ 12.10 hrs, Volume= 0.081 af
Outflow = 0.92 cfs @ 12.10 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af
Outflow = 0.04 cfs @ 12.49 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 1.64" for 2-Year event
Inflow = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af
Outflow = 4.90 cfs @ 12.09 hrs, Volume= 0.355 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af
Outflow = 0.44 cfs @ 12.10 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 0.24" for 2-Year event
Inflow = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af
Outflow = 0.14 cfs @ 12.34 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 0.21" for 2-Year event
Inflow = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af
Outflow = 0.06 cfs @ 12.37 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 0.10" for 2-Year event
Inflow = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af
Outflow = 0.01 cfs @ 13.73 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 0.07" for 2-Year event
Inflow = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 14.89 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af
Outflow = 0.28 cfs @ 12.10 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=0.62"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.88 cfs 0.111 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=3.12"
Tc=6.0 min CN=84 Runoff=9.24 cfs 0.675 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=70 Runoff=1.15 cfs 0.085 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=0.90"
Tc=6.0 min UI Adjusted CN=55 Runoff=1.18 cfs 0.109 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=0.84"
Tc=6.0 min UI Adjusted CN=54 Runoff=0.55 cfs 0.053 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=0.57"
Tc=6.0 min CN=49 Runoff=0.31 cfs 0.042 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=47 Runoff=0.18 cfs 0.031 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.11"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.003 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=70 Runoff=0.73 cfs 0.054 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=3.51"
Tc=6.0 min CN=88 Runoff=1.14 cfs 0.084 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.28 cfs 0.215 af
Outflow=2.28 cfs 0.215 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.88 cfs 0.111 af
Outflow=0.88 cfs 0.111 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.14 cfs 0.084 af
Outflow=1.14 cfs 0.084 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=9.24 cfs 0.675 af
Outflow=9.24 cfs 0.675 af

Reach DP3: North Shore Road - East Headwall Inflow=1.15 cfs 0.085 af
Outflow=1.15 cfs 0.085 af

Reach DP4: North Shore Road - West Headwall Inflow=1.18 cfs 0.109 af
Outflow=1.18 cfs 0.109 af

Reach DP5: North Shore Road - Ditch Inflow=0.55 cfs 0.053 af
Outflow=0.55 cfs 0.053 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.31 cfs 0.042 af
Outflow=0.31 cfs 0.042 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.18 cfs 0.031 af
Outflow=0.18 cfs 0.031 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.00 cfs 0.003 af
Outflow=0.00 cfs 0.003 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.73 cfs 0.054 af
Outflow=0.73 cfs 0.054 af

Total Runoff Area = 10.070 ac Runoff Volume = 1.247 af Average Runoff Depth = 1.49"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af, Depth= 0.62"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af, Depth= 3.12"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af, Depth= 1.91"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af, Depth= 0.90"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af, Depth= 0.84"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af, Depth= 0.57"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af, Depth= 0.48"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af, Depth= 0.11"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af, Depth= 1.91"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 3.51"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 1.00" for 10-Year event
Inflow = 2.28 cfs @ 12.11 hrs, Volume= 0.215 af
Outflow = 2.28 cfs @ 12.11 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 0.62" for 10-Year event
Inflow = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af
Outflow = 0.88 cfs @ 12.14 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 3.51" for 10-Year event
Inflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 3.12" for 10-Year event
Inflow = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af
Outflow = 9.24 cfs @ 12.09 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af
Outflow = 1.15 cfs @ 12.10 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 0.90" for 10-Year event
Inflow = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af
Outflow = 1.18 cfs @ 12.11 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 0.84" for 10-Year event
Inflow = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af
Outflow = 0.55 cfs @ 12.12 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 0.57" for 10-Year event
Inflow = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af
Outflow = 0.31 cfs @ 12.15 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 0.48" for 10-Year event
Inflow = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af
Outflow = 0.18 cfs @ 12.26 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 14.80 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af
Outflow = 0.73 cfs @ 12.10 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=1.22"
Tc=6.0 min UI Adjusted CN=50 Runoff=2.44 cfs 0.218 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=4.35"
Tc=6.0 min CN=84 Runoff=12.74 cfs 0.941 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=70 Runoff=1.80 cfs 0.131 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=1.61"
Tc=6.0 min UI Adjusted CN=55 Runoff=2.43 cfs 0.195 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=1.53"
Tc=6.0 min UI Adjusted CN=54 Runoff=1.18 cfs 0.096 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=1.15"
Tc=6.0 min CN=49 Runoff=0.92 cfs 0.085 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=47 Runoff=0.65 cfs 0.065 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=0.38"
Tc=6.0 min CN=37 Runoff=0.04 cfs 0.009 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=70 Runoff=1.15 cfs 0.083 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=88 Runoff=1.53 cfs 0.115 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=4.20 cfs 0.357 af
Outflow=4.20 cfs 0.357 af

Reach DP1: Essex Center Drive - Ditch Inflow=2.44 cfs 0.218 af
Outflow=2.44 cfs 0.218 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.53 cfs 0.115 af
Outflow=1.53 cfs 0.115 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=12.74 cfs 0.941 af
Outflow=12.74 cfs 0.941 af

Reach DP3: North Shore Road - East Headwall Inflow=1.80 cfs 0.131 af
Outflow=1.80 cfs 0.131 af

Reach DP4: North Shore Road - West Headwall Inflow=2.43 cfs 0.195 af
Outflow=2.43 cfs 0.195 af

Reach DP5: North Shore Road - Ditch Inflow=1.18 cfs 0.096 af
Outflow=1.18 cfs 0.096 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.92 cfs 0.085 af
Outflow=0.92 cfs 0.085 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.65 cfs 0.065 af
Outflow=0.65 cfs 0.065 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.04 cfs 0.009 af
Outflow=0.04 cfs 0.009 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.15 cfs 0.083 af
Outflow=1.15 cfs 0.083 af

Total Runoff Area = 10.070 ac Runoff Volume = 1.939 af Average Runoff Depth = 2.31"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af, Depth= 1.22"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af, Depth= 4.35"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 2.93"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af, Depth= 1.61"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af, Depth= 1.53"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af, Depth= 1.15"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af, Depth= 1.00"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Depth= 0.38"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af, Depth= 2.93"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 4.78"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 1.66" for 25-Year event
Inflow = 4.20 cfs @ 12.10 hrs, Volume= 0.357 af
Outflow = 4.20 cfs @ 12.10 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 1.22" for 25-Year event
Inflow = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af
Outflow = 2.44 cfs @ 12.11 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 4.78" for 25-Year event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 1.53 cfs @ 12.09 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 4.35" for 25-Year event
Inflow = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af
Outflow = 12.74 cfs @ 12.09 hrs, Volume= 0.941 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af
Outflow = 1.80 cfs @ 12.09 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 1.61" for 25-Year event
Inflow = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af
Outflow = 2.43 cfs @ 12.10 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 1.53" for 25-Year event
Inflow = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af
Outflow = 1.18 cfs @ 12.11 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 1.15" for 25-Year event
Inflow = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af
Outflow = 0.92 cfs @ 12.11 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 1.00" for 25-Year event
Inflow = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af
Outflow = 0.65 cfs @ 12.12 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 0.38" for 25-Year event
Inflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af
Outflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: EDA1 Runoff Area=93,200 sf 4.31% Impervious Runoff Depth=2.84"
Tc=6.0 min UI Adjusted CN=50 Runoff=6.63 cfs 0.507 af

Subcatchment2: EDA2 Runoff Area=113,187 sf 74.28% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=84 Runoff=20.06 cfs 1.516 af

Subcatchment3: EDA3 Runoff Area=23,335 sf 43.32% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=70 Runoff=3.25 cfs 0.236 af

Subcatchment4: EDA4 Runoff Area=63,443 sf 22.68% Impervious Runoff Depth=3.44"
Tc=6.0 min UI Adjusted CN=55 Runoff=5.64 cfs 0.418 af

Subcatchment5: EDA5 Runoff Area=32,893 sf 22.02% Impervious Runoff Depth=3.32"
Tc=6.0 min UI Adjusted CN=54 Runoff=2.81 cfs 0.209 af

Subcatchment6: EDA6 Runoff Area=38,519 sf 0.00% Impervious Runoff Depth=2.72"
Tc=6.0 min CN=49 Runoff=2.60 cfs 0.201 af

Subcatchment7: EDA7 Runoff Area=33,779 sf 0.41% Impervious Runoff Depth=2.49"
Tc=6.0 min CN=47 Runoff=2.04 cfs 0.161 af

Subcatchment8: EDA8 Runoff Area=12,861 sf 0.00% Impervious Runoff Depth=1.36"
Tc=6.0 min CN=37 Runoff=0.32 cfs 0.033 af

Subcatchment9: EDA9 Runoff Area=14,846 sf 2.76% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=70 Runoff=2.07 cfs 0.150 af

Subcatchment10: EDA10 Runoff Area=12,583 sf 64.76% Impervious Runoff Depth=7.49"
Tc=6.0 min CN=88 Runoff=2.33 cfs 0.180 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=9.32 cfs 0.725 af
Outflow=9.32 cfs 0.725 af

Reach DP1: Essex Center Drive - Ditch Inflow=6.63 cfs 0.507 af
Outflow=6.63 cfs 0.507 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.33 cfs 0.180 af
Outflow=2.33 cfs 0.180 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=20.06 cfs 1.516 af
Outflow=20.06 cfs 1.516 af

Reach DP3: North Shore Road - East Headwall Inflow=3.25 cfs 0.236 af
Outflow=3.25 cfs 0.236 af

Reach DP4: North Shore Road - West Headwall Inflow=5.64 cfs 0.418 af
Outflow=5.64 cfs 0.418 af

Reach DP5: North Shore Road - Ditch Inflow=2.81 cfs 0.209 af
Outflow=2.81 cfs 0.209 af

Reach DP6: Proctor Brook Culvert #1 Inflow=2.60 cfs 0.201 af
Outflow=2.60 cfs 0.201 af

Reach DP7: Proctor Brook Culvert #2 Inflow=2.04 cfs 0.161 af
Outflow=2.04 cfs 0.161 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.32 cfs 0.033 af
Outflow=0.32 cfs 0.033 af

Reach DP9: Proctor Brook Culvert #4 Inflow=2.07 cfs 0.150 af
Outflow=2.07 cfs 0.150 af

Total Runoff Area = 10.070 ac Runoff Volume = 3.611 af Average Runoff Depth = 4.30"
70.70% Pervious = 7.119 ac 29.30% Impervious = 2.951 ac

Summary for Subcatchment 1: EDA1

Runoff = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af, Depth= 2.84"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
89,179	49		50-75% Grass cover, Fair, HSG A
4,021	98		Unconnected pavement, HSG A
93,200	51	50	Weighted Average, UI Adjusted
89,179			95.69% Pervious Area
4,021			4.31% Impervious Area
4,021			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: EDA2

Runoff = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af, Depth= 7.00"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
25,453	39	>75% Grass cover, Good, HSG A
84,077	98	Unconnected pavement, HSG A
3,657	76	Gravel roads, HSG A
113,187	84	Weighted Average
29,110		25.72% Pervious Area
84,077		74.28% Impervious Area
84,077		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: EDA3

Runoff = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af, Depth= 5.28"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
13,227	49	50-75% Grass cover, Fair, HSG A
10,108	98	Unconnected pavement, HSG A
23,335	70	Weighted Average
13,227		56.68% Pervious Area
10,108		43.32% Impervious Area
10,108		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: EDA4

Runoff = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af, Depth= 3.44"
Routed to Reach DP4 : North Shore Road - West Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
49,053	49		50-75% Grass cover, Fair, HSG A
14,390	98		Unconnected pavement, HSG A
63,443	60	55	Weighted Average, UI Adjusted
49,053			77.32% Pervious Area
14,390			22.68% Impervious Area
14,390			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: EDA5

Runoff = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af, Depth= 3.32"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
25,650	49		50-75% Grass cover, Fair, HSG A
7,243	98		Unconnected pavement, HSG A
32,893	60	54	Weighted Average, UI Adjusted
25,650			77.98% Pervious Area
7,243			22.02% Impervious Area
7,243			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: EDA6

Runoff = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af, Depth= 2.72"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	20,759	32	Woods/grass comb., Good, HSG A
*	17,760	69	Woods/grass comb., Good, HSG B/D
	38,519	49	Weighted Average
	38,519		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: EDA7

Runoff = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af, Depth= 2.49"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	19,944	32	Woods/grass comb., Good, HSG A
*	13,695	69	Woods/grass comb., Good, HSG B/D
	140	98	Water Surface, HSG A
	33,779	47	Weighted Average
	33,639		99.59% Pervious Area
	140		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: EDA8

Runoff = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af, Depth= 1.36"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	11,128	32	Woods/grass comb., Good, HSG A
*	1,733	69	Woods/grass comb., Good, HSG B/D
	12,861	37	Weighted Average
	12,861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: EDA9

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af, Depth= 5.28"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	14,436	69	Woods/grass comb., Good, HSG B/D
	410	98	Water Surface, HSG A
	14,846	70	Weighted Average
	14,436		97.24% Pervious Area
	410		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: EDA10

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Depth= 7.49"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	4,434	69	Woods/grass comb., Good, HSG B/D
	8,149	98	Water Surface, HSG A
	12,583	88	Weighted Average
	4,434		35.24% Pervious Area
	8,149		64.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.585 ac, 7.73% Impervious, Inflow Depth = 3.37" for 100-Year event
Inflow = 9.32 cfs @ 12.10 hrs, Volume= 0.725 af
Outflow = 9.32 cfs @ 12.10 hrs, Volume= 0.725 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.140 ac, 4.31% Impervious, Inflow Depth = 2.84" for 100-Year event
Inflow = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af
Outflow = 6.63 cfs @ 12.10 hrs, Volume= 0.507 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.289 ac, 64.76% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.598 ac, 74.28% Impervious, Inflow Depth = 7.00" for 100-Year event
Inflow = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af
Outflow = 20.06 cfs @ 12.09 hrs, Volume= 1.516 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.536 ac, 43.32% Impervious, Inflow Depth = 5.28" for 100-Year event
Inflow = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af
Outflow = 3.25 cfs @ 12.09 hrs, Volume= 0.236 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 22.68% Impervious, Inflow Depth = 3.44" for 100-Year event
Inflow = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af
Outflow = 5.64 cfs @ 12.10 hrs, Volume= 0.418 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 22.02% Impervious, Inflow Depth = 3.32" for 100-Year event
Inflow = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af
Outflow = 2.81 cfs @ 12.10 hrs, Volume= 0.209 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.884 ac, 0.00% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af
Outflow = 2.60 cfs @ 12.10 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.775 ac, 0.41% Impervious, Inflow Depth = 2.49" for 100-Year event
Inflow = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af
Outflow = 2.04 cfs @ 12.10 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 0.00% Impervious, Inflow Depth = 1.36" for 100-Year event
Inflow = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af
Outflow = 0.32 cfs @ 12.12 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

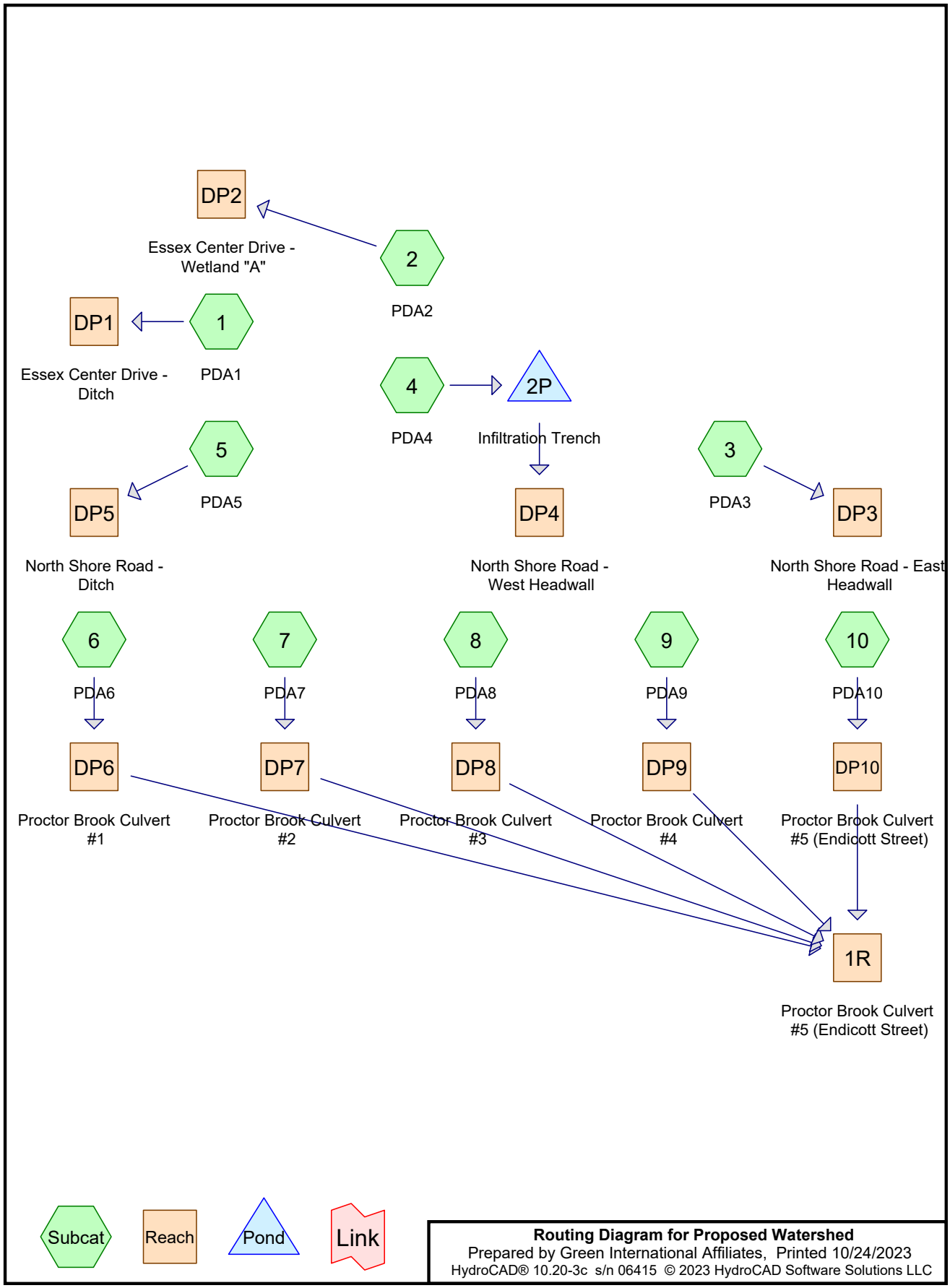
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 2.76% Impervious, Inflow Depth = 5.28" for 100-Year event
Inflow = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af
Outflow = 2.07 cfs @ 12.09 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs


DP2
Essex Center Drive - Wetland "A"
2
PDA2
DP1
1
Essex Center Drive - Ditch
PDA1
4
2P
PDA4
Infiltration Trench
5
3
DP5
PDA5
DP4
PDA3
DP3
North Shore Road - Ditch
North Shore Road - West Headwall
North Shore Road - East Headwall
6
7
8
9
10
PDA6
PDA7
PDA8
PDA9
PDA10
DP6
DP7
DP8
DP9
DP10
Proctor Brook Culvert #1
Proctor Brook Culvert #2
Proctor Brook Culvert #3
Proctor Brook Culvert #4
Proctor Brook Culvert #5 (Endicott Street)
1R
Proctor Brook Culvert #5 (Endicott Street)
Subcat
Reach
Pond
Link
Routing Diagram for Proposed Watershed
Prepared by Green International Affiliates, Printed 10/24/2023
HydroCAD® 10.20-3c s/n 06415 © 2023 HydroCAD Software Solutions LLC

Proposed Watershed

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.15	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.83	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.16	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.94	2

Proposed Watershed

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.829	49	50-75% Grass cover, Fair, HSG A (1)
2.872	39	>75% Grass cover, Good, HSG A (2, 3, 4, 5, 6, 7, 8)
0.057	70	>75% Grass cover, Good, HSG B (10)
0.400	70	>75% Grass cover, Good, HSG B/D (6, 7, 8, 9)
0.271	88	Gravel roads and pier, HSG B/D (9, 10)
0.530	76	Gravel roads, HSG A (1, 2, 3, 4, 5, 6, 7, 8)
0.290	88	Gravel roads, HSG B/D (6, 7, 8)
3.455	98	Unconnected pavement, HSG A (1, 2, 3, 4, 5, 6, 7, 8)
0.374	98	Unconnected pavement, HSG B/D (6, 7, 8, 9, 10)
10.078	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.686	HSG A	1, 2, 3, 4, 5, 6, 7, 8
1.391	HSG B	6, 7, 8, 9, 10
0.000	HSG C	
0.000	HSG D	
0.000	Other	
10.078		**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=0.12"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.04 cfs 0.019 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=1.57"
Tc=6.0 min CN=83 Runoff=5.07 cfs 0.368 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=0.71"
Tc=6.0 min CN=68 Runoff=0.38 cfs 0.032 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=0.14"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.05 cfs 0.017 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=0.10"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.01 cfs 0.006 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=74 Runoff=0.97 cfs 0.074 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=1.00"
Tc=6.0 min CN=74 Runoff=0.85 cfs 0.065 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=1.24"
Tc=6.0 min CN=78 Runoff=0.41 cfs 0.030 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=1.79"
Tc=6.0 min CN=86 Runoff=0.70 cfs 0.051 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=1.95"
Tc=6.0 min CN=88 Runoff=0.64 cfs 0.047 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=3.57 cfs 0.267 af
Outflow=3.57 cfs 0.267 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.04 cfs 0.019 af
Outflow=0.04 cfs 0.019 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=0.64 cfs 0.047 af
Outflow=0.64 cfs 0.047 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=5.07 cfs 0.368 af
Outflow=5.07 cfs 0.368 af

Reach DP3: North Shore Road - East Headwall Inflow=0.38 cfs 0.032 af
Outflow=0.38 cfs 0.032 af

Reach DP4: North Shore Road - West Headwall Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP5: North Shore Road - Ditch Inflow=0.01 cfs 0.006 af
Outflow=0.01 cfs 0.006 af

Reach DP6: Proctor Brook Culvert #1 Inflow=0.97 cfs 0.074 af
Outflow=0.97 cfs 0.074 af

Reach DP7: Proctor Brook Culvert #2 Inflow=0.85 cfs 0.065 af
Outflow=0.85 cfs 0.065 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.41 cfs 0.030 af
Outflow=0.41 cfs 0.030 af

Reach DP9: Proctor Brook Culvert #4 Inflow=0.70 cfs 0.051 af
Outflow=0.70 cfs 0.051 af

Pond 2P: Infiltration Trench Peak Elev=48.53' Storage=8 cf Inflow=0.05 cfs 0.017 af
Discarded=0.04 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.017 af

Total Runoff Area = 10.078 ac Runoff Volume = 0.709 af Average Runoff Depth = 0.84"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af, Depth= 0.12"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af, Depth= 1.57"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af, Depth= 0.71"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 0.05 cfs @ 12.45 hrs, Volume= 0.017 af, Depth= 0.14"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af, Depth= 0.10"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af, Depth= 1.00"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af, Depth= 1.00"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af, Depth= 1.24"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af, Depth= 1.79"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 1.95"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 1.24" for 2-Year event
Inflow = 3.57 cfs @ 12.10 hrs, Volume= 0.267 af
Outflow = 3.57 cfs @ 12.10 hrs, Volume= 0.267 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af
Outflow = 0.04 cfs @ 12.49 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 1.57" for 2-Year event
Inflow = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af
Outflow = 5.07 cfs @ 12.09 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 0.71" for 2-Year event
Inflow = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af
Outflow = 0.38 cfs @ 12.11 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 0.10" for 2-Year event
Inflow = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 13.73 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af
Outflow = 0.97 cfs @ 12.10 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af
Outflow = 0.85 cfs @ 12.10 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 1.24" for 2-Year event
Inflow = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af
Outflow = 0.41 cfs @ 12.10 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 1.79" for 2-Year event
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af
Outflow = 0.70 cfs @ 12.09 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.14" for 2-Year event
Inflow = 0.05 cfs @ 12.45 hrs, Volume= 0.017 af
Outflow = 0.04 cfs @ 12.51 hrs, Volume= 0.017 af, Atten= 5%, Lag= 3.1 min
Discarded = 0.04 cfs @ 12.51 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 48.53' @ 12.51 hrs Surf.Area= 1,600 sf Storage= 8 cf

Plug-Flow detention time= 3.0 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (1,004.7 - 1,001.7)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 12.51 hrs HW=48.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=48.52' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=0.62"
Tc=6.0 min UI Adjusted CN=50 Runoff=0.79 cfs 0.100 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=3.02"
Tc=6.0 min CN=83 Runoff=9.72 cfs 0.708 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=1.76"
Tc=6.0 min CN=68 Runoff=1.07 cfs 0.080 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=0.68"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.70 cfs 0.082 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=0.57"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.26 cfs 0.036 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=2.23"
Tc=6.0 min CN=74 Runoff=2.25 cfs 0.164 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=2.23"
Tc=6.0 min CN=74 Runoff=1.98 cfs 0.144 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=2.57"
Tc=6.0 min CN=78 Runoff=0.87 cfs 0.063 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=3.31"
Tc=6.0 min CN=86 Runoff=1.28 cfs 0.094 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=3.51"
Tc=6.0 min CN=88 Runoff=1.14 cfs 0.084 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=7.51 cfs 0.550 af
Outflow=7.51 cfs 0.550 af

Reach DP1: Essex Center Drive - Ditch Inflow=0.79 cfs 0.100 af
Outflow=0.79 cfs 0.100 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.14 cfs 0.084 af
Outflow=1.14 cfs 0.084 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=9.72 cfs 0.708 af
Outflow=9.72 cfs 0.708 af

Reach DP3: North Shore Road - East Headwall Inflow=1.07 cfs 0.080 af
Outflow=1.07 cfs 0.080 af

Reach DP4: North Shore Road - West Headwall Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP5: North Shore Road - Ditch Inflow=0.26 cfs 0.036 af
Outflow=0.26 cfs 0.036 af

Reach DP6: Proctor Brook Culvert #1 Inflow=2.25 cfs 0.164 af
Outflow=2.25 cfs 0.164 af

Reach DP7: Proctor Brook Culvert #2 Inflow=1.98 cfs 0.144 af
Outflow=1.98 cfs 0.144 af

Reach DP8: Proctor Brook Culvert #3 Inflow=0.87 cfs 0.063 af
Outflow=0.87 cfs 0.063 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.28 cfs 0.094 af
Outflow=1.28 cfs 0.094 af

Pond 2P: Infiltration Trench Peak Elev=50.74' Storage=1,174 cf Inflow=0.70 cfs 0.082 af
Discarded=0.09 cfs 0.082 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.082 af

Total Runoff Area = 10.078 ac Runoff Volume = 1.556 af Average Runoff Depth = 1.85"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af, Depth= 0.62"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af, Depth= 3.02"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af, Depth= 1.76"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 0.70 cfs @ 12.13 hrs, Volume= 0.082 af, Depth= 0.68"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af, Depth= 0.57"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af, Depth= 2.23"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af, Depth= 2.23"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Depth= 2.57"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 3.31"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 3.51"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 2.55" for 10-Year event
Inflow = 7.51 cfs @ 12.09 hrs, Volume= 0.550 af
Outflow = 7.51 cfs @ 12.09 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 0.62" for 10-Year event
Inflow = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af
Outflow = 0.79 cfs @ 12.14 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 3.51" for 10-Year event
Inflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 3.02" for 10-Year event
Inflow = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af
Outflow = 9.72 cfs @ 12.09 hrs, Volume= 0.708 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 1.76" for 10-Year event
Inflow = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af
Outflow = 1.07 cfs @ 12.10 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 0.57" for 10-Year event
Inflow = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af
Outflow = 0.26 cfs @ 12.15 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af
Outflow = 2.25 cfs @ 12.10 hrs, Volume= 0.164 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af
Outflow = 1.98 cfs @ 12.10 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 3.31" for 10-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.68" for 10-Year event
Inflow = 0.70 cfs @ 12.13 hrs, Volume= 0.082 af
Outflow = 0.09 cfs @ 12.05 hrs, Volume= 0.082 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.09 cfs @ 12.05 hrs, Volume= 0.082 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 50.74' @ 15.12 hrs Surf.Area= 1,600 sf Storage= 1,174 cf

Plug-Flow detention time= 139.5 min calculated for 0.082 af (100% of inflow)
Center-of-Mass det. time= 139.4 min (1,053.6 - 914.2)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 12.05 hrs HW=48.61' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=48.52' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=1.22"
Tc=6.0 min UI Adjusted CN=50 Runoff=2.19 cfs 0.196 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=83 Runoff=13.51 cfs 0.994 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=2.74"
Tc=6.0 min CN=68 Runoff=1.71 cfs 0.125 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=1.30"
Tc=6.0 min UI Adjusted CN=51 Runoff=1.81 cfs 0.157 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=1.15"
Tc=6.0 min UI Adjusted CN=49 Runoff=0.78 cfs 0.072 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=3.32"
Tc=6.0 min CN=74 Runoff=3.37 cfs 0.244 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=3.32"
Tc=6.0 min CN=74 Runoff=2.96 cfs 0.215 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=3.72"
Tc=6.0 min CN=78 Runoff=1.26 cfs 0.091 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=86 Runoff=1.74 cfs 0.130 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=88 Runoff=1.52 cfs 0.115 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=10.85 cfs 0.795 af
Outflow=10.85 cfs 0.795 af

Reach DP1: Essex Center Drive - Ditch Inflow=2.19 cfs 0.196 af
Outflow=2.19 cfs 0.196 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=1.52 cfs 0.115 af
Outflow=1.52 cfs 0.115 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=13.51 cfs 0.994 af
Outflow=13.51 cfs 0.994 af

Reach DP3: North Shore Road - East Headwall Inflow=1.71 cfs 0.125 af
Outflow=1.71 cfs 0.125 af

Reach DP4: North Shore Road - West Headwall Inflow=1.15 cfs 0.052 af
Outflow=1.15 cfs 0.052 af

Reach DP5: North Shore Road - Ditch Inflow=0.78 cfs 0.072 af
Outflow=0.78 cfs 0.072 af

Reach DP6: Proctor Brook Culvert #1 Inflow=3.37 cfs 0.244 af
Outflow=3.37 cfs 0.244 af

Reach DP7: Proctor Brook Culvert #2 Inflow=2.96 cfs 0.215 af
Outflow=2.96 cfs 0.215 af

Reach DP8: Proctor Brook Culvert #3 Inflow=1.26 cfs 0.091 af
Outflow=1.26 cfs 0.091 af

Reach DP9: Proctor Brook Culvert #4 Inflow=1.74 cfs 0.130 af
Outflow=1.74 cfs 0.130 af

Pond 2P: Infiltration Trench Peak Elev=51.34' Storage=1,489 cf Inflow=1.81 cfs 0.157 af
Discarded=0.09 cfs 0.106 af Primary=1.15 cfs 0.052 af Outflow=1.24 cfs 0.158 af

Total Runoff Area = 10.078 ac Runoff Volume = 2.340 af Average Runoff Depth = 2.79"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af, Depth= 1.22"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af, Depth= 4.24"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af, Depth= 2.74"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 1.81 cfs @ 12.11 hrs, Volume= 0.157 af, Depth= 1.30"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af, Depth= 1.15"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af, Depth= 3.32"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 3.32"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af, Depth= 3.72"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af, Depth= 4.56"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 4.78"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 3.69" for 25-Year event
Inflow = 10.85 cfs @ 12.09 hrs, Volume= 0.795 af
Outflow = 10.85 cfs @ 12.09 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 1.22" for 25-Year event
Inflow = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af
Outflow = 2.19 cfs @ 12.11 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 4.78" for 25-Year event
Inflow = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 1.52 cfs @ 12.09 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 4.24" for 25-Year event
Inflow = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af
Outflow = 13.51 cfs @ 12.09 hrs, Volume= 0.994 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 2.74" for 25-Year event
Inflow = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af
Outflow = 1.71 cfs @ 12.10 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 0.43" for 25-Year event
Inflow = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af
Outflow = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 1.15" for 25-Year event
Inflow = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af
Outflow = 0.78 cfs @ 12.11 hrs, Volume= 0.072 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 3.32" for 25-Year event
Inflow = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af
Outflow = 3.37 cfs @ 12.09 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 3.32" for 25-Year event
Inflow = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af
Outflow = 2.96 cfs @ 12.09 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 3.72" for 25-Year event
Inflow = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.26 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 4.56" for 25-Year event
Inflow = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af
Outflow = 1.74 cfs @ 12.09 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 1.30" for 25-Year event
Inflow = 1.81 cfs @ 12.11 hrs, Volume= 0.157 af
Outflow = 1.24 cfs @ 12.32 hrs, Volume= 0.158 af, Atten= 32%, Lag= 12.5 min
Discarded = 0.09 cfs @ 11.85 hrs, Volume= 0.106 af
Primary = 1.15 cfs @ 12.32 hrs, Volume= 0.052 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 51.34' @ 12.30 hrs Surf.Area= 1,600 sf Storage= 1,489 cf

Plug-Flow detention time= 136.2 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 138.0 min (1,026.2 - 888.2)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 11.85 hrs HW=48.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.00 cfs @ 12.32 hrs HW=51.34' (Free Discharge)
└**2=Culvert** (Passes 1.00 cfs of 5.43 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 1.00 cfs @ 0.96 fps)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: PDA1 Runoff Area=83,818 sf 4.77% Impervious Runoff Depth=2.84"
Tc=6.0 min UI Adjusted CN=50 Runoff=5.96 cfs 0.456 af

Subcatchment2: PDA2 Runoff Area=122,572 sf 70.76% Impervious Runoff Depth=6.88"
Tc=6.0 min CN=83 Runoff=21.44 cfs 1.613 af

Subcatchment3: PDA3 Runoff Area=23,789 sf 46.61% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=68 Runoff=3.16 cfs 0.229 af

Subcatchment4: PDA4 Runoff Area=63,414 sf 29.21% Impervious Runoff Depth=2.96"
Tc=6.0 min UI Adjusted CN=51 Runoff=4.74 cfs 0.359 af

Subcatchment5: PDA5 Runoff Area=32,893 sf 27.39% Impervious Runoff Depth=2.72"
Tc=6.0 min UI Adjusted CN=49 Runoff=2.22 cfs 0.171 af

Subcatchment6: PDA6 Runoff Area=38,435 sf 31.95% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=74 Runoff=5.81 cfs 0.425 af

Subcatchment7: PDA7 Runoff Area=33,782 sf 30.90% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=74 Runoff=5.11 cfs 0.373 af

Subcatchment8: PDA8 Runoff Area=12,846 sf 47.07% Impervious Runoff Depth=6.27"
Tc=6.0 min CN=78 Runoff=2.09 cfs 0.154 af

Subcatchment9: PDA9 Runoff Area=14,869 sf 32.05% Impervious Runoff Depth=7.25"
Tc=6.0 min CN=86 Runoff=2.70 cfs 0.206 af

Subcatchment10: PDA10 Runoff Area=12,564 sf 30.96% Impervious Runoff Depth=7.49"
Tc=6.0 min CN=88 Runoff=2.33 cfs 0.180 af

Reach 1R: Proctor Brook Culvert #5 (Endicott Street) Inflow=18.03 cfs 1.338 af
Outflow=18.03 cfs 1.338 af

Reach DP1: Essex Center Drive - Ditch Inflow=5.96 cfs 0.456 af
Outflow=5.96 cfs 0.456 af

Reach DP10: Proctor Brook Culvert #5 (Endicott Street) Inflow=2.33 cfs 0.180 af
Outflow=2.33 cfs 0.180 af

Reach DP2: Essex Center Drive - Wetland "A" Inflow=21.44 cfs 1.613 af
Outflow=21.44 cfs 1.613 af

Reach DP3: North Shore Road - East Headwall Inflow=3.16 cfs 0.229 af
Outflow=3.16 cfs 0.229 af

Reach DP4: North Shore Road - West Headwall Inflow=4.64 cfs 0.233 af
Outflow=4.64 cfs 0.233 af

Reach DP5: North Shore Road - Ditch Inflow=2.22 cfs 0.171 af
Outflow=2.22 cfs 0.171 af

Reach DP6: Proctor Brook Culvert #1 Inflow=5.81 cfs 0.425 af
Outflow=5.81 cfs 0.425 af

Reach DP7: Proctor Brook Culvert #2 Inflow=5.11 cfs 0.373 af
Outflow=5.11 cfs 0.373 af

Reach DP8: Proctor Brook Culvert #3 Inflow=2.09 cfs 0.154 af
Outflow=2.09 cfs 0.154 af

Reach DP9: Proctor Brook Culvert #4 Inflow=2.70 cfs 0.206 af
Outflow=2.70 cfs 0.206 af

Pond 2P: Infiltration Trench Peak Elev=51.49' Storage=1,569 cf Inflow=4.74 cfs 0.359 af
Discarded=0.09 cfs 0.129 af Primary=4.64 cfs 0.233 af Outflow=4.73 cfs 0.361 af

Total Runoff Area = 10.078 ac Runoff Volume = 4.167 af Average Runoff Depth = 4.96"
62.01% Pervious = 6.249 ac 37.99% Impervious = 3.829 ac

Summary for Subcatchment 1: PDA1

Runoff = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af, Depth= 2.84"
Routed to Reach DP1 : Essex Center Drive - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
79,682	49		50-75% Grass cover, Fair, HSG A
3,997	98		Unconnected pavement, HSG A
139	76		Gravel roads, HSG A
83,818	51	50	Weighted Average, UI Adjusted
79,821			95.23% Pervious Area
3,997			4.77% Impervious Area
3,997			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2: PDA2

Runoff = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af, Depth= 6.88"
Routed to Reach DP2 : Essex Center Drive - Wetland "A"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
28,394	39	>75% Grass cover, Good, HSG A
86,729	98	Unconnected pavement, HSG A
7,449	76	Gravel roads, HSG A
122,572	83	Weighted Average
35,843		29.24% Pervious Area
86,729		70.76% Impervious Area
86,729		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3: PDA3

Runoff = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af, Depth= 5.04"
Routed to Reach DP3 : North Shore Road - East Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Description
11,891	39	>75% Grass cover, Good, HSG A
11,089	98	Unconnected pavement, HSG A
809	76	Gravel roads, HSG A
23,789	68	Weighted Average
12,700		53.39% Pervious Area
11,089		46.61% Impervious Area
11,089		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4: PDA4

Runoff = 4.74 cfs @ 12.10 hrs, Volume= 0.359 af, Depth= 2.96"
Routed to Pond 2P : Infiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
39,948	39		>75% Grass cover, Good, HSG A
8,775	98		Unconnected pavement, HSG A
4,942	76		Gravel roads, HSG A
9,749	98		Unconnected pavement, HSG A
63,414	59	51	Weighted Average, UI Adjusted
44,890			70.79% Pervious Area
18,524			29.21% Impervious Area
18,524			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5: PDA5

Runoff = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af, Depth= 2.72"
Routed to Reach DP5 : North Shore Road - Ditch

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

Area (sf)	CN	Adj	Description
22,524	39		>75% Grass cover, Good, HSG A
9,011	98		Unconnected pavement, HSG A
1,358	76		Gravel roads, HSG A
32,893	57	49	Weighted Average, UI Adjusted
23,882			72.61% Pervious Area
9,011			27.39% Impervious Area
9,011			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6: PDA6

Runoff = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af, Depth= 5.77"
Routed to Reach DP6 : Proctor Brook Culvert #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	8,207	98	Unconnected pavement, HSG A
*	4,074	98	Unconnected pavement, HSG B/D
	9,656	39	>75% Grass cover, Good, HSG A
*	9,441	70	>75% Grass cover, Good, HSG B/D
	2,803	76	Gravel roads, HSG A
*	4,254	88	Gravel roads, HSG B/D
	38,435	74	Weighted Average
	26,154		68.05% Pervious Area
	12,281		31.95% Impervious Area
	12,281		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7: PDA7

Runoff = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af, Depth= 5.77"
Routed to Reach DP7 : Proctor Brook Culvert #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	7,416	98	Unconnected pavement, HSG A
*	3,022	98	Unconnected pavement, HSG B/D
	9,472	39	>75% Grass cover, Good, HSG A
*	3,316	70	>75% Grass cover, Good, HSG B/D
	3,198	76	Gravel roads, HSG A
*	7,358	88	Gravel roads, HSG B/D
	33,782	74	Weighted Average
	23,344		69.10% Pervious Area
	10,438		30.90% Impervious Area
	10,438		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8: PDA8

Runoff = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af, Depth= 6.27"
Routed to Reach DP8 : Proctor Brook Culvert #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
	5,516	98	Unconnected pavement, HSG A
*	531	98	Unconnected pavement, HSG B/D
	3,240	39	>75% Grass cover, Good, HSG A
*	156	70	>75% Grass cover, Good, HSG B/D
	2,377	76	Gravel roads, HSG A
*	1,026	88	Gravel roads, HSG B/D
	12,846	78	Weighted Average
	6,799		52.93% Pervious Area
	6,047		47.07% Impervious Area
	6,047		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 9: PDA9

Runoff = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af, Depth= 7.25"
Routed to Reach DP9 : Proctor Brook Culvert #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	4,765	98	Unconnected pavement, HSG B/D
*	4,501	70	>75% Grass cover, Good, HSG B/D
*	5,603	88	Gravel roads and pier, HSG B/D
	14,869	86	Weighted Average
	10,104		67.95% Pervious Area
	4,765		32.05% Impervious Area
	4,765		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10: PDA10

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Depth= 7.49"
Routed to Reach DP10 : Proctor Brook Culvert #5 (Endicott Street)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	3,890	98	Unconnected pavement, HSG B/D
*	2,463	70	>75% Grass cover, Good, HSG B
*	6,211	88	Gravel roads and pier, HSG B/D
	12,564	88	Weighted Average
	8,674		69.04% Pervious Area
	3,890		30.96% Impervious Area
	3,890		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.583 ac, 33.26% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 18.03 cfs @ 12.09 hrs, Volume= 1.338 af
Outflow = 18.03 cfs @ 12.09 hrs, Volume= 1.338 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Essex Center Drive - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.924 ac, 4.77% Impervious, Inflow Depth = 2.84" for 100-Year event
Inflow = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af
Outflow = 5.96 cfs @ 12.10 hrs, Volume= 0.456 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP10: Proctor Brook Culvert #5 (Endicott Street)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.288 ac, 30.96% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Essex Center Drive - Wetland "A"

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.814 ac, 70.76% Impervious, Inflow Depth = 6.88" for 100-Year event
Inflow = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af
Outflow = 21.44 cfs @ 12.09 hrs, Volume= 1.613 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: North Shore Road - East Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.546 ac, 46.61% Impervious, Inflow Depth = 5.04" for 100-Year event
Inflow = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af
Outflow = 3.16 cfs @ 12.09 hrs, Volume= 0.229 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP4: North Shore Road - West Headwall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 1.92" for 100-Year event
Inflow = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af
Outflow = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP5: North Shore Road - Ditch

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.755 ac, 27.39% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af
Outflow = 2.22 cfs @ 12.10 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP6: Proctor Brook Culvert #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.882 ac, 31.95% Impervious, Inflow Depth = 5.77" for 100-Year event
Inflow = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af
Outflow = 5.81 cfs @ 12.09 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP7: Proctor Brook Culvert #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.776 ac, 30.90% Impervious, Inflow Depth = 5.77" for 100-Year event
Inflow = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af
Outflow = 5.11 cfs @ 12.09 hrs, Volume= 0.373 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP8: Proctor Brook Culvert #3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.295 ac, 47.07% Impervious, Inflow Depth = 6.27" for 100-Year event
Inflow = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af
Outflow = 2.09 cfs @ 12.09 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Reach DP9: Proctor Brook Culvert #4

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.341 ac, 32.05% Impervious, Inflow Depth = 7.25" for 100-Year event
Inflow = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 2.70 cfs @ 12.09 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proctor Brook Culvert #5 (Endicott Street)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 2P: Infiltration Trench

Inflow Area = 1.456 ac, 29.21% Impervious, Inflow Depth = 2.96" for 100-Year event
Inflow = 4.74 cfs @ 12.10 hrs, Volume= 0.359 af
Outflow = 4.73 cfs @ 12.09 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.09 cfs @ 11.30 hrs, Volume= 0.129 af
Primary = 4.64 cfs @ 12.09 hrs, Volume= 0.233 af
Routed to Reach DP4 : North Shore Road - West Headwall

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 51.49' @ 12.09 hrs Surf.Area= 1,600 sf Storage= 1,569 cf

Plug-Flow detention time= 74.3 min calculated for 0.359 af (100% of inflow)
Center-of-Mass det. time= 78.6 min (939.3 - 860.7)

Volume	Invert	Avail.Storage	Storage Description
#1	48.52'	1,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,800 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
48.52	1,600	0	0
51.52	1,600	4,800	4,800

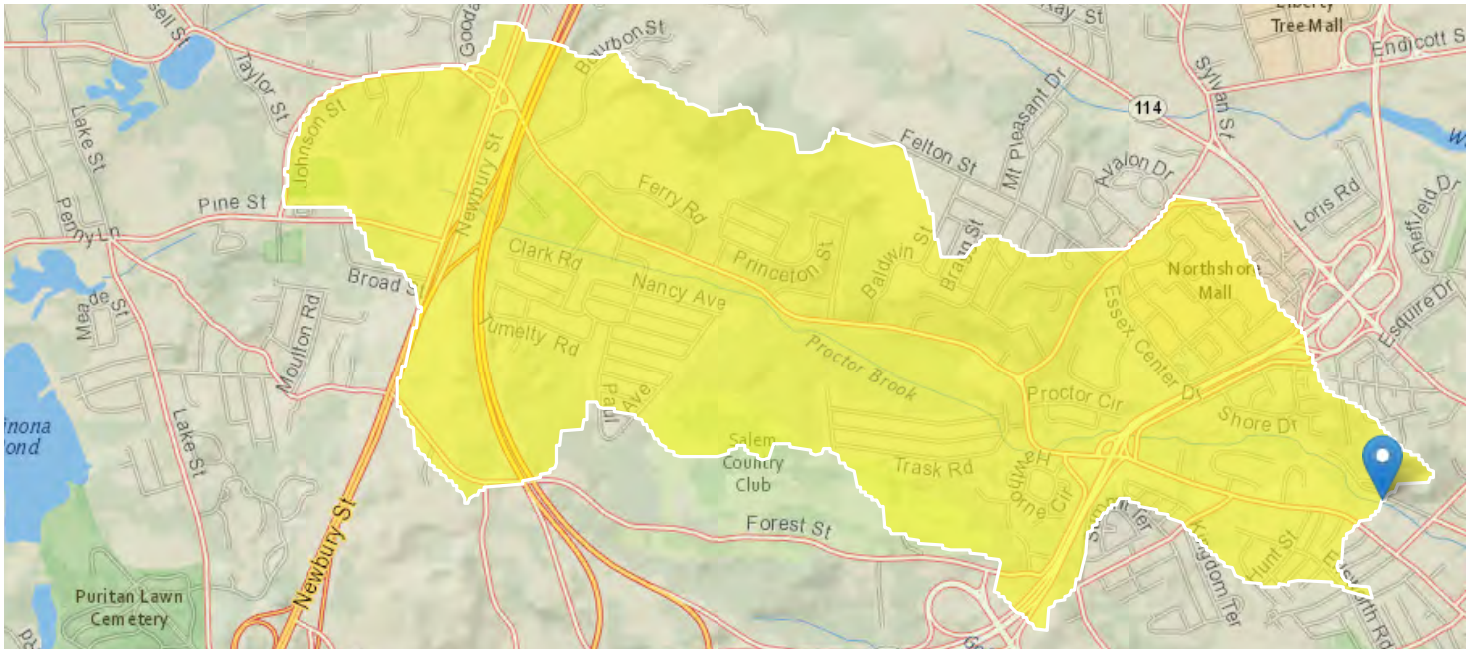
Device	Routing	Invert	Outlet Devices
#1	Discarded	48.52'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	48.61'	**12.0" Round Culvert** L= 62.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.61' / 47.99' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#3	Device 2	51.25'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 11.30 hrs HW=48.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=4.59 cfs @ 12.09 hrs HW=51.49' (Free Discharge)
└**2=Culvert** (Passes 4.59 cfs of 5.61 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 4.59 cfs @ 1.60 fps)

StreamStats Report

Region ID: MA
Workspace ID: MA20201117121813254000
Clicked Point (Latitude, Longitude): 42.53191, -70.93625
Time: 2020-11-17 07:18:29 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.52	square miles

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.4.0

HYDRAULIC AND SCOUR ANALYSIS SUMMARY REPORT

Independence Greenway Extension
Over Proctor Brook
Peabody, Massachusetts

Prepared for

Massachusetts Department of Transportation

February 2023

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

1.0 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to present the results of a Hydraulic and Scour Study performed by Green International Affiliates, Inc. (Green) for MassDOT for Proctor Brook along the Independence Greenway Extension. The proposed bikeway crosses Proctor Brook at three (3) locations. The Hydraulic Report submitted to MassDOT in February 2021 described the proposed bridge located approximated 800' west of Endicott Street. This study evaluates the hydraulic performance of the existing and proposed conditions for the remaining project area upstream of this proposed bridge, including the two (2) crossing locations that weren't discussed in the previous report.

This study was conducted in a manner consistent with the American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Highway Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at brook crossing sites.

1.2 Scope of Work

The Scope of Work for this study included a review of available hydrologic and hydraulic data for Proctor Brook from the City of Peabody Flood Insurance Study (FIS) dated November 1978, a detailed hydraulic analysis for the brook; and a scour/stability analysis. Pertinent data and the hydraulic computer modeling output are contained in the attachments of this report.

Section 2 of this report contains a project description. Section 3 outlines the data collected and applications used in the study. Section 4 describes the Engineering methods used in the hydrologic and hydraulic analyses, as well as the scour/stability analysis. Section 5 contains conclusions and recommendations.

This project involves the construction of two (2) new culverts that will cross over Proctor Brook in the City of Peabody, Massachusetts. There were previous culvert structures that used to carry railroad over Proctor Brook, the railroad was abandoned, along with the culverts, and the culvert structures have been washed away over time. The purpose of this report is to present the results of a study conducted for the subject culvert sites to evaluate the hydraulic performance of the proposed structures for these crossings.

The scope of this investigation consists of a review of pertinent hydrologic analysis data for the Proctor Brook at the project site and a detailed hydraulic analysis. Data collected, hydraulic model input/output and scour calculations are presented in the appendices of this report. A project description, engineering methods, as well as conclusions of the hydraulic study follows.

2.0 PROJECT DESCRIPTION

The existing Independence Greenway bike path is proposed to be extended from its present terminus at the Northshore Mall eastwards into central districts of the City of Peabody. The project limits start at the intersection of Northshore Road and Northshore Mall South Driveway Entrance, and end at the intersection of Boston & Maine Railroad right-of-way (ROW)/Endicott Street. The proposed length of the extension is 1.45 miles.

The proposed project is located along the abandoned railroad right-of-way that has not seen any

improvements since the rails were removed. Existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed will be replaced with new culverts designed to address, to the maximum extent possible, the Massachusetts State Stream Crossings Standards.

In place of the former railroad bridge over Proctor Brook that has been washed away, a new light duty timber boardwalk on helical piles structure is proposed in order to make the abandoned railroad right-of-way usable for a bicycle/pedestrian path. The proposed 8-span structure will be approximately 60'-0" long with an out-to-out width of 12'-0" and will provide a clear width of 11'-0" to accommodate two 5-0" wide travel lanes, one in each direction.

2.1 Existing Conditions

Proctor Brook originates in western Peabody, Massachusetts and flows southeast until it joins Goldthwait Brook to form the North River. Historical flood data is not available for this waterway. The subject locations are within NFIP SFHA Zone AE and spans a section of the river's NFIP regulatory floodway.

Refer to Figure 1 for a locus map of the project area.

The remnants of two (2) culverts remain in the channel. There are no existing trail, roadway, or railroad tracks at the crossing location. The area surrounding the remains of the culverts are currently wooded and includes Bordering Vegetated Wetlands.

The existing culverts were studied during FEMA's 1978 FIS study. At the time of the study the culverts had not been washed out and were functioning as hydraulic connections to convey Proctor Brook under the railroad bed. More detailed description of the culverts are as follows:

Culvert at Station 329+85

This culvert is located at cross section H of the FEMA FIS study. The existing culvert is a 25' long double 42" barrel RCP culvert. The culvert hasn't been maintained and the railbed above the culvert has been washed away. The culvert piping has remained in place. Remnants of granite guidebanks remain at the upstream entrance to the culvert and remnants of a granite headwall remain on the downstream end of the culvert

Culvert at Station 346+20

This culvert is located at cross section F of the FEMA FIS study. Review of the FEMA's HEC-2 hydraulic model indicates that the culvert was originally a 6'-5" box culvert. Due to a lack of maintenance along the abandoned railroad bed, the culvert has collapsed, and the remnants remain in the channel.

2.2 Proposed Conditions

Although the culvert crossings have failed to varying degrees, the horizontal alignment of Proctor Brook has remained. The culverts are being replaced at the same locations as the original structures in order to maintain the alignment of Proctor Brook at these crossings. The channel elevation will remain although some sediment will be removed to facilitate construction.

Both of the culverts will be replaced with 8'x4' concrete box culverts. The bottom 1' of each culvert will be filled with streambed material to provide a more natural wildlife habitat. This hydraulic study examines the impact of providing an 8'x3' hydraulic opening at both of these crossings.

3.0 DATA COLLECTION

The following data and reports on the study area were available and were used as guidance during the hydraulic and hydrologic model development and Analysis:

Sources

- Federal Emergency Management Agency, Flood Insurance Study, City of Peabody, Essex County, Massachusetts, November 1978.
- Federal Emergency Management Agency, Flood Insurance Study, Essex County, MA, July 19, 2018.
- Federal Emergency Management Agency, Original HEC-2 Model for Flood Insurance Study-Peabody, MA, November 1976.
- FHWA; Hydraulic Engineering Circular Number 23, HEC-23. Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 2009.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 20 Stream Stability at Highway Structures, Fourth Edition, April 2012.
- U.S. Dept. of Transportation, Federal Highway Administration: Hydraulic Engineering Circular No. 14 Hydraulic Design of Energy Dissipators for Culverts and Channels, Third Edition, July 2006.
- Topographic field survey prepared by Green, March 2018.
- Particle Size Analysis included in Geotechnical Engineering Report by GZA GeoEnvironmental, Inc., April 19, 2021.

Green also used the following computer applications and/or design guidelines for this study:

Applications

- U.S. Army Corps of Engineers: HEC-RAS River Analysis System, Computer Program and User's Manual, Version 5.0.7, March 2019.
- Federal Highway Administration: Hydraulic Toolbox 5.1.4.0 Computer Program

4.0 ENGINEERING METHODS

Proctor Brook was studied for its entire length within the City of Peabody, MA by FEMA using detailed methods as part of the FIS for the City of Peabody. To ensure compliance with FEMA requirements (44 CFR 60.3) and the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.0), the proposed conditions of the culverts have been analyzed to ensure that existing flood elevations will not increase under proposed conditions. In addition, a hydraulic analysis was also performed to calculate the potential for scour.

Figure 2 shows the project location in the flood insurance rate map.

In this hydraulic and scour summary report, peak flow rates from the effective FEMA FIS were used in the analysis.

4.1 Hydrologic Analysis

Peak 10-, 50-, 100- and 500-year flood discharges for Proctor Brook were adopted from Table 6, Essex County FIS, and are presented below in Table 4.1. Please consult the Essex County Effective FIS, last revised July 2018, for information regarding hydrologic computational procedures. As further described in the Stormwater Water prepared for this project, the peak flow rates have been adjusted to account for the proposed increase in impervious area. Table 4.1 also presents the proposed flow projections for the project area.

Table 4.1 – Summary of Discharges

Description	Alternative	10% Annual Chance [10-yr] (CFS)	4% Annual Chance [25-yr] (CFS)	2% Annual Chance [50-yr] (CFS)	1% Annual Chance [100-yr] (CFS)	0.2% Annual Chance [500-yr] (CFS)
North River andProctor Brook Upstream of Goldthwait Brook	FEMA FIS	240	285	360	420	610
	Proposed Conditions	243	290	366	428	618

4.2 Hydraulic Analysis

Green used a combination of the topographical survey and the proposed design of the brook crossings to create a proposed conditions hydraulic model in HEC-RAS. Cross sections were cut approximately every 100 to 200 ft and then imported into HEC-RAS. Backwater analyses using the USACE HEC-RAS computer program were performed for the 10-, 50-, and 100-, and 500-year return events in a manner consistent with the standards used to develop water surface profiles under the National Flood Insurance Program (NFIP).

The computed water surface elevations of this HEC-RAS analysis were compared to water surface elevations listed on the HEC-2 output received from FEMA.

Table 4.2 shows a comparison between the results of the HEC-2 data received from FEMA and Green's proposed model.

Table 4.2 – Comparison of FEMA and Proposed Base Flood Elevations (BFE - referenced to NAVD88) at several cross sections near the Proposed Structures

HEC-RAS Model Cross Sections	FIS Cross-Section	[1] Published Data* (FEET)	[2] Proposed Condition Model (FEET)	[2] – [1] No – Rise Evaluation
34	-	-	46.50	
33	-	-	46.33	
32	-	-	46.33	
31	H	46.89	46.33	0.56
30	-	-	46.23	
29.5	Culvert at Sta 329+85			
29.4	-	-	42.54	
29.3	-	-	42.44	
28	-	-	42.57	
27	G	42.50	42.50	0.00
26.5	-	-	42.00	
26	F	41.96	41.39	0.57
25	-		41.40	
24.5	Culvert at Sta 346+20			
24.4	-		40.74	
24.3	-		40.12	
23	-		40.28	
22	E	40.84	40.24	0.6
21.7	-		40.11	
21.6	-		40.11	
21.5	Bridge			
21.4			39.90	
21.35	-		39.75	

21.3	-		39.80	
21.2	-		39.66	
19	-		39.66	
18	D	39.60	39.60	0.00

Adjusted datum to NAVD 88

As shown in Table 4.2, Proctor Brook will not have an increase in the Water Surface Elevation (WSEL) for the FEMA Base Flood Elevation.

Attachment A includes the 1977 HEC-2 model input/output report received from FEMA Headquarters. Attachment B includes the output of Green's Proposed Conditions HEC-RAS analyses for the proposed Independence Greenway Extension boardwalkover Proctor Brook with the new crossing culverts.

4.3 Scour Safety/Stability Analyses

We calculated the scour hole dimensions (length, width, and depth) using the Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 5: "Estimating Scour at Culvert Outlets" and using equation 5.1 for cohesionless soils shown below:

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g}(R_c^{2.5})}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta}$$

We used the river's 100-year flood as the scour design in this analysis. No scour potential under current conditions was assessed, as one of the structures has washed away and based on evidence, there are no indications of vertical or horizontal instability.

Peak 100-year flood proposed discharge used in this analysis was taken from Table 4.1.

Soil samples were taken at points within the brook, upstream of the culverts and the banks of the brook. These samples were analyzed, and the results are included in Attachment C. The grain size (D_x) was estimated for each soil sample. The D_x results of the samples were used in the scour analysis.

The results of the scour analyses are shown on Table 4.3.

Table 4.3 – Summary of Calculated Scour at Proposed Culverts

Alternative	Return Frequency (year)	Scour Hole Depth (Feet)	Scour Hole Width (Feet)	Scour Hole Length (Feet)	Scour Hole Volume (Cubic Feet)	Location of Maximum Scour (Feet)
Sta 329+85	Incipient	5.89	32.00	57.82	8,133.98	23.13
Sta 346+20	Incipient	4.69	23.64	44.11	3,527.78	17.65

Scour Countermeasures

The scour/stability analyses were performed using Hydraulic Engineering Circular (HEC) No. 14; "Hydraulic Design of Energy Dissipators for Culverts and Channels" Chapter 10: "Riprap Basins and Aprons" and using equation 10.4 shown below:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

Table 4.4 displays dimensions for riprap apron at the proposed culverts.

Table 4.4 – Summary of Scour Countermeasure Design at Proposed Culverts

Alternative	Riprap Size D_{50} (Inches)	Riprap Class	Riprap Apron Length (Feet)	Riprap Apron Depth (Feet)	Riprap Apron Width (Feet)
Sta 329+85	6	2	24	2	34
Sta 346+20	5	1	22	1	31

Attachment D includes the scour analyses, and computations.

5.0 CONCLUSIONS

A. The HEC-RAS model under proposed conditions resulted in lower elevations than the effective FEMA FIS. Therefore, the project implementation will result in no increase to the waterway's Base (100-year) Flood Elevation (BFE) profile, and it will not necessitate alteration of the waterway's floodway delineation, anywhere within the affected community.

B. The natural stream bed will result in a scour depth at culvert at Station 329+85 of 5.89' during incipient flow.

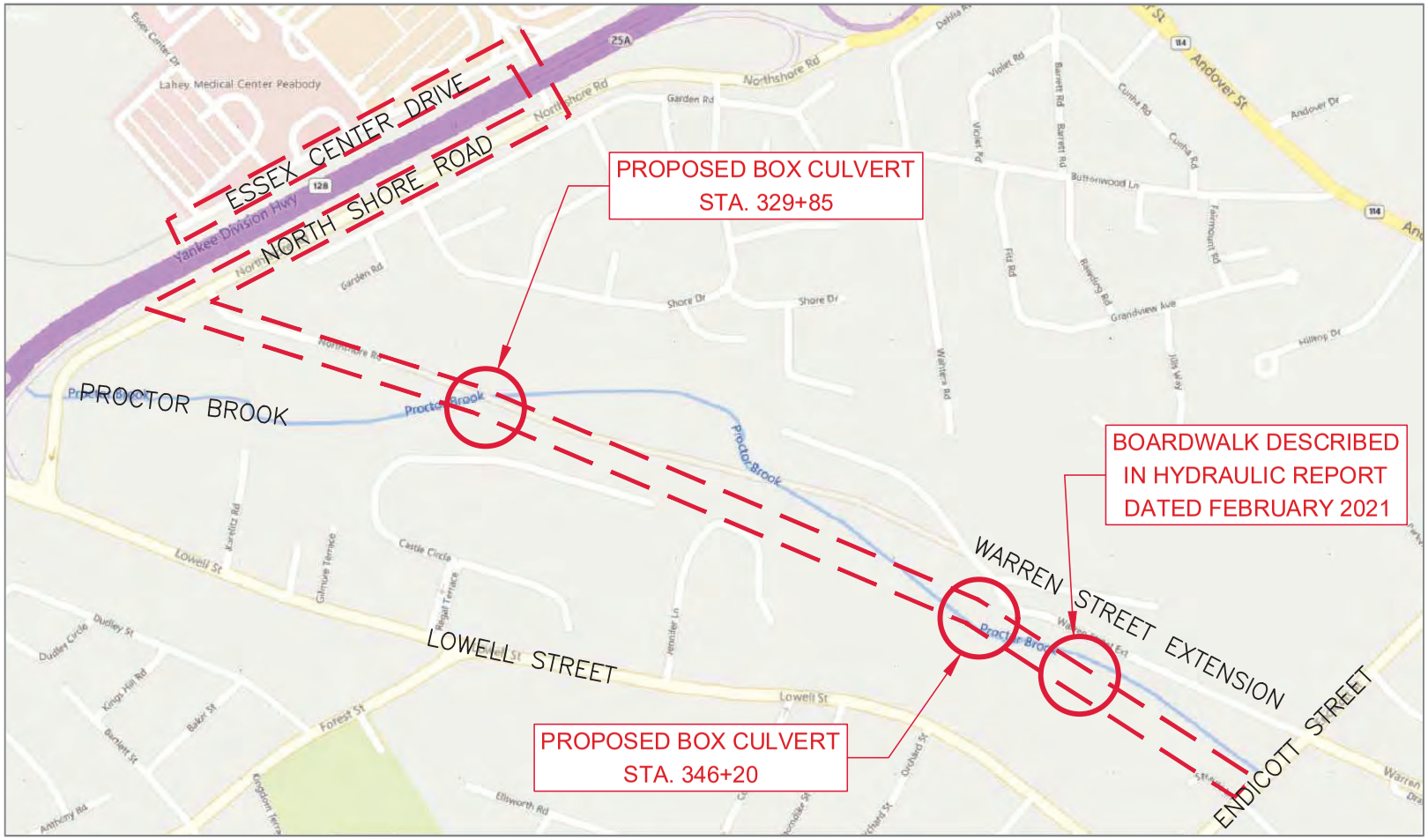
C. The natural stream bed will result in a scour depth at culvert at Station 340+26 of 4.69' during incipient flow.

D. Riprap Countermeasures are proposed to mitigate against the risk of scour. The countermeasures have been designed in accordance with HEC-14 and HEC-23.

E. By placing riprap revetment at the ends of the culvert, it is anticipated that the scour depth will be negligible.

FIGURES

FIGURE 1



LEGEND:

Project Limits

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS TEWKSBURY, MASSACHUSETTS

MASSDOT
PEABODY BIKEWAY EXTENSION
NORTH SHORE MALL TO ENDICOTT STREET
PEABODY, MA

CULVERT LOCATION LOCUS MAP
NOT TO SCALE

F:\Projects\2013\13033\13033.10X–Weymouth Bridge St\Survey\Research\Utilities\UTility Request\Locus Map.dwg

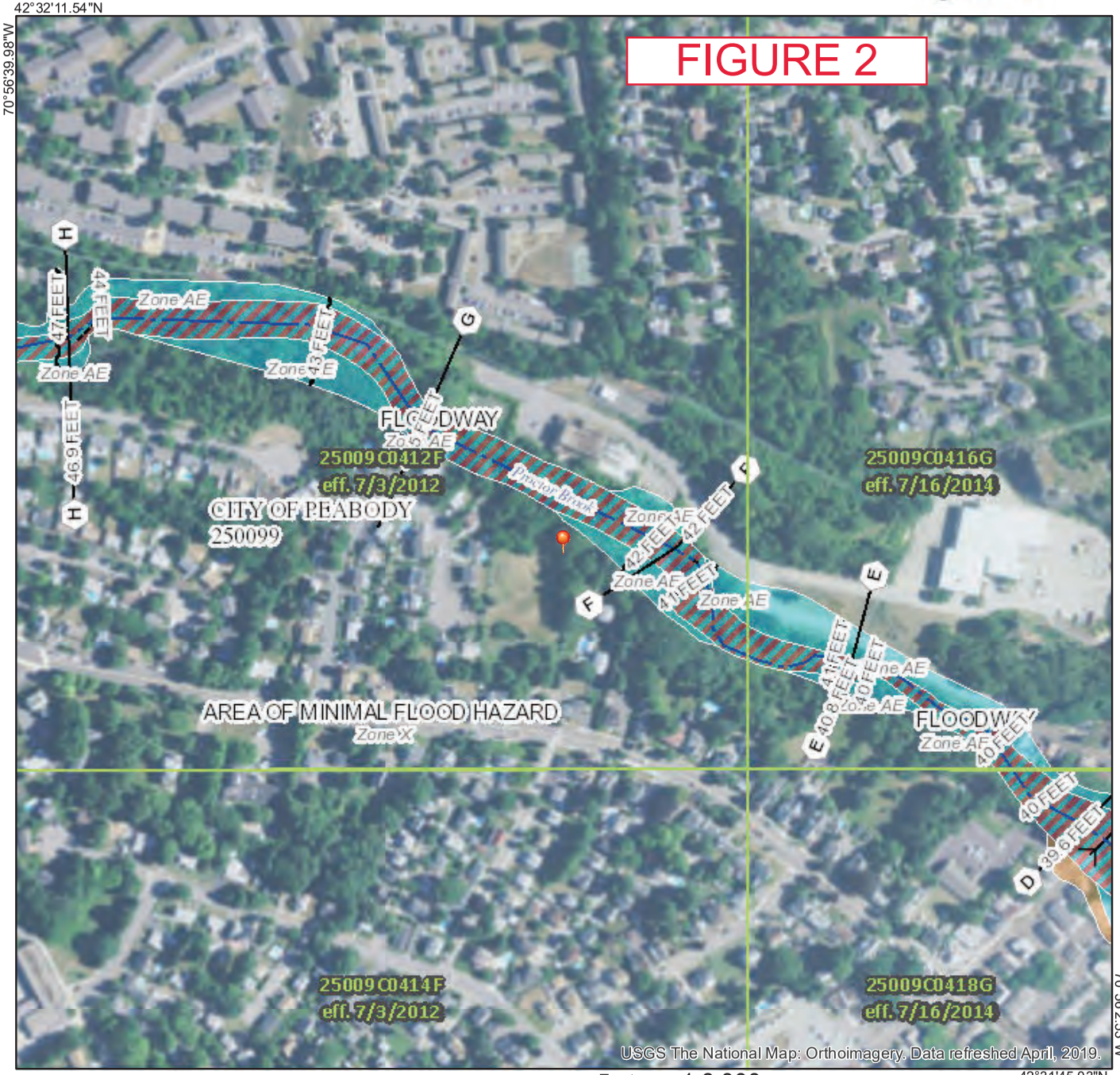
A00860 - 405

Proposal No. 609211-132091

National Flood Hazard Layer FIRMette

FEMA

FIGURE 2



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- **SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- **OTHER AREAS OF FLOOD HAZARD**
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- **OTHER AREAS**
  - NO SCREEN — Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- **GENERAL STRUCTURES**
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- **OTHER FEATURES**
  - 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
  - Coastal Transect
  - 513 — Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- **MAP PANELS**
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/24/2019 at 9:07:12 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

A00860 - 406

Proposal No. 609211-132091

ATTACHMENT A: 1977 HEC-2 MODEL INPUT/RESULTS

North River 0.0 - .69
Proctor Brook .69 - end

THIS RUN EXECUTED 11/13/78 19.06.25

PROCTOR BRK.

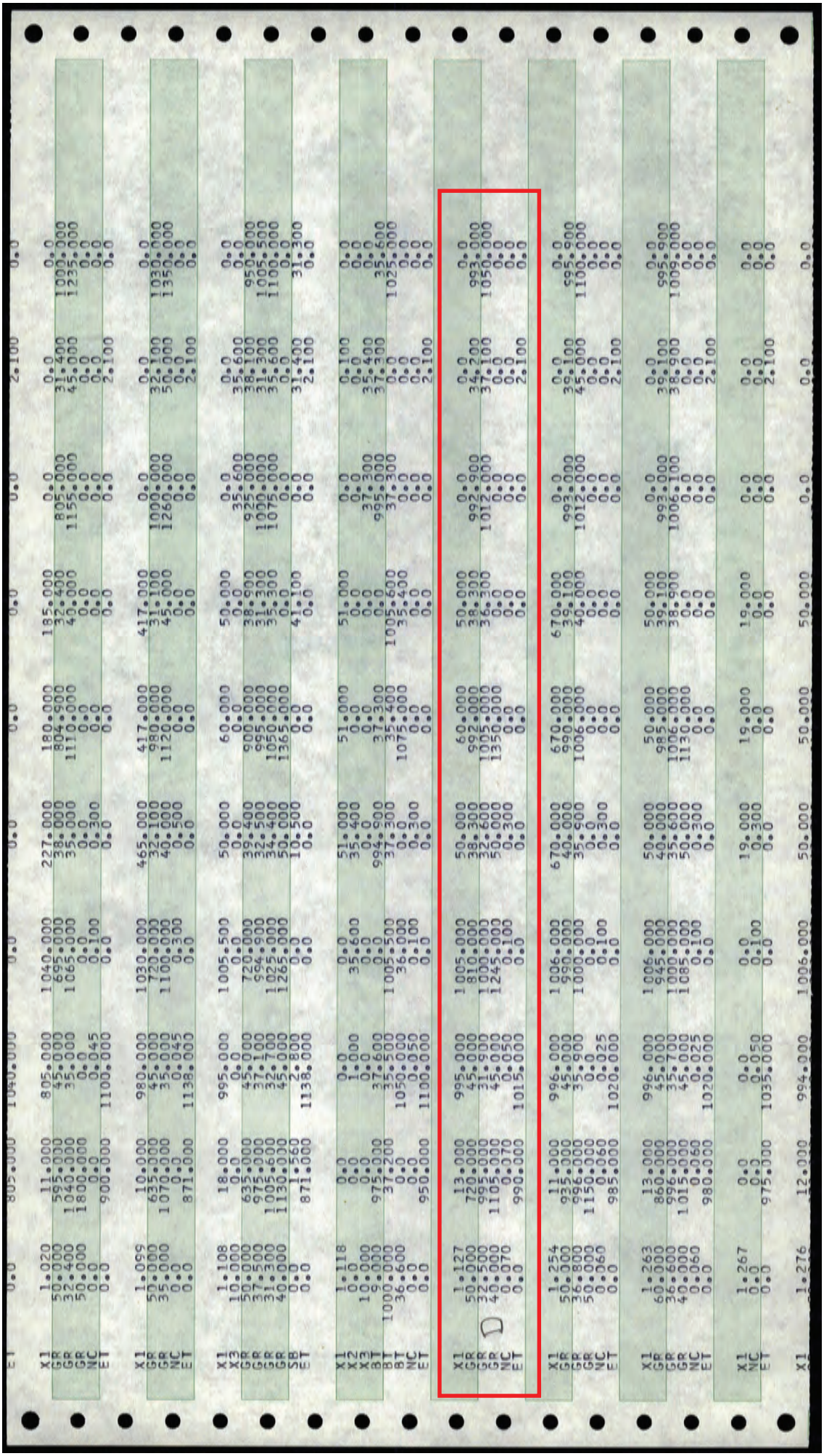
B.W. FINAL

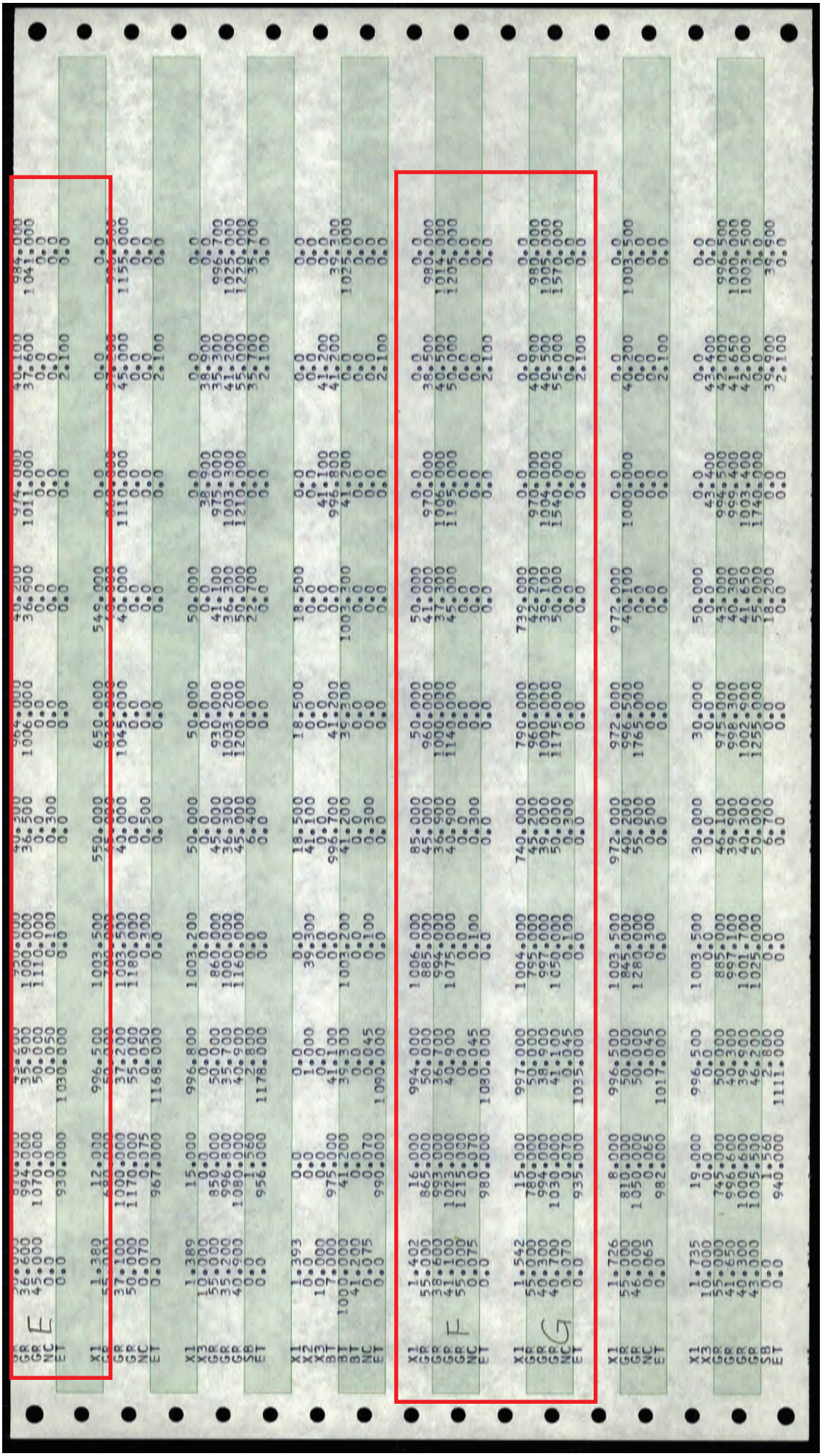
70'

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
**************************************************

T1      PEABODY, MASS.
T2      PROCTOR BROOK 10 YR.
T3      SALEM CORPORATE LIMIT TO PEABODY RD.

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       2.        0.        0.  0.0            0.0       0.0       0.     9.200     0.0
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
    1.000       0.0    -1.000       0.0       0.0       0.0       0.0       0.0       0.0       0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
    38.000     1.000     2.000     3.000    40.000    41.000    42.000    53.000    21.000     4.000

    22.000    54.000    34.000       0.0    38.000     1.000    39.000    50.000    61.000    51.000

    26.000    43.000    13.000    14.000    15.000    27.000    28.000       0.0       0.0       0.0
QT      9.000   640.000   970.000  1140.000  1620.000  1140.000  1140.000  1140.000  1140.000  1140.000
NC      0.080     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET        0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1      0.002    17.000   992.500  1005.500       0.0       0.0       0.0       0.0       0.0       0.0
GR     20.000   625.000    15.000   650.000    10.000   750.000    11.200   949.000    11.200   964.000
GR     10.800   979.500     5.400   992.500     4.200  1000.000     4.600  1005.500     5.300  1008.000
GR      8.300  1011.000     8.700  1025.000     8.700  1040.000     8.700  1055.000     9.500  1082.000
GR     10.000  1140.000    40.000  1140.100       0.0       0.0       0.0       0.0       0.0       0.0
NC      0.075     0.060     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET        0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1      0.056    12.000   994.000  1006.000   340.000   285.000   285.000       0.0       0.0       0.0
GR     20.000   570.000    15.000   630.000    10.000   730.000    10.000   905.000     5.000   980.000
GR      4.800   994.000     4.600  1000.000     4.800  1006.000     5.000  1010.000    10.200  1035.000
GR     10.500  1090.000    40.000  1090.100       0.0       0.0       0.0       0.0       0.0       0.0
NC      0.050     0.050     0.040     0.100     0.300       0.0       0.0       0.0       0.0       0.0
ET        0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1      0.056    10.000   994.000  1006.000     1.000     1.000     1.000       0.0       0.0       0.0
GR     40.000   950.000    10.000   950.100     5.000   980.000     4.800   994.000     4.600  1000.000
GR      4.800  1006.000     5.000  1010.000    10.200  1035.000    10.500  1090.000    40.000  1090.100
NC      0.040     0.045     0.040     0.300     0.500       0.0       0.0       0.0       0.0       0.0
ET        0.0   900.000  1100.000       0.0       0.0       0.0       0.0       0.0     2.100       0.0

X1      0.069    15.000   985.700  1014.700    70.000    70.000    69.000       0.0       0.0       0.0
```

A00860 - 408

Proposal No. 609211-132091





SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
1.108	36.88	0.0	36.89	0.0	0.0	31.30	994.90	995.00	113.85	1005.50	1108.76	190.52
1.108	38.58	0.0	38.58	0.0	0.0	31.30	935.09	995.00	185.21	1005.50	1120.30	385.08
1.108	40.31	0.0	40.31	0.0	0.0	31.30	870.75	995.00	267.62	1005.50	1138.37	711.10
1.108	41.16	0.0	41.16	0.0	0.0	31.30	843.46	995.00	317.83	1005.50	1161.29	932.54
1.118	36.87	0.0	36.95	35.40	35.60	31.40	995.00	995.00	112.97	1005.50	1107.97	41.15
1.118	38.66	0.0	38.67	35.40	35.60	31.40	935.35	995.00	184.89	1005.50	1120.24	383.86
1.118	40.39	0.0	40.39	35.40	35.60	31.40	871.33	995.00	266.55	1005.50	1137.88	706.81
1.118	41.27	0.0	41.27	35.40	35.60	31.40	843.09	995.00	318.52	1005.50	1161.61	935.87
1.127	36.93	0.0	37.13	0.0	0.0	31.90	992.93	995.00	49.14	1005.00	1042.07	50.28
1.127	38.61	0.0	38.71	0.0	0.0	31.90	983.53	995.00	95.14	1005.00	1078.67	117.26
1.127	40.38	0.0	40.40	0.0	0.0	31.90	935.42	995.00	180.30	1005.00	1115.72	263.75
1.127	41.25	0.0	41.28	0.0	0.0	31.90	911.56	995.00	228.76	1005.00	1140.32	383.56
1.254	39.42	0.0	40.00	0.0	0.0	35.90	991.93	996.00	19.22	1006.00	1011.15	24.61
1.254	39.51	39.37	40.74	0.0	0.0	35.90	991.62	996.00	19.67	1006.00	1011.29	25.89
1.254	40.20	0.0	41.22	0.0	0.0	35.90	990.00	996.00	25.73	1006.00	1015.73	36.85
1.254	40.87	40.81	42.20	0.0	0.0	35.90	990.00	996.00	37.40	1006.00	1027.40	50.24
1.263	39.58	0.0	40.20	0.0	0.0	35.60	988.69	996.00	24.05	1006.00	1012.74	53.96
1.263	40.07	39.45	41.06	0.0	0.0	35.60	984.42	996.00	31.61	1006.00	1016.02	68.13
1.263	40.45	39.95	41.48	0.0	0.0	35.60	981.42	996.00	39.85	1006.00	1021.27	81.08
1.263	41.33	41.06	42.48	0.0	0.0	35.60	974.38	996.00	59.21	1006.00	1033.59	119.44
1.267	39.65	0.0	40.23	0.0	0.0	35.60	988.11	996.00	24.98	1006.00	1013.09	55.71
1.267	40.25	39.45	41.12	0.0	0.0	35.60	983.02	996.00	35.45	1006.00	1018.47	73.95
1.267	40.65	39.97	41.54	0.0	0.0	35.60	979.80	996.00	44.29	1006.00	1024.10	88.83
1.267	41.59	41.07	42.54	0.0	0.0	35.60	972.26	996.00	65.03	1006.00	1037.29	133.45
1.276	40.31	0.0	40.33	0.0	0.0	35.90	963.97	994.00	87.64	1006.00	1051.61	107.01
1.276	41.22	0.0	41.25	0.0	0.0	35.90	959.57	994.00	95.61	1006.00	1055.18	169.41
1.276	41.64	0.0	41.67	0.0	0.0	35.90	957.54	994.00	99.28	1006.00	1056.82	203.91
1.276	42.64	0.0	42.68	0.0	0.0	35.90	952.71	994.00	108.04	1006.00	1060.75	300.66
1.380	40.53	0.0	40.54	0.0	0.0	37.10	856.86	996.50	257.84	1003.50	1114.71	152.48
1.380	41.39	0.0	41.39	0.0	0.0	37.10	851.72	996.50	270.69	1003.50	1122.42	295.40
1.380	41.79	0.0	41.79	0.0	0.0	37.10	849.30	996.50	276.76	1003.50	1126.05	378.11
1.380	42.78	0.0	42.78	0.0	0.0	37.10	843.35	996.50	291.62	1003.50	1134.97	619.85
1.389	40.51	0.0	40.61	0.0	0.0	35.20	977.20	996.80	44.75	1003.20	1021.95	58.62
1.389	41.36	0.0	41.46	0.0	0.0	35.20	972.01	996.80	192.47	1003.20	1164.48	91.75
1.389	41.77	0.0	41.84	0.0	0.0	35.20	967.27	996.80	201.22	1003.20	1168.49	122.29
1.389	42.77	0.0	42.81	0.0	0.0	35.20	955.74	996.80	222.50	1003.20	1178.24	227.39
1.393	41.80	0.0	41.83	41.10	39.30	35.20	966.89	996.80	201.92	1003.20	1168.81	125.06
1.393	42.45	0.0	42.47	41.10	39.30	35.20	959.38	996.80	215.77	1003.20	1175.16	189.68
1.393	42.75	0.0	42.77	41.10	39.30	35.20	955.98	996.80	222.05	1003.20	1178.03	224.78
1.393	43.53	0.0	43.55	41.10	39.30	35.20	946.91	996.80	238.79	1003.20	1185.70	335.36
1.402	41.82	0.0	41.85	0.0	0.0	36.70	967.95	994.00	184.37	1006.00	1152.33	114.03
1.402	42.47	0.0	42.50	0.0	0.0	36.70	966.33	994.00	194.72	1006.00	1161.05	176.79
1.402	42.76	0.0	42.79	0.0	0.0	36.70	965.59	994.00	199.40	1006.00	1165.00	211.71
1.402	43.55	0.0	43.58	0.0	0.0	36.70	963.61	994.00	212.04	1006.00	1175.65	318.60

D

E

F

	SECND	CWSEL	CRIWS	EG	ELTRD	ELLC	ELMIN	SSTA	STCHL	TOPWID	STCHR	ENDST	.01K
G	1.542	42.40	0.0	42.47	0.0	0.0	38.90	969.31	997.00	99.03	1004.00	1068.35	55.08
	1.542	43.01	0.0	43.08	0.0	0.0	38.90	967.31	997.00	109.50	1004.00	1076.80	87.37
	1.542	43.28	0.0	43.35	0.0	0.0	38.90	966.41	997.00	114.18	1004.00	1080.59	104.35
	1.542	44.02	0.0	44.09	0.0	0.0	38.90	963.95	997.00	127.00	1004.00	1090.95	159.05
	1.726	43.86	0.0	43.90	0.0	0.0	40.10	939.96	996.50	92.86	1003.50	1032.82	70.24
	1.726	44.45	0.0	44.51	0.0	0.0	40.10	930.82	996.50	106.75	1003.50	1037.56	100.41
	1.726	44.71	0.0	44.77	0.0	0.0	40.10	926.89	996.50	112.71	1003.50	1039.60	115.47
	1.726	45.41	0.0	45.48	0.0	0.0	40.10	916.11	996.50	129.08	1003.50	1045.19	163.74
*	1.735	43.94	43.94	44.88	0.0	0.0	39.90	988.61	996.50	22.60	1003.50	1011.21	15.83
*	1.735	44.67	44.67	45.64	0.0	0.0	39.90	983.97	996.50	31.72	1003.50	1015.70	25.16
*	1.735	44.94	44.94	45.94	0.0	0.0	39.90	982.27	996.50	35.08	1003.50	1017.35	29.57
*	1.735	45.59	45.59	46.69	0.0	0.0	39.90	978.21	996.50	43.08	1003.50	1021.28	42.48
	1.740	46.70	0.0	46.75	46.10	43.40	39.90	961.25	996.50	93.76	1003.50	1055.01	76.86
	1.740	47.35	0.0	47.41	46.10	43.40	39.90	946.04	996.50	148.87	1003.50	1094.91	111.85
	1.740	47.61	0.0	47.67	46.10	43.40	39.90	940.06	996.50	170.52	1003.50	1110.58	129.89
	1.740	48.32	0.0	48.37	46.10	43.40	39.90	923.80	996.50	229.44	1003.50	1153.24	194.12
F	1.749	46.76	0.0	46.77	0.0	0.0	39.90	855.65	996.00	233.97	1002.00	1089.62	413.41
	1.749	47.43	0.0	47.43	0.0	0.0	39.90	842.21	996.00	251.58	1002.00	1093.79	534.17
	1.749	47.69	0.0	47.69	0.0	0.0	39.90	836.95	996.00	258.47	1002.00	1095.42	586.16
	1.749	48.39	0.0	48.39	0.0	0.0	39.90	822.75	996.00	277.08	1002.00	1099.83	740.34
	1.882	46.80	0.0	46.81	0.0	0.0	40.80	939.19	994.00	167.28	1006.00	1106.48	283.97
	1.882	47.48	0.0	47.49	0.0	0.0	40.80	933.01	994.00	184.79	1006.00	1117.81	367.00
	1.882	47.75	0.0	47.75	0.0	0.0	40.80	930.58	994.00	191.68	1006.00	1122.26	403.31
	1.882	48.47	0.0	48.48	0.0	0.0	40.80	924.01	994.00	210.29	1006.00	1134.31	512.35
H	2.019	46.89	0.0	46.91	0.0	0.0	41.40	934.39	993.00	134.55	1007.00	1068.94	136.65
	2.019	47.59	0.0	47.62	0.0	0.0	41.40	927.52	993.00	146.17	1007.00	1073.69	198.05
	2.019	47.87	0.0	47.90	0.0	0.0	41.40	924.80	993.00	150.78	1007.00	1075.58	225.75
	2.019	48.62	0.0	48.65	0.0	0.0	41.40	917.45	993.00	163.22	1007.00	1080.67	310.20
	2.028	46.63	0.0	47.27	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	27.95
	2.028	47.07	0.0	48.24	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	32.86
	2.028	47.19	0.0	48.69	0.0	0.0	42.60	995.00	995.00	9.50	1004.50	1004.50	34.13
	2.028	48.55	0.0	48.81	0.0	0.0	42.60	989.39	995.00	57.41	1004.50	1046.79	121.45
	2.036	46.90	0.0	47.46	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	30.96
	2.036	48.23	0.0	48.96	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	46.35
	2.036	48.98	0.0	49.75	51.00	47.00	42.60	995.00	995.00	9.50	1004.50	1004.50	55.57
	2.036	51.68	0.0	51.73	51.00	47.00	42.60	894.32	995.00	175.38	1004.50	1069.70	335.37
	2.049	47.37	0.0	47.80	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	42.29
	2.049	48.71	0.0	49.32	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	58.97
	2.049	49.44	0.0	50.10	0.0	0.0	42.10	995.50	995.50	9.00	1004.50	1004.50	68.29
	2.049	51.70	0.0	51.80	0.0	0.0	42.10	959.89	995.50	71.92	1004.50	1031.81	295.82
	2.087	47.87	0.0	48.26	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	46.38
	2.087	50.27	0.0	50.73	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	72.87
	2.087	51.73	0.0	52.17	56.10	47.10	41.90	996.00	996.00	8.00	1004.00	1004.00	89.33
	2.087	56.80	0.0	56.82	56.10	47.10	41.90	835.94	996.00	168.06	1004.00	1004.00	804.85

ATTACHMENT B: PROPOSED CONDITIONS HEC-RAS ANALYSES – SUMMARY TABLES AND PLOTS

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

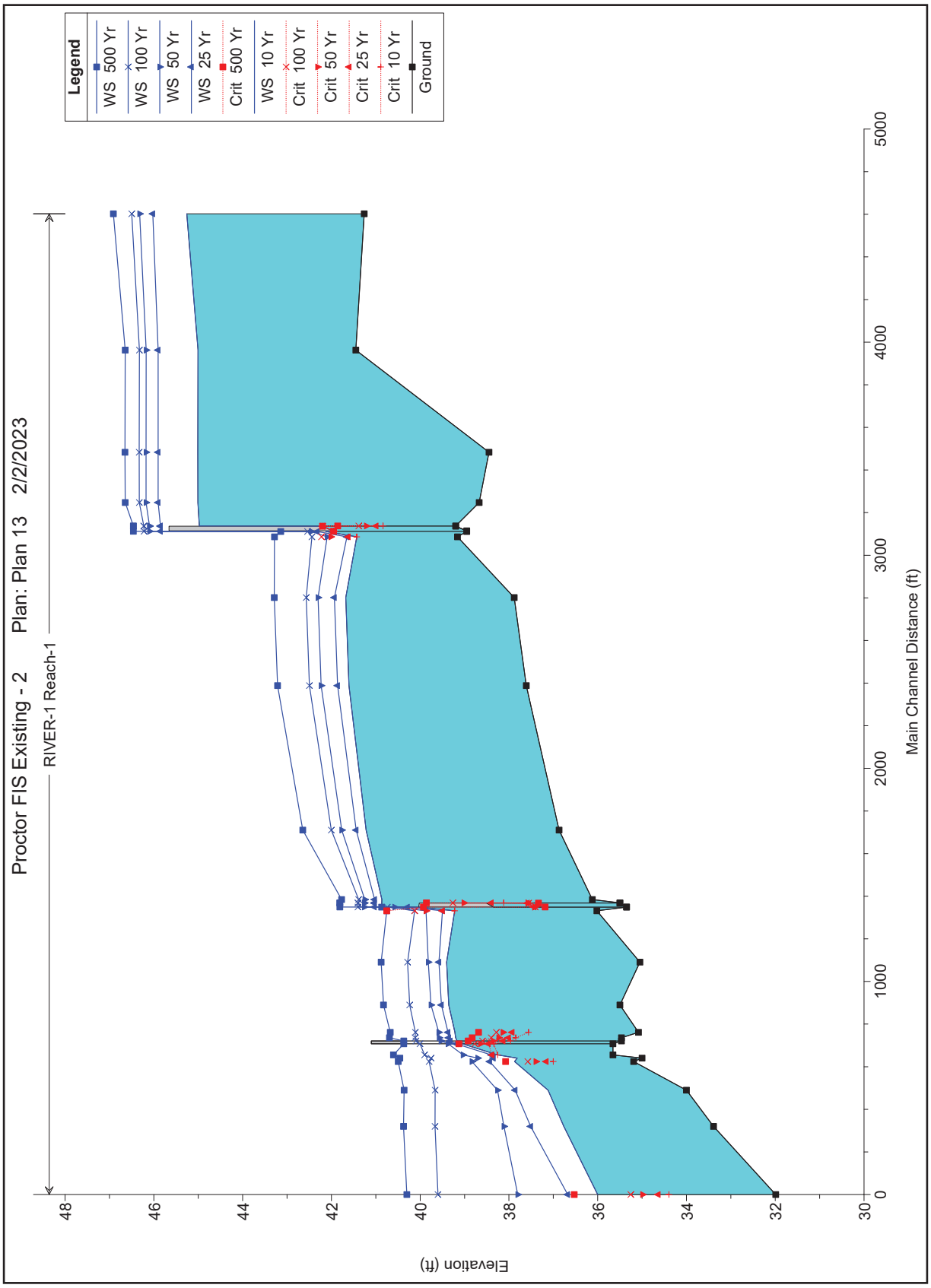
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	34	10 Yr	242.26	41.26	45.26		45.43	0.001879	3.47	97.63	84.71	0.37
Reach-1	34	25 Yr	289.42	41.26	46.02		46.12	0.000911	2.85	165.79	93.11	0.27
Reach-1	34	50 Yr	365.72	41.26	46.32		46.44	0.001017	3.17	193.87	96.36	0.29
Reach-1	34	100 Yr	427.56	41.26	46.50		46.64	0.001136	3.46	211.21	98.32	0.30
Reach-1	34	500 Yr	618.49	41.26	46.91		47.12	0.001543	4.30	252.72	102.84	0.36
Reach-1	33	10 Yr	242.26	41.45	45.01		45.02	0.000267	1.46	319.60	148.08	0.15
Reach-1	33	25 Yr	289.42	41.45	45.90		45.92	0.000140	1.26	461.53	168.49	0.11
Reach-1	33	50 Yr	365.72	41.45	46.17		46.19	0.000173	1.46	508.09	174.67	0.12
Reach-1	33	100 Yr	427.56	41.45	46.33		46.35	0.000206	1.63	534.97	178.14	0.14
Reach-1	33	500 Yr	618.49	41.45	46.64		46.68	0.000327	2.15	592.88	185.39	0.17
Reach-1	32	10 Yr	242.26	38.45	45.01		45.01	0.000006	0.29	871.30	219.19	0.02
Reach-1	32	25 Yr	289.42	38.45	45.90		45.91	0.000005	0.29	1075.76	237.72	0.02
Reach-1	32	50 Yr	365.72	38.45	46.18		46.18	0.000006	0.35	1141.15	243.35	0.03
Reach-1	32	100 Yr	427.56	38.45	46.33		46.33	0.000008	0.39	1178.58	246.52	0.03
Reach-1	32	500 Yr	618.49	38.45	46.65		46.65	0.000014	0.54	1258.64	253.15	0.04
Reach-1	31	10 Yr	242.26	38.67	45.01		45.01	0.000007	0.33	957.81	294.77	0.03
Reach-1	31	25 Yr	289.42	38.67	45.90		45.90	0.000006	0.32	1257.05	373.59	0.02
Reach-1	31	50 Yr	365.72	38.67	46.17		46.18	0.000007	0.39	1361.68	397.48	0.03
Reach-1	31	100 Yr	427.56	38.67	46.33		46.33	0.000009	0.44	1423.28	410.90	0.03
Reach-1	31	500 Yr	618.49	38.67	46.65		46.65	0.000016	0.60	1558.78	438.97	0.04
Reach-1	30	10 Yr	242.26	39.20	44.97	40.84	45.00	0.000123	1.46	233.94	97.19	0.11
Reach-1	30	25 Yr	289.42	39.20	45.85	40.99	45.89	0.000147	1.77	286.00	116.47	0.12
Reach-1	30	50 Yr	365.72	39.20	46.10	41.21	46.16	0.000205	2.14	320.35	168.44	0.15
Reach-1	30	100 Yr	427.56	39.20	46.23	41.38	46.30	0.000261	2.45	344.37	203.35	0.17
Reach-1	30	500 Yr	618.49	39.20	46.46	41.86	46.60	0.000470	3.36	399.49	268.61	0.22
Reach-1	29.5		Culvert									
Reach-1	29.4	10 Yr	242.26	38.95	42.13		42.35	0.002509	3.78	65.97	34.07	0.42
Reach-1	29.4	25 Yr	289.42	38.95	42.32		42.59	0.002777	4.17	71.88	36.81	0.45
Reach-1	29.4	50 Yr	365.72	38.95	42.45		42.84	0.003728	5.00	76.15	38.79	0.53
Reach-1	29.4	100 Yr	427.56	38.95	42.54		43.03	0.004604	5.67	78.75	39.99	0.59
Reach-1	29.4	500 Yr	618.49	38.95	43.14		43.83	0.005019	6.72	97.41	48.63	0.64
Reach-1	29.3	10 Yr	242.26	39.16	41.43	41.43	42.09	0.016855	6.51	37.23	28.61	1.01
Reach-1	29.3	25 Yr	289.42	39.16	41.65	41.62	42.33	0.015409	6.60	43.87	30.87	0.98
Reach-1	29.3	50 Yr	365.72	39.16	42.09	42.01	42.65	0.009391	6.09	75.57	104.97	0.79
Reach-1	29.3	100 Yr	427.56	39.16	42.44	42.22	42.87	0.006204	5.55	119.41	149.42	0.66
Reach-1	29.3	500 Yr	618.49	39.16	43.28		43.51	0.002697	4.55	291.00	258.02	0.46
Reach-1	28	10 Yr	242.26	37.88	41.68		41.69	0.000194	1.04	274.93	163.88	0.12
Reach-1	28	25 Yr	289.42	37.88	41.93		41.95	0.000190	1.11	316.93	165.79	0.12
Reach-1	28	50 Yr	365.72	37.88	42.30		42.32	0.000186	1.20	378.73	168.29	0.12
Reach-1	28	100 Yr	427.56	37.88	42.57		42.59	0.000186	1.27	423.89	170.10	0.12
Reach-1	28	500 Yr	618.49	37.88	43.29		43.32	0.000187	1.45	547.98	174.95	0.13
Reach-1	27	10 Yr	242.26	37.61	41.61		41.62	0.000162	0.94	262.98	122.78	0.11
Reach-1	27	25 Yr	289.42	37.61	41.86		41.88	0.000162	1.01	294.64	125.36	0.11
Reach-1	27	50 Yr	365.72	37.61	42.23		42.25	0.000164	1.11	341.70	129.09	0.11
Reach-1	27	100 Yr	427.56	37.61	42.50		42.52	0.000166	1.18	376.39	131.78	0.12
Reach-1	27	500 Yr	618.49	37.61	43.21		43.24	0.000174	1.39	473.33	138.92	0.12
Reach-1	26.5	10 Yr	242.26	36.87	41.22		41.36	0.001442	3.06	87.17	51.16	0.33
Reach-1	26.5	25 Yr	289.42	36.87	41.44		41.61	0.001540	3.33	99.43	57.56	0.34
Reach-1	26.5	50 Yr	365.72	36.87	41.77		41.97	0.001663	3.72	119.82	68.30	0.36
Reach-1	26.5	100 Yr	427.56	36.87	42.00		42.23	0.001747	3.99	136.75	77.37	0.38
Reach-1	26.5	500 Yr	618.49	36.87	42.64		42.94	0.001857	4.60	194.69	102.52	0.40
Reach-1	26	10 Yr	242.26	36.12	40.86		40.99	0.000887	2.90	97.10	48.82	0.26
Reach-1	26	25 Yr	289.42	36.12	41.03		41.19	0.001086	3.30	105.58	55.12	0.29
Reach-1	26	50 Yr	365.72	36.12	41.25		41.47	0.001415	3.90	118.63	63.60	0.33
Reach-1	26	100 Yr	427.56	36.12	41.39		41.67	0.001704	4.38	127.82	68.95	0.37
Reach-1	26	500 Yr	618.49	36.12	41.77		42.22	0.002529	5.64	157.16	83.79	0.45
Reach-1	25	10 Yr	242.26	35.50	40.87	38.12	40.96	0.000715	2.55	119.60	72.16	0.23
Reach-1	25	25 Yr	289.42	35.50	41.03	38.40	41.15	0.000858	2.88	132.11	78.29	0.26
Reach-1	25	50 Yr	365.72	35.50	41.26	39.01	41.42	0.001087	3.37	150.74	86.62	0.29
Reach-1	25	100 Yr	427.56	35.50	41.40	39.26	41.60	0.001287	3.75	163.64	91.94	0.32
Reach-1	25	500 Yr	618.49	35.50	41.81	39.86	42.11	0.001818	4.73	204.06	106.93	0.39
Reach-1	24.5		Culvert									
Reach-1	24.4	10 Yr	242.26	35.35	40.06		40.30	0.001760	3.99	66.19	24.87	0.36
Reach-1	24.4	25 Yr	289.42	35.35	40.29		40.59	0.002068	4.50	72.65	32.38	0.39

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	24.4	50 Yr	365.72	35.35	40.57		40.99	0.002586	5.26	83.66	44.02	0.44
Reach-1	24.4	100 Yr	427.56	35.35	40.74		41.26	0.003065	5.87	91.57	50.78	0.48
Reach-1	24.4	500 Yr	618.49	35.35	40.87	39.93	41.86	0.005758	8.19	98.31	55.89	0.66
Reach-1	24.3	10 Yr	242.26	36.02	39.22	39.22	40.06	0.016648	7.32	33.08	20.10	1.01
Reach-1	24.3	25 Yr	289.42	36.02	39.50	39.50	40.36	0.014524	7.45	40.48	30.70	0.96
Reach-1	24.3	50 Yr	365.72	36.02	39.87	39.87	40.76	0.012248	7.69	54.77	45.79	0.91
Reach-1	24.3	100 Yr	427.56	36.02	40.12	40.12	41.04	0.011122	7.88	67.75	55.44	0.88
Reach-1	24.3	500 Yr	618.49	36.02	40.75	40.75	41.73	0.009372	8.41	110.23	79.19	0.84
Reach-1	23	10 Yr	242.26	35.05	39.40		39.41	0.000052	0.66	401.39	156.58	0.07
Reach-1	23	25 Yr	289.42	35.05	39.58		39.58	0.000062	0.75	428.63	158.87	0.07
Reach-1	23	50 Yr	365.72	35.05	39.82		39.83	0.000078	0.88	467.37	161.12	0.08
Reach-1	23	100 Yr	427.56	35.05	40.28		40.30	0.000069	0.90	543.40	165.46	0.08
Reach-1	23	500 Yr	618.49	35.05	40.88		40.90	0.000089	1.12	643.56	171.00	0.09
Reach-1	22	10 Yr	242.26	35.50	39.36		39.38	0.000658	1.33	183.03	138.19	0.20
Reach-1	22	25 Yr	289.42	35.50	39.52		39.55	0.000646	1.41	206.41	141.44	0.20
Reach-1	22	50 Yr	365.72	35.50	39.76		39.79	0.000649	1.54	240.00	145.98	0.21
Reach-1	22	100 Yr	427.56	35.50	40.24		40.27	0.000400	1.39	312.34	155.31	0.17
Reach-1	22	500 Yr	618.49	35.50	40.83		40.86	0.000381	1.56	407.24	166.76	0.17
Reach-1	21.7	10 Yr	242.26	35.08	39.22	37.56	39.28	0.000955	1.98	122.64	69.81	0.25
Reach-1	21.7	25 Yr	289.42	35.08	39.37	37.93	39.45	0.001049	2.19	133.79	75.72	0.27
Reach-1	21.7	50 Yr	365.72	35.08	39.58	38.13	39.68	0.001203	2.50	150.44	83.77	0.29
Reach-1	21.7	100 Yr	427.56	35.08	40.11	38.28	40.19	0.000788	2.33	200.47	104.22	0.25
Reach-1	21.7	500 Yr	618.49	35.08	40.67	38.68	40.79	0.000846	2.73	262.26	114.10	0.26
Reach-1	21.6	10 Yr	242.26	35.46	39.20	37.85	39.24	0.001125	1.61	151.05	126.87	0.26
Reach-1	21.6	25 Yr	289.42	35.46	39.36	38.01	39.40	0.001123	1.70	171.47	134.62	0.26
Reach-1	21.6	50 Yr	365.72	35.46	39.57	38.23	39.62	0.001149	1.83	201.40	145.23	0.27
Reach-1	21.6	100 Yr	427.56	35.46	40.11	38.40	40.15	0.000579	1.53	287.30	168.00	0.20
Reach-1	21.6	500 Yr	618.49	35.46	40.69	38.83	40.74	0.000482	1.67	387.91	179.91	0.19
Reach-1	21.5		Bridge									
Reach-1	21.4	10 Yr	242.26	35.66	38.25	38.25	38.69	0.018701	5.36	49.29	69.69	1.00
Reach-1	21.4	25 Yr	289.42	35.66	38.40	38.38	38.84	0.015829	5.45	59.82	75.85	0.94
Reach-1	21.4	50 Yr	365.72	35.66	39.03		39.26	0.004572	4.02	116.63	102.92	0.55
Reach-1	21.4	100 Yr	427.56	35.66	39.90		40.01	0.001307	2.84	221.82	139.83	0.31
Reach-1	21.4	500 Yr	618.49	35.66	40.60		40.71	0.001041	2.98	325.78	155.54	0.29
Reach-1	21.35	10 Yr	242.26	35.00	37.81		38.18	0.004617	4.84	50.10	20.60	0.55
Reach-1	21.35	25 Yr	289.42	35.00	38.35		38.69	0.003646	4.71	61.40	21.66	0.49
Reach-1	21.35	50 Yr	365.72	35.00	38.70		39.14	0.004131	5.29	69.16	22.36	0.53
Reach-1	21.35	100 Yr	427.56	35.00	39.75		39.95	0.003457	3.54	120.75	67.51	0.47
Reach-1	21.35	500 Yr	618.49	35.00	40.46		40.66	0.002652	3.59	172.05	77.22	0.42
Reach-1	21.3	10 Yr	242.26	35.19	37.87	37.00	38.07	0.003009	3.56	68.12	35.00	0.45
Reach-1	21.3	25 Yr	289.42	35.19	38.43	37.16	38.60	0.002006	3.27	88.47	37.88	0.38
Reach-1	21.3	50 Yr	365.72	35.19	38.83	37.39	39.02	0.001886	3.47	118.41	103.01	0.37
Reach-1	21.3	100 Yr	427.56	35.19	39.80	37.57	39.90	0.000750	2.69	226.91	122.06	0.25
Reach-1	21.3	500 Yr	618.49	35.19	40.49	38.08	40.61	0.000756	3.03	316.67	135.81	0.26
Reach-1	21.2	10 Yr	242.26	34.00	37.12		37.53	0.005100	5.16	46.99	19.03	0.58
Reach-1	21.2	25 Yr	289.42	34.00	37.86		38.18	0.004995	4.54	63.78	31.80	0.56
Reach-1	21.2	50 Yr	365.72	34.00	38.26		38.59	0.005840	4.64	78.83	43.52	0.61
Reach-1	21.2	100 Yr	427.56	34.00	39.66		39.77	0.001224	2.63	167.44	82.49	0.30
Reach-1	21.2	500 Yr	618.49	34.00	40.36		40.49	0.001111	2.91	231.71	101.78	0.29
Reach-1	19	10 Yr	242.26	33.39	36.76		36.91	0.002162	3.10	78.03	37.25	0.38
Reach-1	19	25 Yr	289.42	33.39	37.51		37.59	0.002064	2.22	130.62	103.19	0.35
Reach-1	19	50 Yr	365.72	33.39	38.11		38.17	0.000996	1.85	197.34	117.88	0.25
Reach-1	19	100 Yr	427.56	33.39	39.66		39.68	0.000173	1.04	409.41	155.64	0.11
Reach-1	19	500 Yr	618.49	33.39	40.37		40.40	0.000181	1.18	525.96	172.92	0.12
Reach-1	18	10 Yr	242.26	31.99	36.00	34.40	36.21	0.002151	3.71	65.28	23.13	0.39
Reach-1	18	25 Yr	289.42	31.99	36.68	34.63	36.84	0.002605	3.25	93.05	65.81	0.41
Reach-1	18	50 Yr	365.72	31.99	37.80	34.99	37.88	0.000776	2.41	195.57	116.43	0.24
Reach-1	18	100 Yr	427.56	31.99	39.60	35.26	39.63	0.000159	1.49	478.02	197.41	0.12
Reach-1	18	500 Yr	618.49	31.99	40.30	36.53	40.34	0.000184	1.75	627.24	228.91	0.13

HEC-RAS Plan: Plan 13 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Reach-1	29.5 Culvert #1	10 Yr	45.00	44.97	45.15	45.00	45.67	242.26		2.85	10.09	10.09
Reach-1	29.5 Culvert #1	25 Yr	45.89	45.85	45.92	45.89	45.67	270.18	19.24	3.53	11.26	11.26
Reach-1	29.5 Culvert #1	50 Yr	46.16	46.10	46.16	46.16	45.67	274.98	90.74	3.64	11.46	11.46
Reach-1	29.5 Culvert #1	100 Yr	46.30	46.23	46.28	46.30	45.67	277.33	150.23	3.69	11.56	11.56
Reach-1	29.5 Culvert #1	500 Yr	46.61	46.46	46.58	46.61	45.67	266.02	352.47	3.32	11.08	11.08
Reach-1	24.5 Culvert #1	10 Yr	40.97	40.87	40.58	40.97	40.06	139.22	103.04	0.81	5.80	5.80
Reach-1	24.5 Culvert #1	25 Yr	41.16	41.03	40.83	41.16	40.06	136.42	153.00	0.75	5.68	5.68
Reach-1	24.5 Culvert #1	50 Yr	41.43	41.26	41.12	41.43	40.06	134.93	230.79	0.68	5.62	5.62
Reach-1	24.5 Culvert #1	100 Yr	41.61	41.40	41.32	41.61	40.06	133.78	293.78	0.66	5.57	5.57
Reach-1	24.5 Culvert #1	500 Yr	42.11	41.81	41.88	42.11	40.06	112.70	505.79	0.94	4.70	4.70


Proctor FIS Existing - 2 Plan: Plan 13 2/2/2023
RIVER-1 Reach-1
Legend
WS 500 Yr
WS 100 Yr
WS 50 Yr
WS 25 Yr
Crit 500 Yr
WS 10 Yr
Crit 100 Yr
Crit 50 Yr
Crit 25 Yr
Crit 10 Yr
Ground
Elevation (ft)
48
46
44
42
40
38
36
34
32
30
Main Channel Distance (ft)
0
1000
2000
3000
4000
5000

Appendix E: O&M Plan, LTPPP, and IDCS

- Stormwater Management System Operation and Maintenance (O&M) Plan
- Long Term Pollution Prevention Plan (LTPPP)
- Illicit Discharge Compliance Statement (IDCS)

To:	Brendan Callahan, City of Peabody, Assistant Director of Planning
Cc:	
From:	Danielle Spicer, P.E. Green International Affiliates, Inc. (Green)
Date:	February 2, 2023
Revised:	
Project:	Independence Greenway Extension – Peabody, MA (Green No. 17118)
Subject:	Stormwater Operation and Maintenance Plan & Long-Term Pollution Prevention Plan

Operation & Maintenance Plan

All Operation and Maintenance shall be done in accordance with the relevant O&M plan per the Department of Public Services for the City of Peabody, in addition to the items noted below.

OPERATION & MAINTENANCE PLAN – OUTFALLS

Level spreaders are required at the point of discharge to limit erosion. Outfalls should be inspected every six months during the first year and annually thereafter for sediment buildup, bare spots and vegetation health. Any erosion or low spots in the level spreader must be repaired.

OPERATION & MAINTENANCE PLAN – CATCH BASINS

Catch basins require regular cleaning. Inspect the catch basins at least four times per year, including at the end of foliage- and snow removal-season. Sediment must also be removed when the depth of deposits is greater than or equal to half of the depth from the bottom of the invert of the lowest pipe in the catch basin. More frequent cleaning may be necessary in critical areas or areas with higher potential pollutant loads. Vacuum trucks are preferable to clamshell buckets for cleaning, as vacuuming is faster and removes more sediment and supernatant.

OPERATION & MAINTENANCE PLAN – INFILTRATION TRENCH

Infiltration trenches shall be inspected after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months once established. Routinely remove leaves and accumulated sediment from the surface of the trench.

When inspecting infiltration trenches look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench surface is clogged. To address surface clogging, remove and replace the first 6” layer of stone aggregate. If water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.

Long-Term Pollution Prevention Plan

In general, long-term pollution prevention and related maintenance activities will be conducted consistent with the City of Peabody's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit.

This LTPPP satisfies the requirements related to pollution prevention under Massachusetts Stormwater Standards 4, 5, 6, and 10.

Practices for Long-Term Pollution Prevention

For the facilities covered, long-term pollution prevention includes the following measures:

Litter Pick-up

The City of Peabody will conduct litter pick-up from the stormwater management facilities in conjunction with routine road maintenance activities.

Routine Inspection and Maintenance of SCMs

The City of Peabody will conduct inspection and maintenance of the stormwater control measures in accordance with the Project's O&M plan and Peabody's Department of Public Services (DPS) O&M for the City.

Maintenance of Landscaped Areas

Routine mowing will be conducted according to standard DPS practices. Embankments designed to impound water should be mowed as required to prevent establishment of woody vegetation.

Except in rare circumstances, the City does not use fertilizers, herbicides, and pesticides for the maintenance of facilities. Exceptions include using fertilizer to ensure the survival of new plantings and herbicides to control invasive plants. Use of fertilizers and herbicides shall be reviewed and approved by DPS prior to application. Local Conservation Commission review may also be required.

Snow and Ice Management

Snow and Ice Management will be conducted consistent with the practices outlined in the City's Snow and Ice Control Program.

Street Sweeping

Routine highway cleaning, with a brush-type street sweeper, will be conducted in accordance with standard DPS practices. Sweeping will occur annually in the Spring.

Prohibition of Illicit Discharges

The MassDEP Stormwater Management Standards prohibit illicit discharges to the stormwater management system. Illicit discharges are discharges that do not consist entirely of stormwater, except for certain specified non-stormwater discharges.

Examples of discharges from the following sources are not considered illicit discharges:

- Firefighting activities*
- Foundation drains
- Water line flushing
- Footing drains
- Landscape irrigation
- Residential car washing
- Uncontaminated groundwater
- Rising groundwater
- Riparian habitats/wetlands
- Potable water sources
- Dechlorinated swimming pool water
- Street sweeping
- Wash water from buildings (without detergents)
- Condensation from air conditioning units
- Run-on from private driveways caused by precipitation
- Lawn watering

*Water from firefighting activities is allowed under this permit and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

There are no known or proposed illicit connections associated with the project limits.

Spill Prevention and Response

This project does not discharge to a Zone I, Zone II or Zone A surface water supply protection area.

Response procedures will be implemented at the proposed infiltration trench for any significant release of hazardous materials such as fuels, oils, or chemical materials that have the potential of discharging to Proctor Brook.

Reportable quantities will immediately be reported to the applicable Federal, State, and local agencies as required by law. Reportable quantities of chemical, fuels, or oils are established under the Clean Water Act and enforced through MassDEP. The MassDEP Emergency Response Program shall be immediately notified in accordance with required procedures for the report of a release (telephone 888-304-1133).

In the case of a spill, applicable containment and clean-up procedures will be performed immediately. The Peabody Fire Department will be the first responders. Spill material collected during the response will be promptly removed and disposed of in accordance with Federal, State, and local requirements. If necessary, a licensed emergency response contractor will assist in cleanup of releases depending on the amount of the release and the ability of the responsible party to perform the required response.

Illicit Discharge Compliance Statement

Per Standard 10 of the Massachusetts Stormwater Handbook, the following is an Illicit Discharge Compliance Statement:

The design plans submitted for the Notice of Intent have been designed in full compliance with current standards.

The Long-Term Pollution Prevention Plan is part of the Operation and Maintenance Plan and includes measures to prevent illicit discharges. There are no known combined sewer outfalls and to the best of our knowledge all closed stormwater systems discharge per Massachusetts DEP requirements. Based on observations during a site visit in November 2022 the site does not contain any known existing illicit discharges.

Registered Professional Engineer Block and Signature

2/3/2023

Signature and Date

APPENDIX G – NOI PLAN SET (BOUND SEPARATELY)

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	140
PROJECT FILE NO.	609211		

TITLE SHEET & INDEX

PLAN AND PROFILE OF

INDEPENDENCE GREENWAY EXTENSION
BRIDGE P-03-020 (CAK)

IN THE CITY OF

PEABODY

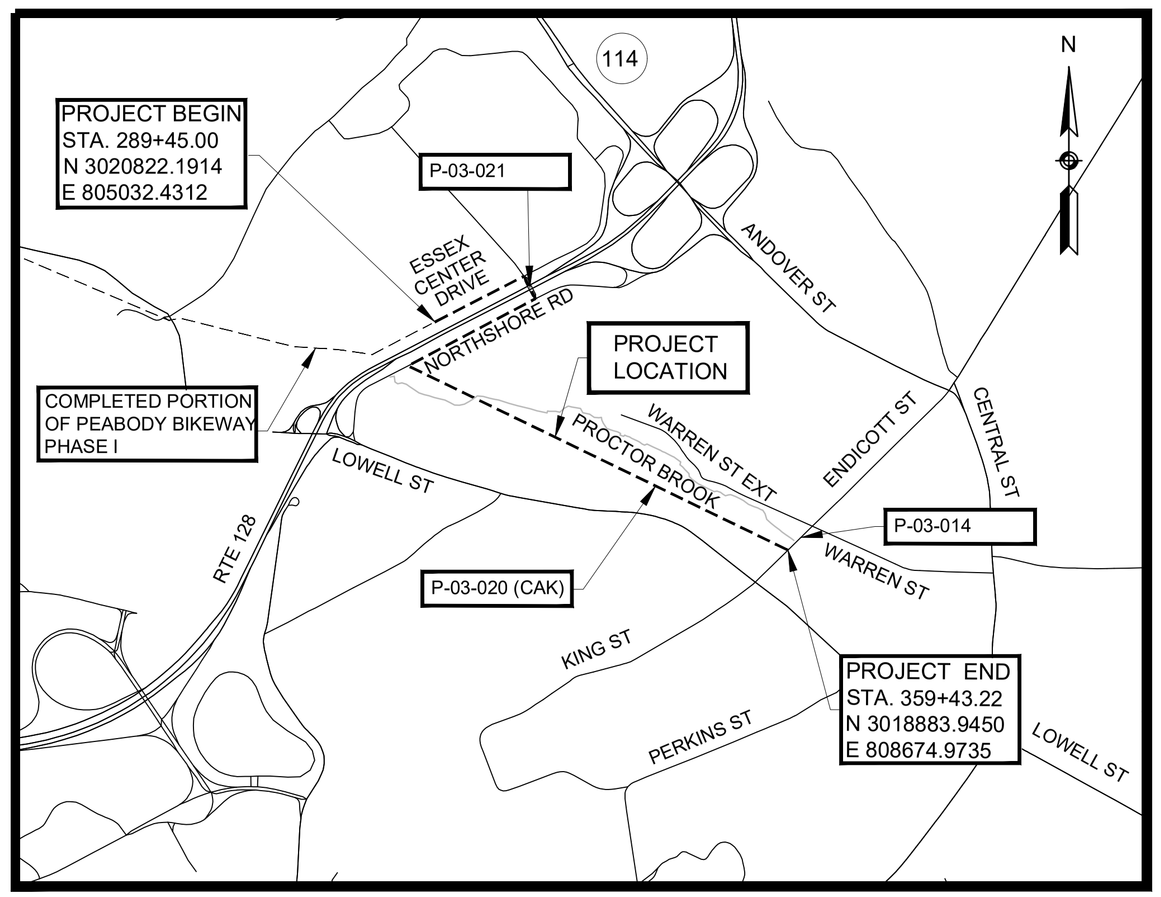
ESSEX COUNTY

FEDERAL AID PROJECT NO.

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	LEGEND & ABBREVIATIONS
3	GENERAL NOTES
4	KEY PLAN
5 - 6	BORING LOGS
7 - 8	TYPICAL SECTIONS & DETAILS 1
9 - 16	CONSTRUCTION PLANS & PROFILES
17 - 20	CURB TIE & GRADING PLANS
21 - 24	DRAINAGE AND UTILITY PLANS
25 - 31	PAVEMENT MARKINGS AND SIGNING PLANS
32	COMPENSATORY FLOOD STORAGE PLAN
33	WETLAND REPLICATION PLAN
34 - 39	CULVERT PLANS
40 - 45	CONSTRUCTION DETAILS (SELECTED SHEETS)
46 - 50	LANDSCAPE PLANS
51 - 58	TEMPORARY TRAFFIC CONTROL PLANS
59 - 75	BRIDGE PLANS (SELECTED SHEETS)
76 - 141	CROSS SECTIONS



0 1000 2000 3000 4000

SCALE: 1" = 1000'

LENGTH OF PROJECT = 6998.22 FEET = 1.325 MILES

NOTICE OF INTENT SUBMISSION DATE

04/09/2024

DESIGN DESIGNATION

	ESSEX CENTER DRIVE	NORTHSHORE ROAD	ENDICOTT STREET
ADT (2019)	6,302	6,917	7,427
ADT (2041)	6,963	7,643	8,206
DESIGN SPEED (MPH)	30	35	35
K	8.8	8.7	7.8
D	55%	63%	55%
T (PEAK HOUR)	6%	2%	5%
T (AVERAGE DAY)	6%	2%	5%
DHV	613	665	640
DDHV	337	419	352
FUNCTIONAL CLASSIFICATION	LOCAL ROADWAY	LOCAL ROADWAY	URBAN COLLECTOR

PLANS ARE FOR PERMIT SUBMISSION AND NOT FOR CONSTRUCTION

DATE	DESCRIPTION	REV #
4/17/2024	REVISED PS&E SUBMISSION	5
2/2/2024	PS&E DESIGN SUBMISSION	4
11/7/2023	100% DESIGN SUBMISSION	3
2/2/2023	75% DESIGN SUBMISSION	2
4/20/2021	25% DESIGN SUBMISSION	1

COMMONWEALTH OF MASSACHUSETTS
DANIELLE H. SPICER
CIVIL
No. 46067
REGISTERED PROFESSIONAL ENGINEER
4/09/2024

massDOT
Massachusetts Department of Transportation
Highway Division

APPROVED

CHIEF ENGINEER _____ DATE _____

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
TRANSPORTATION · STRUCTURAL · WATER RESOURCES · CIVIL/SITE

Proposal No. 609211-132091
SHT001_HD(TITLE).DWG Plotted on 9-Apr-2024 3:41 PM
A00860 - 426

GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
JB	JB	JERSEY BARRIER
CB	CB	CATCH BASIN
		CATCH BASIN CURB INLET
FP	FP	FLAG POLE
GP	GP	GAS PUMP
MB	MB	MAIL BOX
		POST SQUARE
		POST CIRCULAR
WELL	WELL	WELL
EHH	EHH	ELECTRIC HANDHOLE
		FENCE GATE POST
GG	GG	GAS GATE
BHL #	BHL #	BORING HOLE
MW #	MW #	MONITORING WELL
TP #	TP #	TEST PIT
		HYDRANT
		LIGHT POLE
CO.BD.		COUNTY BOUND
		GPS POINT
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		GAS MANHOLE
		MISC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		WATER MANHOLE
MHB	MHB	MASSACHUSETTS HIGHWAY BOUND
MON		MONUMENT
SB		STONE BOUND
TB		TOWN OR CITY BOUND
		TRAVERSE OR TRIANGULATION STATION
TPL or GUY	TPL or GUY	TROLLEY POLE OR GUY POLE
HTP		TRANSMISSION POLE
UFB	UFB	UTILITY POLE W/ FIREBOX
UPDL	UPDL	UTILITY POLE WITH DOUBLE LIGHT
ULT	ULT	UTILITY POLE W / 1 LIGHT
UPL	UPL	UTILITY POLE
		BUSH
SIZE & TYPE		TREE
		STUMP
		SWAMP / MARSH
WG	WG	WATER GATE
PM	PM	PARKING METER
		OVERHEAD CABLE/WIRE
		CURBING
100 99		CONTOURS (ON-THE-GROUND SURVEY DATA)
100 99		CONTOURS (PHOTOGRAMMETRIC DATA)
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		BALANCED STONE WALL
		GUARD RAIL - STEEL POSTS
		GUARD RAIL - WOOD POSTS
x	x	CHAIN LINK OR METAL FENCE
		WOOD FENCE
		SEDIMENT CONTROL BARRIER
		COIR LOG
		TREE LINE
		SAWCUT LINE
		TOP OR BOTTOM OF SLOPE
		EDGE OF PAVEMENT
		LIMIT OF MICROMILLING AND OVERLAY
		BANK OF RIVER OR STREAM
		BORDER OF WETLAND
		100 FT WETLAND BUFFER
		200 FT RIVERFRONT BUFFER
		STATE HIGHWAY LAYOUT
		TOWN OR CITY LAYOUT
		COUNTY LAYOUT
		RAILROAD SIDELINE
		TOWN OR CITY BOUNDARY LINE
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		EASEMENT

TRAFFIC SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
1	1	CONTROLLER PHASE ACTUATED
		TRAFFIC SIGNAL HEAD (SIZE AS NOTED)
		WIRE LOOP DETECTOR (6' x 6' TYP UNLESS OTHERWISE SPECIFIED)
		VIDEO DETECTION CAMERA
		MICROWAVE DETECTOR
		PEDESTRIAN PUSH BUTTON, SIGN (DIRECTIONAL ARROW AS SHOWN) AND SADDLE
	*	EMERGENCY PREEMPTION CONFIRMATION STROBE LIGHT
		VEHICULAR SIGNAL HEAD
		VEHICULAR SIGNAL HEAD, OPTICALLY PROGRAMMED
		FLASHING BEACON
		PEDESTRIAN SIGNAL HEAD, (TYPE AS NOTED OR AS SPECIFIED)
RRSG	RRSG	RAILROAD SIGNAL
OR		SIGNAL POST AND BASE (ALPHA-NUMERIC DESIGNATION NOTED)
	20'	MAST ARM, SHAFT AND BASE (ARM LENGTH AS NOTED)
		HIGH MAST POLE OR TOWER
		SIGN AND POST
		SIGN AND POST (2 POSTS)
	20'	MAST ARM WITH LUMINAIRE
		OPTICAL PRE-EMPTION DETECTOR
		CONTROL CABINET, GROUND MOUNTED
		CONTROL CABINET, POLE MOUNTED
		FLASHING BEACON CONTROL AND METER PEDESTAL
		LOAD CENTER ASSEMBLY
		PULL BOX 12"x12" (OR AS NOTED)
		ELECTRIC HANDHOLE 12"x24" (OR AS NOTED)
		TRAFFIC SIGNAL CONDUIT
		INFORMATIONAL SIGN

PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
ONLY	ONLY	LEGEND "ONLY" - WHITE
	SL	STOP LINE (12")
	CW	CROSSWALK
	SWL	SOLID WHITE LINE (6")
	SYL	SOLID YELLOW LINE (6")
	BWL	BROKEN WHITE LINE (10' LINE SEGMENT, 30' GAP)
	BYL	BROKEN YELLOW LINE (10' LINE SEGMENT, 30' GAP)
	DWL	DOTTED WHITE LINE (3' LINE SEGMENT, 9' GAP)
	DYL	DOTTED YELLOW LINE (3' LINE SEGMENT, 9' GAP)
	DWLEx	DOTTED WHITE LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DYLEx	DOTTED YELLOW LINE EXTENSION (2' LINE SEGMENT, 6' GAP)
	DBWL	DOUBLE WHITE LINE (6")
	DBYL	DOUBLE YELLOW LINE (6")

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
JCT	JUNCTION
L	LENGTH OF CURVE
LB	LEACH BASIN
LP	LIGHT POLE
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCR	PEDESTRIAN CURB RAMP
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	140
PROJECT FILE NO.	609211		

LEGEND & ABBREVIATIONS

ABBREVIATIONS (cont.)

GENERAL

PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
RMD	REMODEL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT
SB	STONE BOUND
SGE	SLOPED GRANITE EDGING
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STATION
STD	STANDARD
STW	SPRING TENSION WIRE
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE OR TOP OF SEDIMENT
TOW	TOP OF WATER
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION
DGCB	DOUBLE GRATE CATCH BASIN

TRAFFIC SIGNAL ABBREVIATIONS

CAB	CABINET
CCVE	CLOSED CIRCUIT VIDEO EQUIPMENT
DW	STEADY UPRAISED HAND
FDW	FLASHING UPRAISED HAND
FR	FLASHING CIRCULAR RED
FRL	FLASHING RED LEFT ARROW
FRR	FLASHING RED RIGHT ARROW
FY	FLASHING CIRCULAR YELLOW
FYL	FLASHING YELLOW LEFT ARROW
FYR	FLASHING YELLOW RIGHT ARROW
G	STEADY CIRCULAR GREEN
GL	STEADY GREEN LEFT ARROW
GR	STEADY GREEN RIGHT ARROW
GSL	STEADY GREEN SLASH LEFT ARROW
GSR	STEADY GREEN SLASH RIGHT ARROW
GV	STEADY GREEN VERTICAL ARROW
OL	OVERLAP
PED	PEDESTRIAN
PTZ	PAN, TILT, ZOOM
R	STEADY CIRCULAR RED
RL	STEADY RED LEFT ARROW
RR	STEADY RED RIGHT ARROW
TR SIG	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONDUIT
W	STEADY WALKING PERSON
Y	STEADY CIRCULAR YELLOW
YL	STEADY YELLOW LEFT ARROW

Proposal No. 609211-132091

SHT002_HDLEGEND & NOTES).DWG Plotted on 5-Apr-2024 5:36 PM

A00860 - 427

Proposal No. 609211-132091

SHT002_HD(GENERAL NOTES).DWG Plotted on 5-Apr-24 5:36 PM

A00860 - 428

GENERAL NOTES

1. ALL UTILITY POLES REQUIRING RELOCATION ARE TO BE RELOCATED BY OTHERS.
2. THE CONTRACTOR SHALL MAINTAIN COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD AT ALL OBSTRUCTIONS.
3. PEDESTRIAN CURB RAMPS SHALL CONFORM TO THE CURRENT MASSDOT STANDARDS.
4. TRANSITION GRANITE CURB SHALL BE INSTALLED AT PROJECT LIMITS TO MATCH EXISTING ELEVATIONS (PAVEMENT OR EXISTING CURB).
5. THE CONTRACTOR SHALL RETAIN ALL CURBS, FENCES, WALLS, TREES, SHRUBS, POSTS, LANDSCAPE FEATURES, AND OTHER MISCELLANEOUS ITEMS WITHIN ABUTTING PROPERTIES, UNLESS OTHERWISE NOTED. WHEN RETAINING THOSE ITEMS IS NOT PRACTICAL IN THE OPINION OF THE ENGINEER, THE CONTRACTOR SHALL REMOVE, STOCKPILE, PROTECT AND RESET THE ITEMS. THE CONTRACTOR SHALL REPLACE ITEMS DAMAGED DURING REMOVAL, STOCKPILING, OR RESETTING DUE TO NEGLIGENCE, CARELESSNESS, OR MISHANDLING WITH EQUIVALENT NEW ITEMS AT NO COST TO THE OWNER.
6. ALL TREES WITHIN THE SLOPE LIMIT SHALL BE RETAINED AND PROTECTED UNLESS OTHERWISE NOTED.
7. ALL TREES CALLED OUT TO BE RETAINED SHALL BE PROTECTED USING ITEM NO. 102.511 TREE PROTECTION - ARMORING AND PRUNING AND ITEM NO. 102.521 TREE AND PLANT PROTECTION FENCE.
8. CONTRACTOR SHALL PROTECT ALL PROPERTY MARKERS OF ABUTTERS.
9. TREATMENT OF SLOPE AREAS SHALL BE REPLACED IN KIND UNLESS OTHERWISE NOTED.
10. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN EXCAVATING ALONG THE ABUTMENT FOR THE SHARED-USE PATH AT THE ROUTE 128 UNDERPASS.

UTILITY NOTES:

1. THE LOCATION OF ALL UNDERGROUND UTILITIES ARE SHOWN APPROXIMATE AND WERE COMPILED USING FIELD SURVEY INFORMATION AND AVAILABLE RECORD INFORMATION. THE LOCATION OF EXISTING PIPES OR OTHER UNDERGROUND STRUCTURES OR PROPERTY LINES ARE NOT WARRANTED TO BE EXACT, NOR IS IT WARRANTED THAT ALL UNDERGROUND PIPES OR STRUCTURES ARE SHOWN. THE CONTRACTOR SHALL CALL "DIG SAFE" (1-888-344-7233) AND NOTIFY THE CITY OF PEABODY AND MASSDOT AT LEAST 72 HOURS (EXCLUDING SATURDAYS, SUNDAYS AND HOLIDAYS) PRIOR TO ANY EXCAVATION TO OBTAIN ACCURATE UTILITY LOCATIONS.
2. RECORD UTILITY INFORMATION FROM THE VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES ARE APPROXIMATE ONLY AND ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD.
3. THE COMPLETION AND ACCURACY OF LATERAL UTILITY SERVICES IS NOT GUARANTEED AND MUST BE VERIFIED BY THE CONTRACTOR IN THE FIELD.
4. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE MUST BE NOTIFIED, INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN, (SEE CHAPTER 370, ACTS OF 1963, MASSACHUSETTS) PRIOR TO DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORING OR REPAVING.
5. SUBSURFACE UTILITY LOCATIONS HAVE BEEN PLOTTED TO MEET UTILITY QUALITY LEVEL "C" AS DESCRIBED IN ASCE STANDARD 38-02 AND SUMMARIZED ON THIS SHEET. THE UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS BASED ON ABOVE-GROUND FIELD OBSERVATION AND EXISTING RECORD INFORMATION RECEIVED FROM UTILITY STAKE-HOLDERS.
6. INVERTS SHOWN ON PLAN ARE NOT GUARANTEED TO BE ACCURATE. DUE TO THE LIMITATIONS OF FIELD OBSERVATION AND SURVEY TECHNIQUES THE INVERTS ARE SHOWN AS APPROXIMATE ONLY AND SHALL NOT BE WARRANTED TO BE CORRECT. ADDITIONAL FIELD INVESTIGATION IS NECESSARY WHERE ACCURATE MEASUREMENTS ARE REQUIRED FOR DESIGN OF CRITICAL AREAS.
7. WHERE AN EXISTING UTILITY IS FOUND TO BE IN CONFLICT WITH THE PROPOSED WORK, THE CONTRACTOR SHALL ACCURATELY DETERMINE THE LOCATION, ELEVATION AND SIZE OF THE UTILITY AND FURNISH THE INFORMATION TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
8. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHEN EXCAVATING NEAR AND BACKFILLING IN THE VICINITY OF EXISTING UTILITIES. THE CONTRACTOR SHALL USE HAND EXCAVATION WHERE APPROPRIATE TO PROTECT EXISTING UTILITIES.
9. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING UTILITIES IN SERVICE AT ALL TIMES UNLESS NOTED ON THE PLANS OR APPROVED BY THE ENGINEER.
10. THE CONTRACTOR SHALL SUPPORT AND PROTECT EXISTING UTILITIES IN AND AROUND EXCAVATIONS, AND IN PARTICULAR, WHEN CROSSING OVER OR UNDER ANY DUCT OR PIPE. ALL PROTECTIVE MEASURES SHALL BE CONSIDERED INCIDENTAL WORK.
11. IF THE CONTRACTOR DAMAGES ANY UTILITY SYSTEM, HE OR SHE SHALL IMMEDIATELY NOTIFY THE RESPECTIVE UTILITY COMPANY AND SHALL REPAIR/REPLACE THE AFFECTED SYSTEM AT HIS OR HER OWN EXPENSE.
12. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE UTILITY COMPANIES AND MAKE ARRANGEMENTS FOR ADJUSTMENTS, ALTERATIONS AND REPLACEMENT OF PRIVATE UTILITIES.
13. BELOW GROUND STRUCTURES ARE SHOWN SYMBOLIC UNLESS DIMENSIONED.
14. THE EXISTING CONDITIONS PLAN IS TO BE USED FOR THE SPECIFIED PROJECT ONLY AND IS NOT WARRANTED TO BE COMPLETE FOR ANY OTHER FUTURE PROJECTS.
15. THE EXISTING SEWER LINE WITHIN THE PROJECT LIMITS SHALL BE INSPECTED USING CLOSED CIRCUIT TV (CCTV) AT THE BEGINNING OF THE PROJECT, PRIOR TO ANY MAJOR WORK ACTIVITIES OR LARGE EQUIPMENT MOBILIZING ON SITE. A CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE SAME LIMITS SHALL ALSO BE PERFORMED AT THE END OF CONSTRUCTION TO CONFIRM ITS CONDITION HAS NOT CHANGED OVER THE COURSE OF THE PROJECT.
IN ADDITION TO THE PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE EXISTING SEWER LINE FOR THE PROJECT LIMITS, INTERIM CCTV INSPECTION OF CERTAIN SEGMENTS OF THE SEWER LINE SHALL BE PERFORMED FOR SPECIFIC VIBRATION GENERATING ACTIVITIES. CCTV INSPECTION SHALL BE PERFORMED AT THE FOLLOWING LOCATIONS AND PROPOSED CONSTRUCTION ITEMS FOR EXCAVATION AND STONE INSTALLATION ACTIVITIES:

- STA 329+85 BOX CULVERT NO. 1
- STA 340+05 36" DIP PIPE CULVERT
- STA 342+25 24" DIP PIPE CULVERT
- STA 346+20 BOX CULVERT NO. 2
- STA 351+10 BOARDWALK WEST ABUTMENT
- STA 355+48 BOARDWALK EAST ABUTMENT
- STA 358+50 16" DUCTILE IRON PIPE

SUMMARY OF UTILITY MAPPING QUALITY LEVELS:

THE FOLLOWING IS A SUMMARY OF THE SURVEY MAPPING LEVELS FOR UTILITIES AS DESCRIBED IN ASCE STANDARD 38-02, "STANDARD GUIDELINE FOR THE DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". THESE GUIDELINES ARE MORE FULLY DESCRIBED IN THE ASCE STANDARD.

UTILITY QUALITY LEVEL A:
PRECISE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES OBTAINED BY THE ACTUAL EXPOSURE (OR VERIFICATION OF PREVIOUSLY EXPOSED AND SURVEYED UTILITIES) AND SUBSEQUENT MEASUREMENT OF SUBSURFACE UTILITIES, USUALLY AT A SPECIFIC POINT. MINIMALLY INTRUSIVE EXCAVATION EQUIPMENT IS TYPICALLY USED TO MINIMIZE THE POTENTIAL FOR UTILITY DAMAGE. A PRECISE HORIZONTAL AND VERTICAL LOCATION, AS WELL AS OTHER UTILITY ATTRIBUTES, IS SHOWN ON PLAN DOCUMENTS. ACCURACY IS TYPICALLY SET TO 15-MM VERTICAL AND TO APPLICABLE HORIZONTAL SURVEY AND MAPPING ACCURACY AS DEFINED OR EXPECTED BY THE PROJECT OWNER.

UTILITY QUALITY LEVEL B:
INFORMATION OBTAINED THROUGH THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND APPROXIMATE HORIZONTAL POSITION OF SUBSURFACE UTILITIES. QUALITY LEVEL B DATA SHOULD BE REPRODUCIBLE BY SURFACE GEOPHYSICS AT ANY POINT OF THEIR DEPICTION. THIS INFORMATION IS SURVEYED TO APPLICABLE TOLERANCES DEFINED BY THE PROJECT AND REDUCED ONTO PLAN DOCUMENTS.

UTILITY QUALITY LEVEL C:
INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D INFORMATION.

UTILITY QUALITY LEVEL D:
INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS.

SURVEY NOTES

1. THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULT OF AN ARIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON THE GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.
2. HORIZONTAL DATUM IS BASED ON THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, VERTICAL DATUM IS NAVD88. THE UNIT OF MEASUREMENTS IS US SURVEY FEET.
3. WETLANDS WERE DELINEATED BY GREEN ON 2/15/2018 AND REFLAGGED BY ECOSYSTEMS-SOLUTIONS IN 2022 ACCORDANCE WITH THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION AND FIELD LOCATED BY GREEN ON 2/20/2018. REFLAGGING DETERMINED BOUNDARIES HAD NOT CHANGED.
4. THE RIGHT OF WAY LINES SHOWN ON THIS PLAN ARE THE DIRECT RESULT OF AN INSTRUMENT SURVEY PERFORMED ON THE GROUND BY GREEN INTERNATIONAL AFFILIATES, INC. WITH AN ERROR OF CLOSURE LESS THAN 1:15,000, AND FROM PLANS AND DEEDS OF RECORD. PRIVATE PROPERTY LINES ARE COMPILED FROM DEEDS AND PLANS AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE SAID PARCELS SHOWN HERE ARE SUBJECT TO RIGHTS AND EASEMENTS AS CONTAINED IN THE VARIOUS DEEDS OF RECORD DESCRIBING SAID PREMISES. THE LOCATIONS AND EXTENT OF SAID RIGHTS AND EASEMENTS ARE NOT THE SUBJECT OF THIS SURVEY.

EROSION AND SEDIMENT CONTROL

1. ALL EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE START OF ANY LAND DISTURBANCE/EARTHWORK ACTIVITIES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE, REPAIR AND REPLACEMENT OF ALL SEDIMENTATION/EROSION CONTROL MEASURES UNTIL ALL DISTURBED AREAS ARE STABILIZED.

Proposal No. 609211-132091

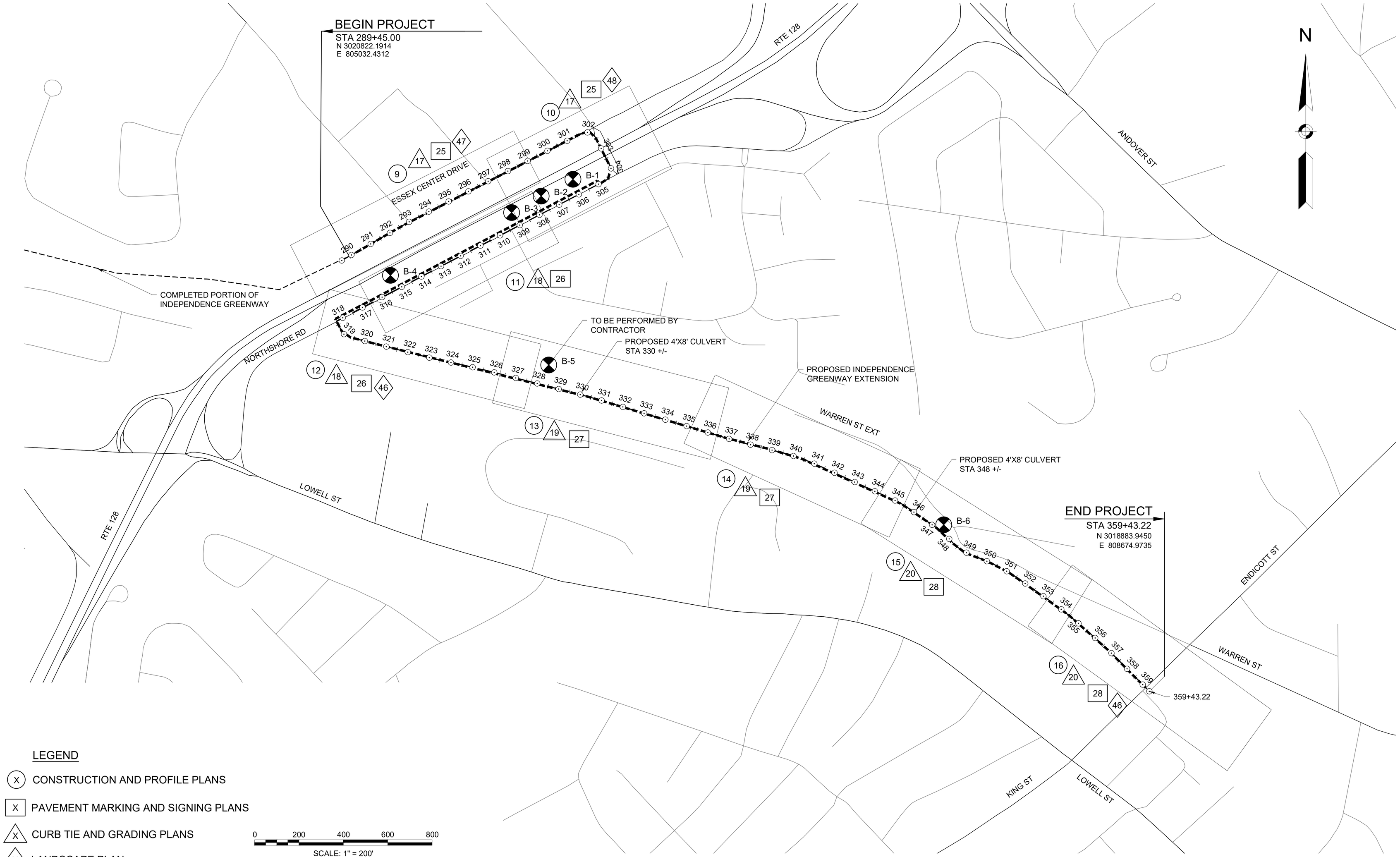
A00860 - 429

SHT003_HDI(KEY PLAN).DWG Plotted on 5-Apr-2024 5:36 PM

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	4	140
PROJECT FILE NO.		609211	

KEY PLAN



LEGEND

- (X) CONSTRUCTION AND PROFILE PLANS
- [X] PAVEMENT MARKING AND SIGNING PLANS
- △X CURB TIE AND GRADING PLANS
- ◇X LANDSCAPE PLAN

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	5	140
PROJECT FILE NO.	609211		

BORING LOGS - 1

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021910.4030, E 806262.1626
Ground Surface Elev. (ft.): 68.6
Final Boring Depth (ft.): 15.3
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1030	6.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	14	1 2 2 3	4	S-1: (Top 7") Dry, dark brown, fine SAND and SILT, trace Roots. (TOPSOIL) (Bottom 7") Dry, brown, fine SAND, some Silt, trace Roots. (SUBSOIL)	1 2			FILL	
5		S-2	5-7	24	13	8 19 86 22	R	S-2: (Top 3") Moist, brown, fine to medium SAND, some Silt. (FILL) (Bottom 10") Moist, brown, fine to coarse SAND, little Silt, trace Gravel. (Piece of gravel stuck in tip of spoon.)			5.3		63.3'
		S-3	7-9	24	10	38 42 45 50	87	S-3: Very dense, wet, brown/gray, GRAVEL, some fine to coarse Sand, trace Silt.	3			GLACIAL DEPOSIT	
10		S-4	9-11	24	7	25 30 13 36	43	S-4: Dense, wet, brown, fine to medium SAND, some Silt, some Gravel.	4				
15		S-5	15-15.1	1	1	100/1"	R	S-5: Very dense, wet, brown/gray, GRAVEL, trace Silt. (Fragment of possible bedrock stuck in tip of spoon.) Bottom of boring at 15.3 feet.	5 6		15.3		53.3'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Borehole relocated approximately 25 feet from staked location due to access.
3. Driller noted increased drilling resistance at 6.5 feet below ground surface (bgs).
4. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 11 feet bgs.
5. Auger refusal at 15.3 feet bgs on possible bedrock. Borehole terminated.
6. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY: 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021834.6298, E 806118.9857
Ground Surface Elev. (ft.): 68.4
Final Boring Depth (ft.): 10.5
Date Start - Finish: 1/2/2019 - 1/2/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/2/19	1230	10	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	18	1 4 27 36	31	S-1: (Top 10") Dry, dark brown, fine SAND, some Silt, trace Roots. (TOPSOIL) (Bottom 8") Dry, dark brown/black, fine to medium SAND, little Silt, trace Gravel.	1			FILL	
		S-2	2-4	24	20	30 56 40 36	96	S-2: Very dense, moist, black/gray, fine to coarse SAND, little Silt, trace Gravel.			4		64.4'
5		S-3	4-6	24	9	28 11 19 17	30	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.					
		S-4	6-8	24	14	70 25 20 20	45	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, some Silt.	2			GLACIAL DEPOSIT	
10		S-5	10-10.3	3	0	100/3"	R	S-5: No recovery. (Fragments of possible bedrock stuck in tip of spoon.) Bottom of boring at 10.5 feet.	3 4		10.5		57.9'
15													
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Gravel and Cobbles (less than 6 inches) observed in drill spoils at approximately 6.5 feet below ground surface (bgs).
3. Auger refusal at 10.5 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY: 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021760.5337, E 805985.8731
Ground Surface Elev. (ft.): 62.3
Final Boring Depth (ft.): 14.7
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other: -

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19		Not encountered		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
0		S-1	0-2	24	13	2 3 11 14	14	S-1: Medium dense, dry, dark brown, fine to coarse SAND, some Silt, trace Gravel, trace Roots. (TOPSOIL)	1			FILL	
		S-2	2-4	24	18	14 35 72 69	R	S-2: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
5		S-3	4-6	24	14	27 11 12 14	23	S-3: Very dense, moist, black with brown, fine to coarse SAND, little Gravel, trace Silt, trace Ash.					
		S-4	6-8	24	10	12 14 5 3	19	S-4: Very dense, moist, black with brown, GRAVEL and fine to coarse SAND, trace Silt, trace Ash.					
		S-5	8-10	24	9	3 6 9 14	15	S-5: Medium dense, moist, brown, fine to coarse SAND, little Gravel, trace Silt.			8		54.3'
10												GLACIAL DEPOSIT	
15		S-6	14.5-14.7	2	0	100/2"	R	S-6: No recovery. Bottom of boring at 14.7 feet.	2 3		14.7		47.6'
20													
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Auger refusal at 14.5 feet below ground surface (bgs) on possible bedrock. Advanced split spoon. Split spoon refusal at 14.7 feet bgs. Borehole terminated.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY: 3/18/2019

BORING NOTES

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Hollow Stem Auger

Boring Location: N 3021477.6337, E 805439.9424
Ground Surface Elev. (ft.): 51.8
Final Boring Depth (ft.): 17
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA
I.D/O.D.(in): 2.75/5.75
Hammer Weight (lb.): -
Hammer Fall (in.): -
Other:

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1145	9.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev.- (ft.)
		S-1	0-2	24	9	3 2 3 2	5	S-1: Loose, dry, dark brown, fine to medium SAND, some Silt, trace Roots.	1			FILL	
		S-2	2-4	24	6	2 3 3 14	6	S-2: Loose, moist, brown, fine to coarse SAND, trace Gravel, trace Silt.			3.5		48.3'
5		S-3	4-6	24	14	12 15 23 17	38	S-3: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-4	6-8	24	13	13 20 19 19	39	S-4: Dense, moist, brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	6	15 21 30 21	51	S-5: Very dense, wet, brown, fine to coarse SAND, some Gravel, little Silt.	2			GLACIAL DEPOSIT	
15		S-6	15-16.9	23	12	12 18 69 100/5"	87	S-6: Very dense, wet, brown/gray, fine to coarse SAND, some Gravel, little Silt. (Possible bedrock fragments stuck in tip of spoon.)			17		34.8'
20								Bottom of boring at 17 feet.	3 4				
25													
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Driller noted increased drilling effort at 9 feet below ground surface (bgs).
3. Auger refusal at 17 feet bgs on possible bedrock. Borehole terminated.
4. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

174019 PROPOSED PEABODY BIKEWAY.GPJ, STRATUM ONLY, 3/18/2019

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-6
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Zachary Morris

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:HSA/D&W

Boring Location: N 3020353.9560, E 807932.5686
Ground Surface Elev. (ft.): 40.5
Final Boring Depth (ft.): 25.9
Date Start - Finish: 1/3/2019 - 1/3/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HSA/HW
I.D/O.D.(in): 2.75/5.75 & 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/3/19	1530	3.5	n/a	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev.- (ft.)
		S-1	0-2	24	13	4 4 11 5	15	S-1: Medium dense, dry, dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots.	1			FILL	
		S-2	2-4	24	14	9 6 5 6	11	S-2: Medium dense, wet, brown, fine to medium SAND and SILT, trace Gravel.			2		38.5'
5		S-3	4-6	24	14	4 8 10 14	18	S-3: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt.					
		S-4	6-8	24	19	13 16 17 16	33	S-4: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
10		S-5	10-12	24	16	6 11 19 28	30	S-5: Dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.	2				
15		S-6	14-16	24	7	4 5 6 6	11	S-6: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.				SAND AND GRAVEL	
20		S-7	19-21	24	8	5 6 5 5	11	S-7: Medium dense, wet, brown/gray, fine to coarse SAND, trace Silt, trace Gravel.					
25		S-8	24-25.9	22	10	16 14 22 100/2"	36	S-8: Dense, wet, brown/gray, fine to coarse SAND and GRAVEL, trace Silt. (Possible bedrock fragments stuck in tip of spoon.)			25.9		14.6'
								Bottom of boring at 25.9 feet.	3				
30													

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Hole appears to have blown in prior to sampling S-5. Blow counts at S-5 may be inaccurate. Driller removed augers and offset 4 feet southeast of staked location and continued hole with 4-inch casing. Samples S-6 through S-8 obtained using drive and wash drilling methods.
3. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

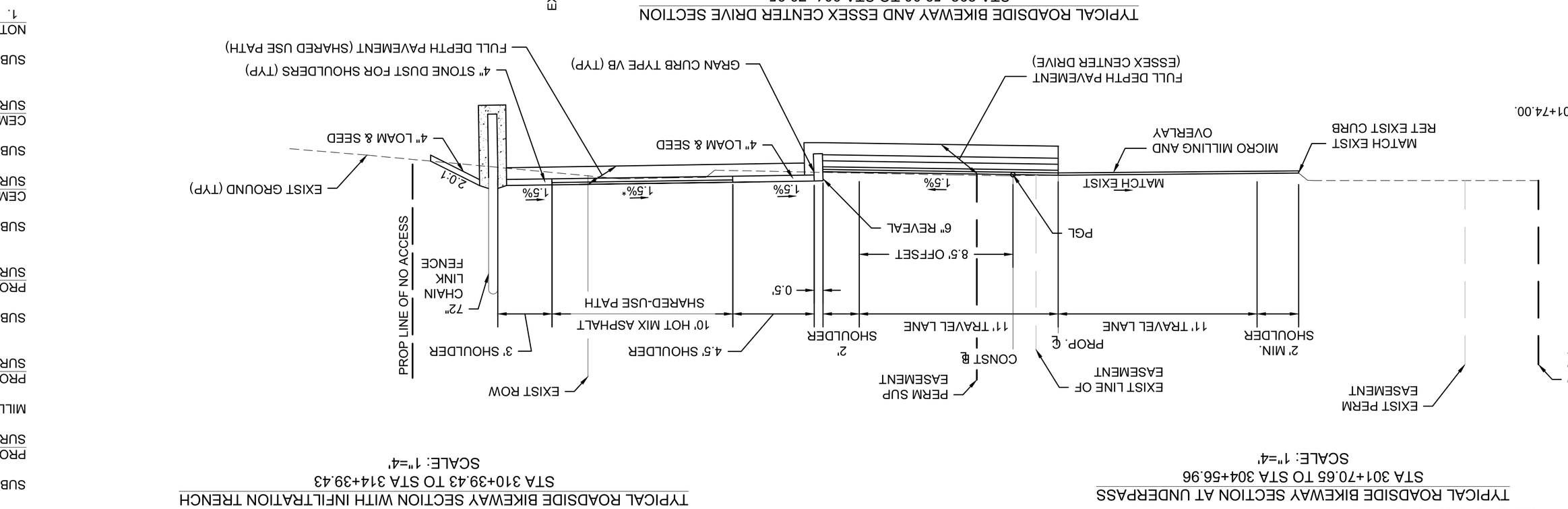
Boring No.: B-6

174019 PROPOSED PEABODY BIKEWAY.GPJ, STRATUM ONLY, 3/18/2019

BORING NOTES

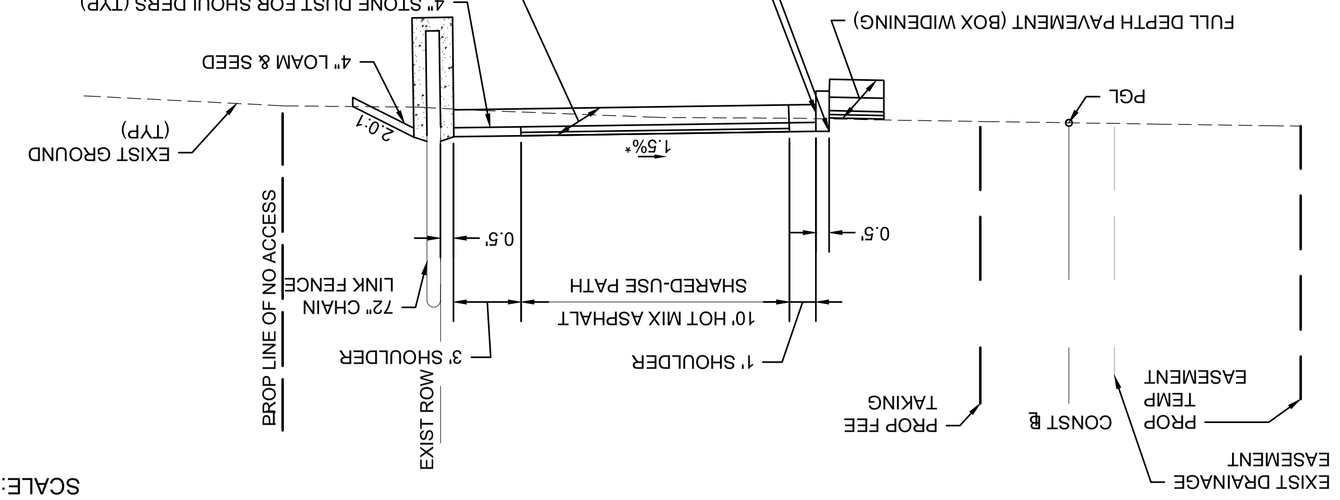
1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B-1
2. BORINGS TAKEN FOR THE PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES TO THE LEFT OF COLUMNS INDICATE DEPTH BELOW SURFACE AT BORING POINT.
5. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS PRODUCED BY A 30" FALL OF 140 POUND MASS HAMMER REQUIRED TO DRIVE 2" I.D. SPOON 1 FOOT.
6. BORING SAMPLE TAKEN 1/2/2019 - 1/3/2019.
7. BORING CONTRACTOR - NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH 03038
8. BORING SAMPLES WERE STORED AT A STORAGE FACILITY ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.

Proposal No. 609211-132091
SHT00017_HD(BORING LOGS).DWG Plotted on 5-Apr-2024 5:38 PM
A00860 - 431

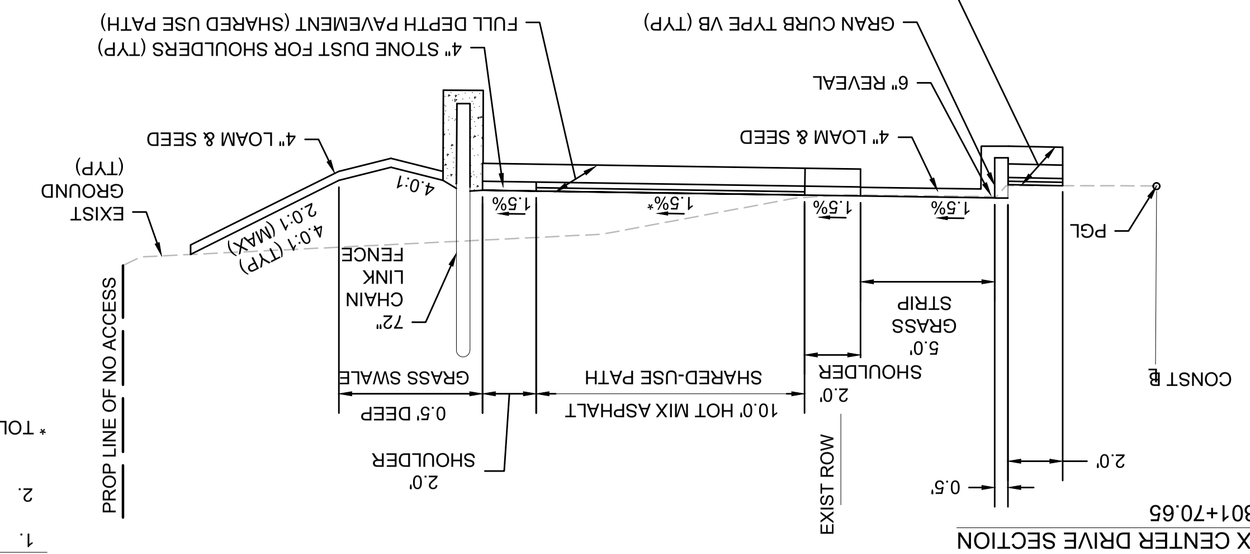


NOTE: MILLING ENDS AT STA 301+74.00.

TYPICAL ROADSIDE BIKEWAY AND ESSEX CENTER DRIVE SECTION
STA 292+53.00 TO STA 301+70.65
SCALE: 1"=4'



TYPICAL ROADSIDE BIKEWAY AND ESSEX CENTER DRIVE SECTION
STA 289+83.24 TO STA 292+53.00
SCALE: 1"=4'



TYPICAL ROADSIDE BIKEWAY SECTION WITH SWALE
STA 304+56.96 TO STA 310+39.43
STA 314+39.43 TO STA 318+32.11
SCALE: 1"=4'

* TOLERANCE FOR CONSTRUCTION +/-0.5%

NOTES:
1. ALL HMA FOR PATCHING, ASPHALT EMULSION FOR TACK COAT AND HMA JOINT ADHESIVE SHALL BE INSTALLED PER SECTION 460 AND 700.
2. HMA SIDEWALKS, DRIVEWAYS, AND SHARED USE PATH ARE TO BE PAID FOR UNDER ITEM 702.

SUB-BASE COURSE: 18" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE REINFORCED PAVEMENT
SURFACE COURSE: 6" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610) WITH WWF 6X6 - W1.4 x W1.4 AT MID DEPTH

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH PAVEMENT (BOX WIDENING)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

BASE COURSE: 4" SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) OVER
4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER

INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER

SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

PROPOSED FULL DEPTH PAVEMENT (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

INTERMEDIATE COURSE: 2.5" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER

PROPOSED FULL DEPTH PAVEMENT (SHARED USE PATH)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

CEMENT CONCRETE WALK/PEDESTRIAN CURB RAMP
SURFACE COURSE: 4" CEMENT CONCRETE (AIR ENTRAINED - 4000 PSI, 3/4", 610)

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PAVEMENT NOTES

PROPOSED FULL DEPTH PAVEMENT (SHARED USE PATH)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

INTERMEDIATE COURSE: 2.5" SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA DRIVEWAY
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
2.5" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) (SEE NOTE 2)

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA WALK
SURFACE COURSE: 1.25" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
1.75 SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5)

MILLING COURSE: 1.5" PAVEMENT MICRO MILLING

PROPOSED MICRO MILLING AND OVERLAY (ESSEX CENTER DRIVE)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

BASE COURSE: 6" HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE OVER

INTERMEDIATE COURSE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER

SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

PROPOSED FULL DEPTH PAVEMENT (BOX WIDENING)
SURFACE COURSE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER

SUB-BASE COURSE: 8" GRAVEL BORROW (TYPE B)

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	140
PROJECT FILE NO. 609211			

TYPICAL SECTIONS & DETAILS 1

TYPICAL ROADSIDE BIKEWAY SECTION WITH INFILTRATION TRENCH
STA 310+39.43 TO STA 314+39.43
SCALE: 1"=4'

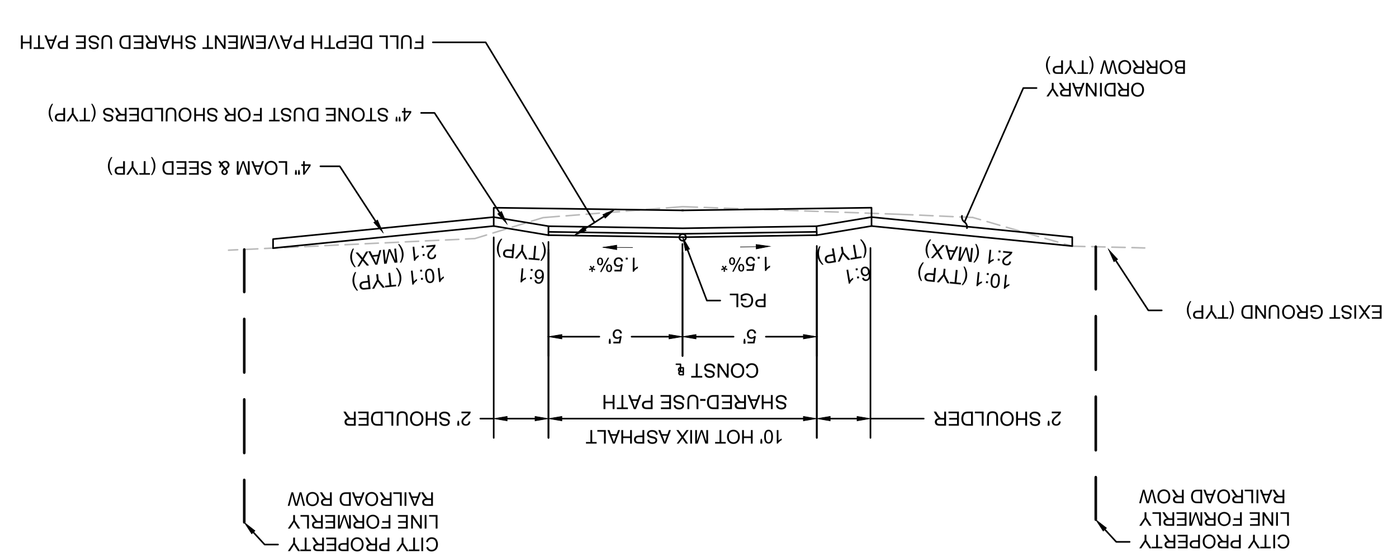
NOTE: THE PROPOSED SHARED-USE PATH SHALL NOT IMPACT THE EXISTING BRIDGE FOOTING.
NOTE: WIDTH OF SHOULDER WITH BOLLARD VARIES FROM 301+70.65 TO 302+57.78 AND 303+85.45 TO 304+56.96.

TYPICAL ROADSIDE BIKEWAY SECTION AT UNDERPASS
STA 301+70.65 TO STA 304+56.96
SCALE: 1"=4'

SHT004_HDTYPICAL SECTIONS).DWG Plotted on 9-Apr-2024 10:34 AM

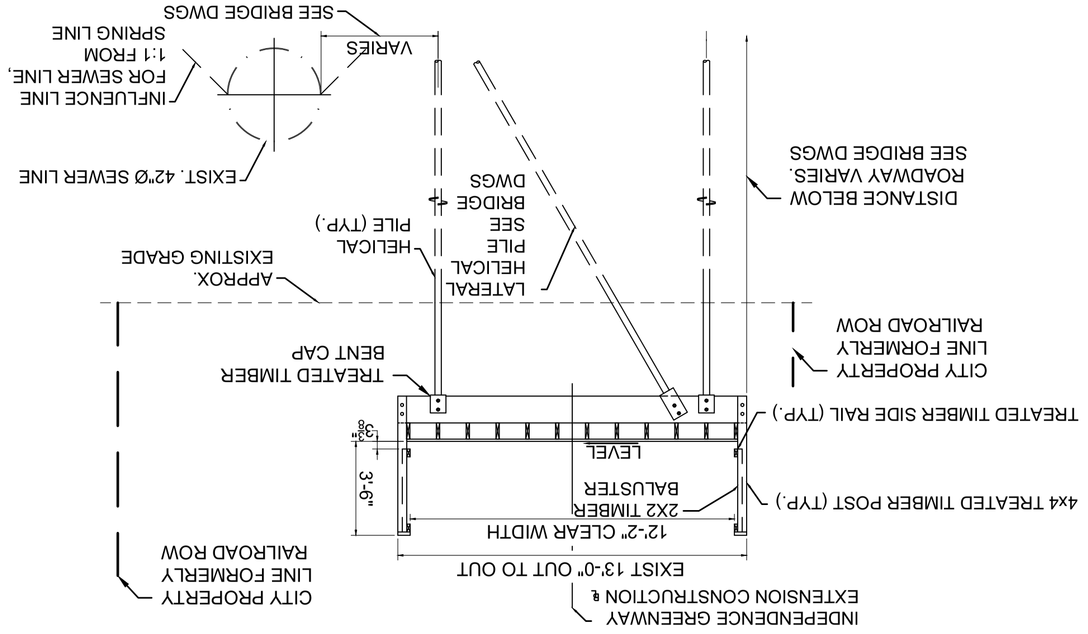
Proposal No. 609211-132091

TYPICAL BIKEWAY SECTION
STA 318+32.11 TO STA 351+09.93
STA 355+47.73 TO STA 358+93.89
SCALE: 1"=4'

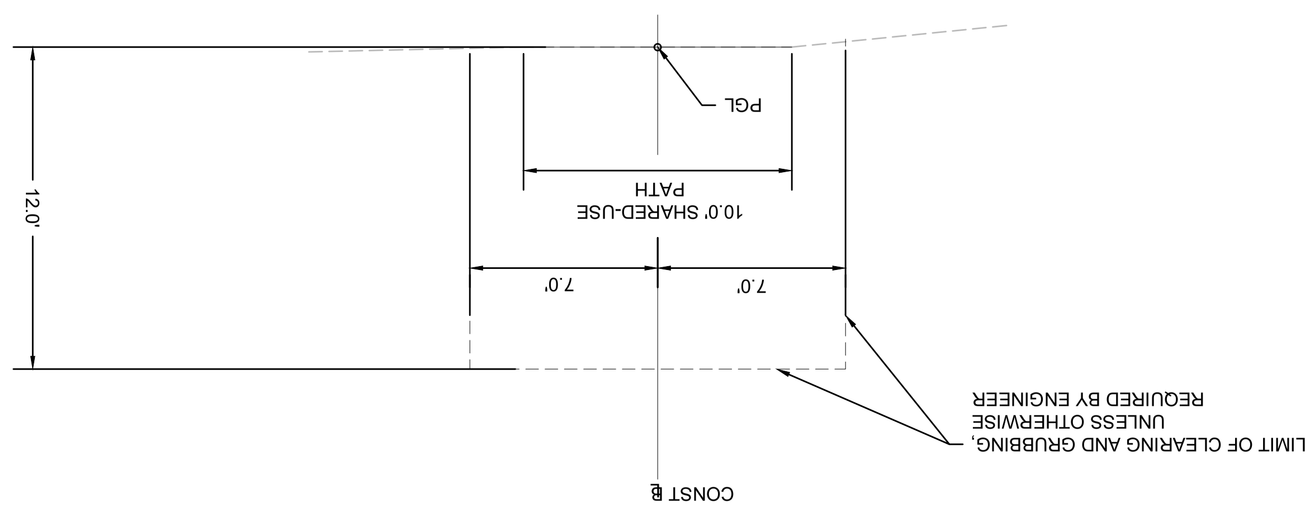


* TOLERANCE FOR CONSTRUCTION +/-0.5%

TYPICAL BOARDWALK SECTION
STA 351+09.93 TO STA 355+47.73
SCALE: 1"=4'



TYPICAL BIKEWAY CLEARANCE
SCALE: 1"=4'

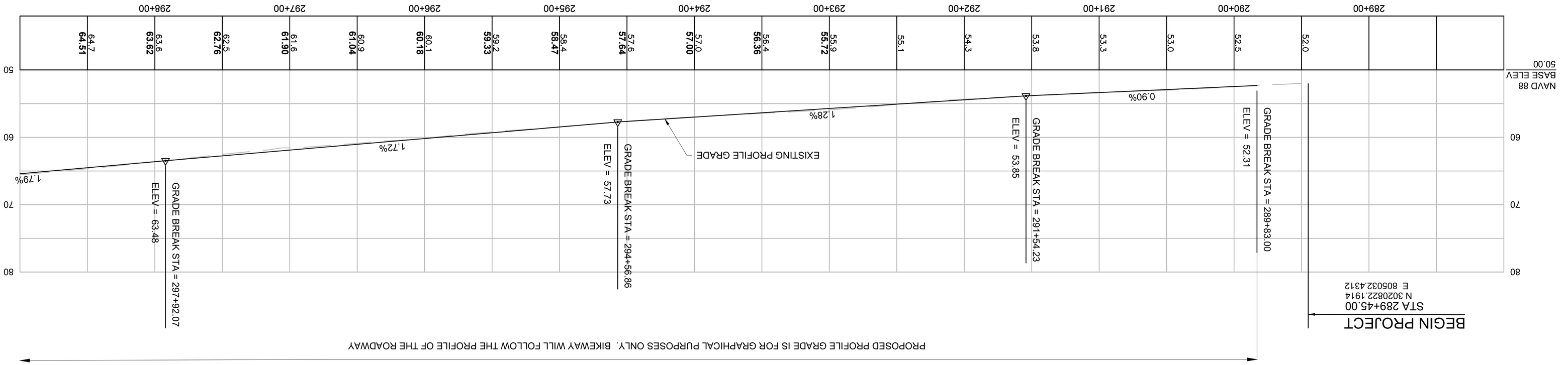


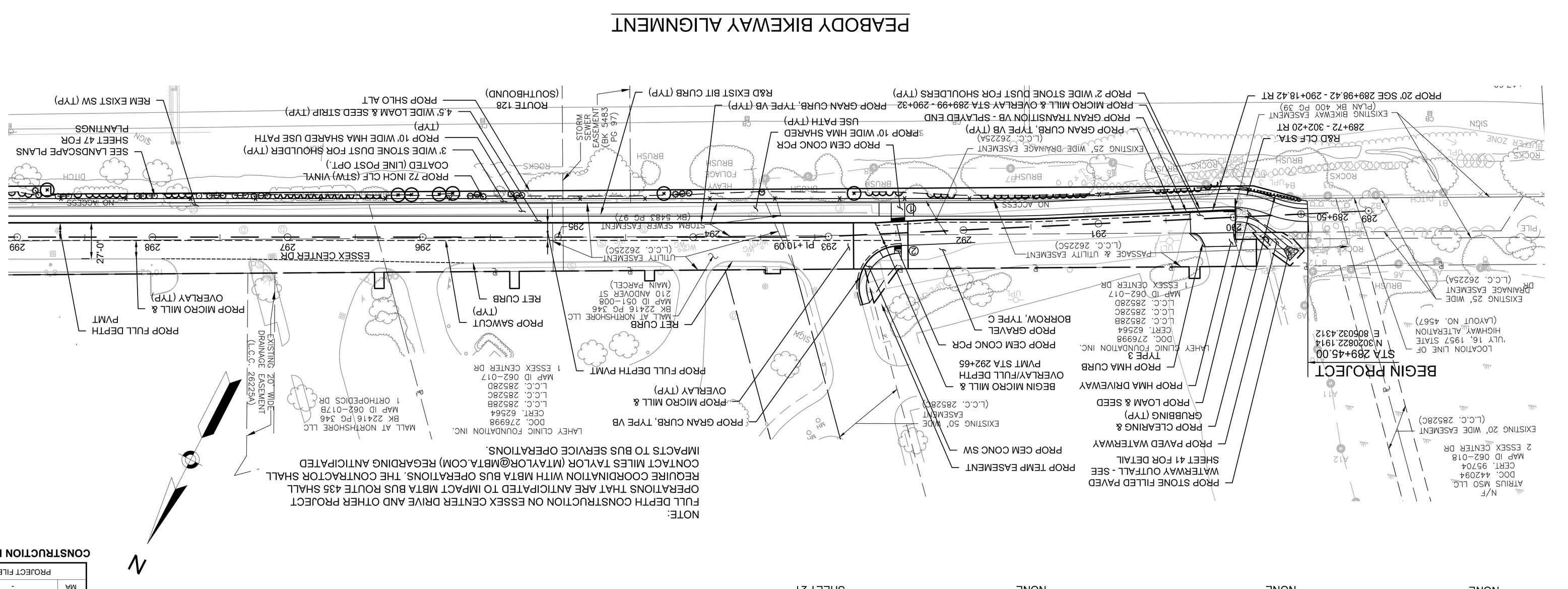
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	8	140
PROJECT FILE NO. 609211			

TYPICAL SECTIONS & DETAILS 2

PEABODY BIKEWAY ALIGNMENT





HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

CONSTRUCTION PLAN & PROFILE - 1

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	9	140

PROJECT FILE NO. 609211

PEABODY BIKEWAY ALIGNMENT

PROPOSED PROFILE GRADE IS FOR GRAPHICAL PURPOSES ONLY. BIKEWAY WILL FOLLOW THE PROFILE OF THE ROADWAY

HIGH POINT ELEV = 67.38
HIGH POINT STA = 300+46.76
PVI STA = 300+46.76
PVI ELEV = 68.03
A.D. = -6.54%
K = 15.29
100' VC

LOW POINT ELEV = 59.62
LOW POINT STA = 303+01.45
PVI STA = 302+46.07
PVI ELEV = 58.56
A.D. = 6.12%
K = 32.70
200' VC

GRADE BREAK STA = 304+58.29
ELEV = 61.46

PVI STA = 304+97.10
PVI ELEV = 62.24
A.D. = 1.20%
K = 62.54
75' VC

PVI STA = 305+85.42
PVI ELEV = 65.07
A.D. = -2.65%
K = 18.85
50' VC

GRADE BREAK STA = 306+96.55
ELEV = 65.69

GRADE BREAK STA = 297+92.07
ELEV = 63.48

PVC: 301+46.07
ELEV: 63.31

PVT: 303+46.07
ELEV: 59.93

PVC: 304+59.60
ELEV: 61.48

PVT: 305+34.60
ELEV: 63.44

PVC: 305+60.42
ELEV: 64.27

PVT: 306+10.42
ELEV: 65.21

PVC: 299+96.76
ELEV: 67.14

PVT: 300+96.76
ELEV: 65.86

184.9' HSD

HSD>500

275.5' SSD

151.6' SSD

EXISTING PROFILE GRADE

MATCH EXISTING PROFILE GRADE

PROPOSED PROFILE GRADE

-4.02%
0.56%
3.21%
2.01%
1.36%
-4.75%
1.79%

NAVD 88
BASE ELEV
50.00

59.52 59.9
61.53 62.4
63.54 64.0
65.55 65.6
65.43 65.4
65.12 65.0
63.93 63.9
62.43 62.4
61.34 61.3
60.66 60.4
59.98 60.0
59.82 59.9
60.03 60.1
61.20 61.1
63.13 63.2
65.50 65.6
67.16 67.1
67.19 67.2
66.30 66.5
65.41 65.6
64.51 64.7
63.62 63.6

298+00 299+00 300+00 301+00 302+00 303+00 304+00 305+00 306+00 307+00 308+00

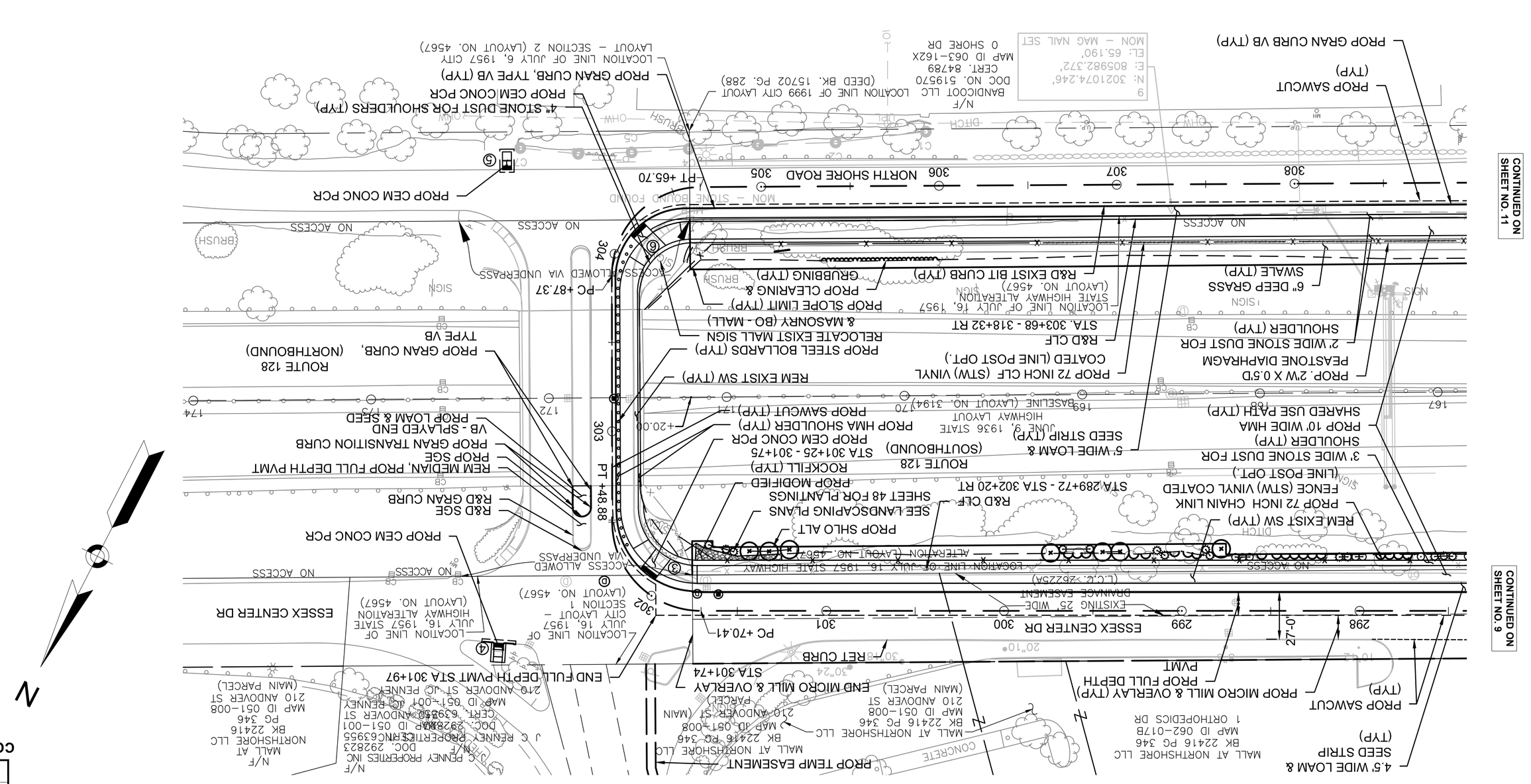
50 60 70 80

CONTINUED ON SHEET NO. 11

CONTINUED ON SHEET NO. 9

HOR. SCALE IN FEET
40 0 40 80

VER. SCALE IN FEET
8 0 8 16



HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	10	140
PROJECT FILE NO. 609211			

CONSTRUCTION PLAN & PROFILE - 2

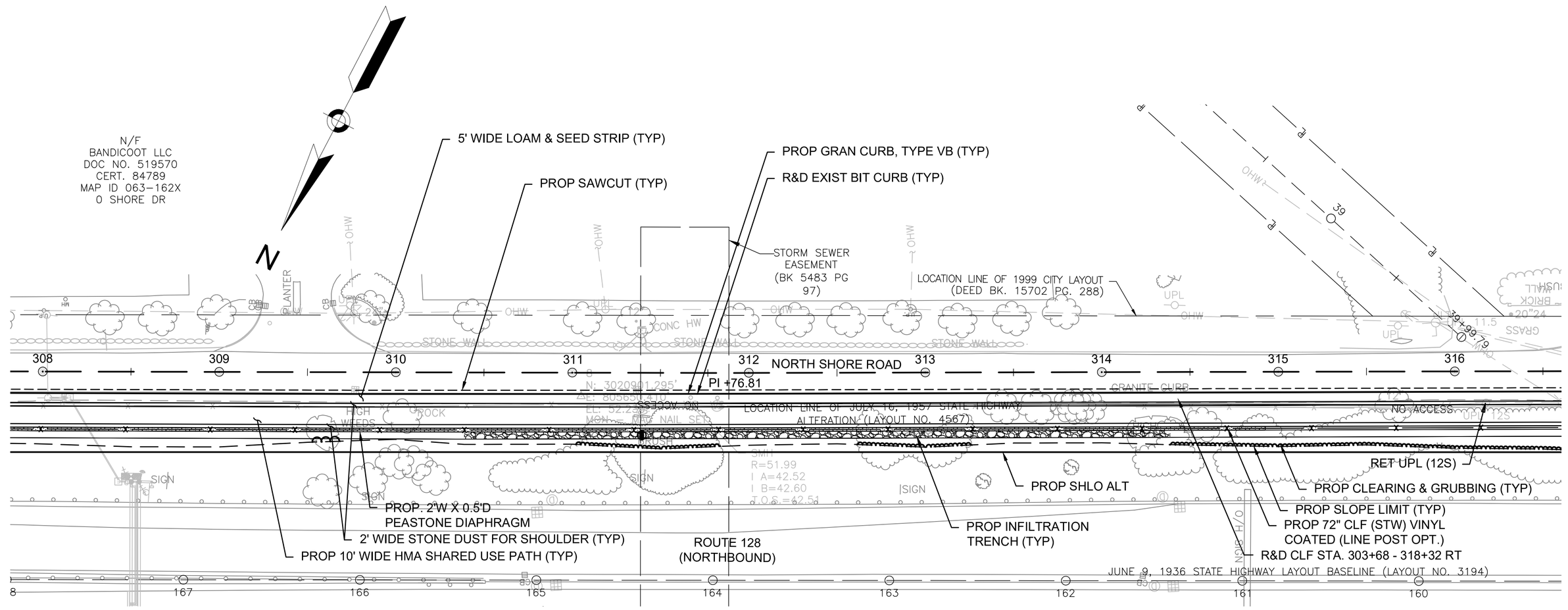
SHT005_HD\CONSTRUCTION PLANS & PROFILES.DWG Plotted on 9-Apr-2024 10:37 AM

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	11	140
PROJECT FILE NO.		609211	

CONSTRUCTION PLAN & PROFILE - 3

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SHEET 21

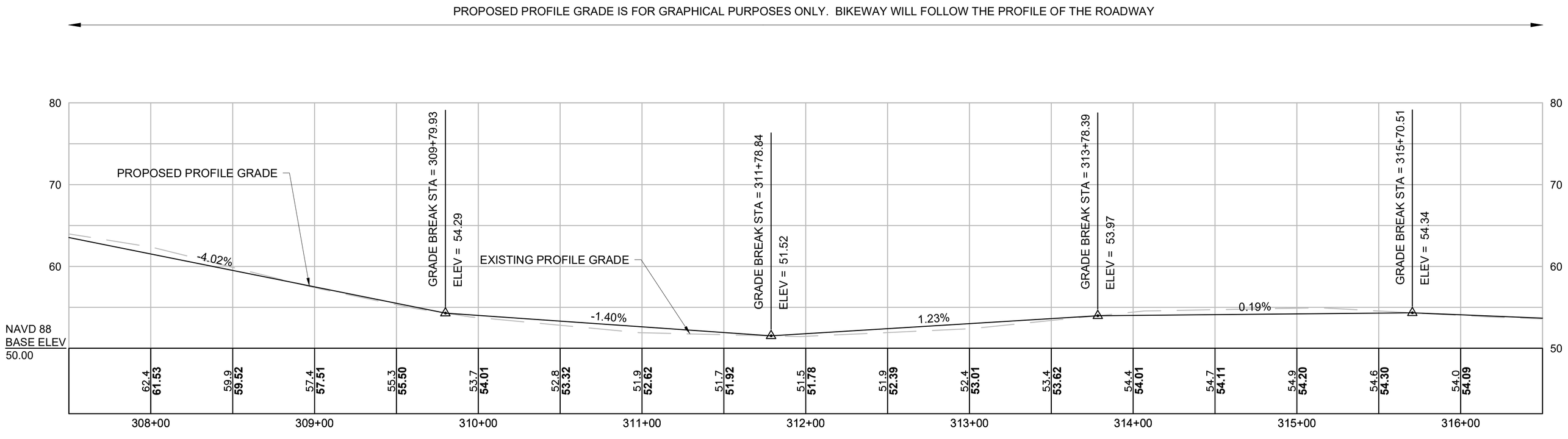


NOTE:
THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

CONTINUED ON SHEET NO. 10

CONTINUED ON SHEET NO. 12

PEABODY BIKEWAY ALIGNMENT



HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

Proposal No. 609211-132091

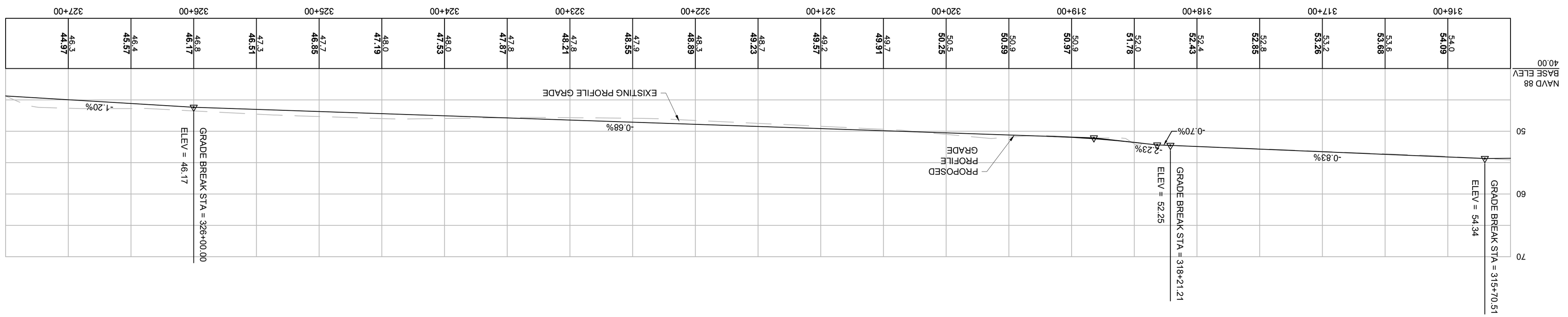
SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:07 PM

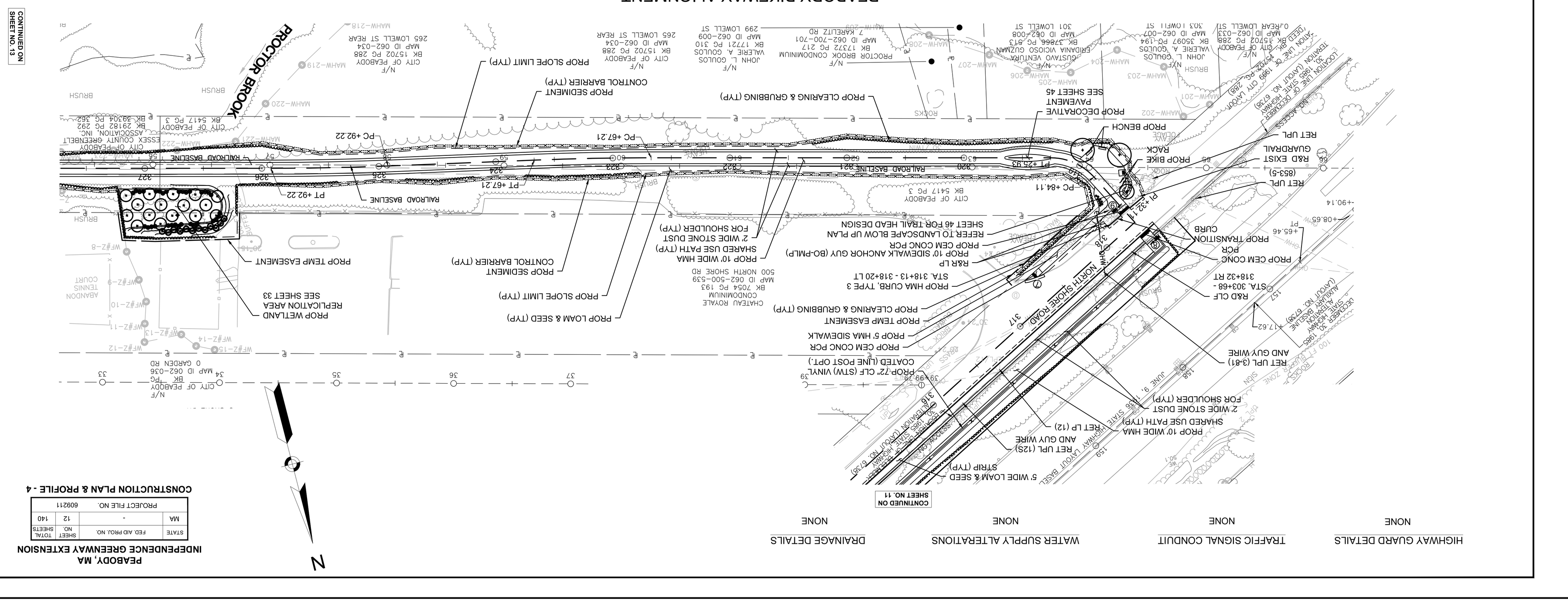
A00860 - 436

Proposal No. 609211-132091

A00860 - 437

PEABODY BIKEWAY ALIGNMENT





HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	NONE

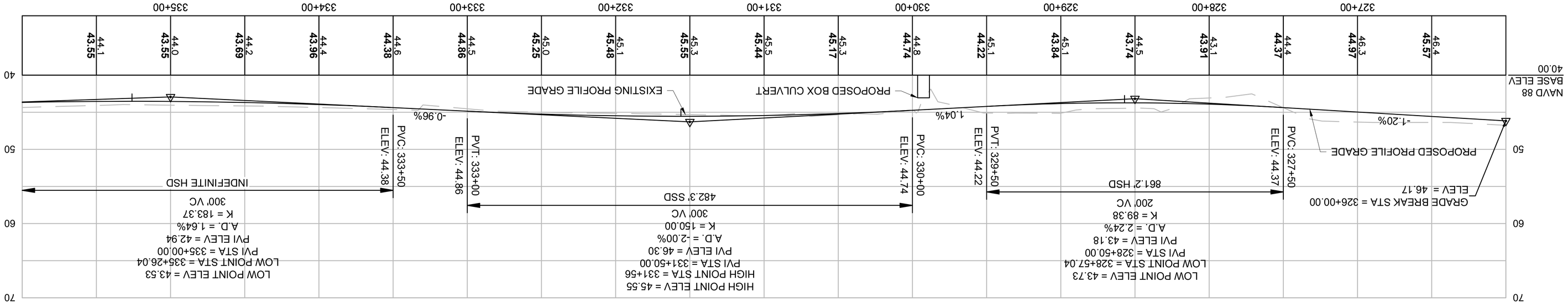
CONSTRUCTION PLAN & PROFILE - 4

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	12	140
PROJECT FILE NO. 609211			

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

SHT005_HD\CONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:01 PM

PEABODY BIKEWAY ALIGNMENT

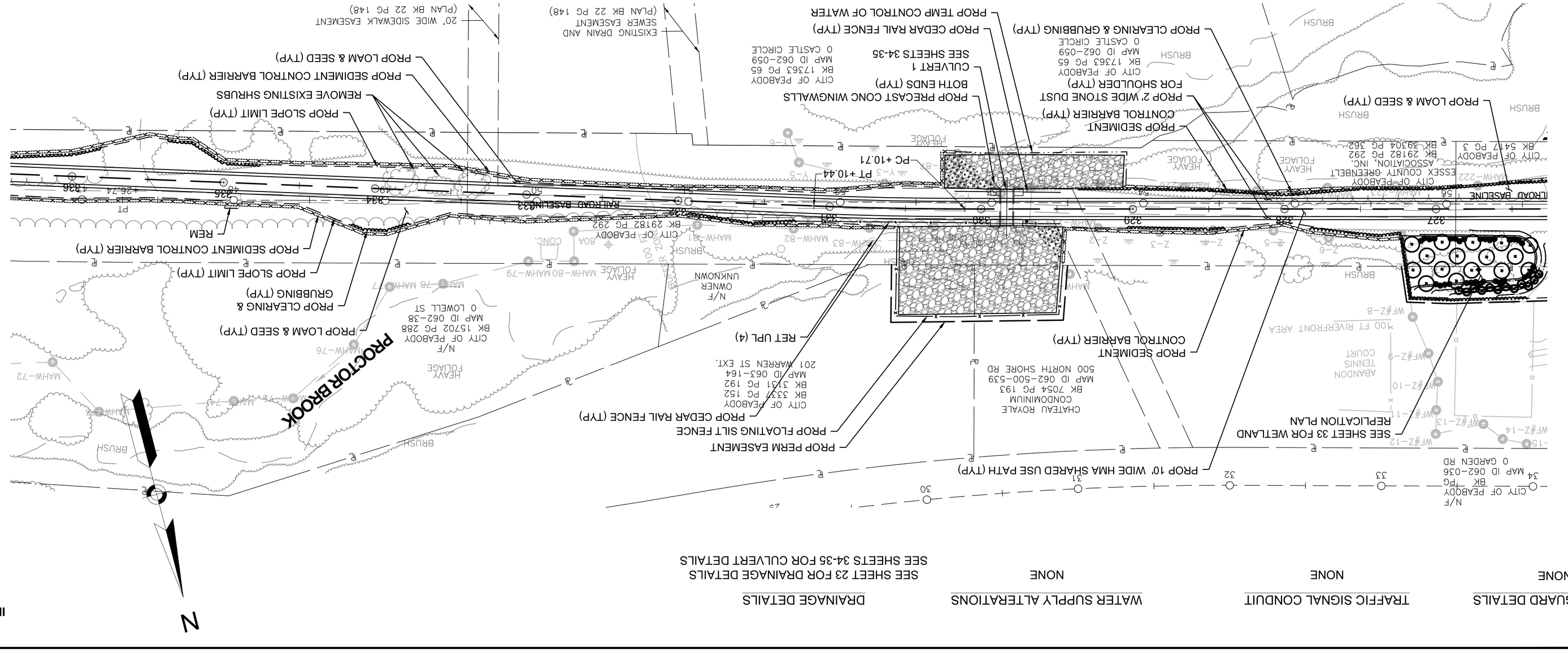


HOR. SCALE IN FEET
40 0 40 80

VER. SCALE IN FEET
8 0 8 16

CONTINUED ON SHEET NO. 14

CONTINUED ON SHEET NO. 12



HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SEE SHEET 23 FOR DRAINAGE DETAILS SEE SHEETS 34-35 FOR CULVERT DETAILS

CONSTRUCTION PLAN & PROFILE - 5

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	13	140

PROJECT FILE NO. 609211

A00860 - 438

SH1005_HDICONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:11 PM

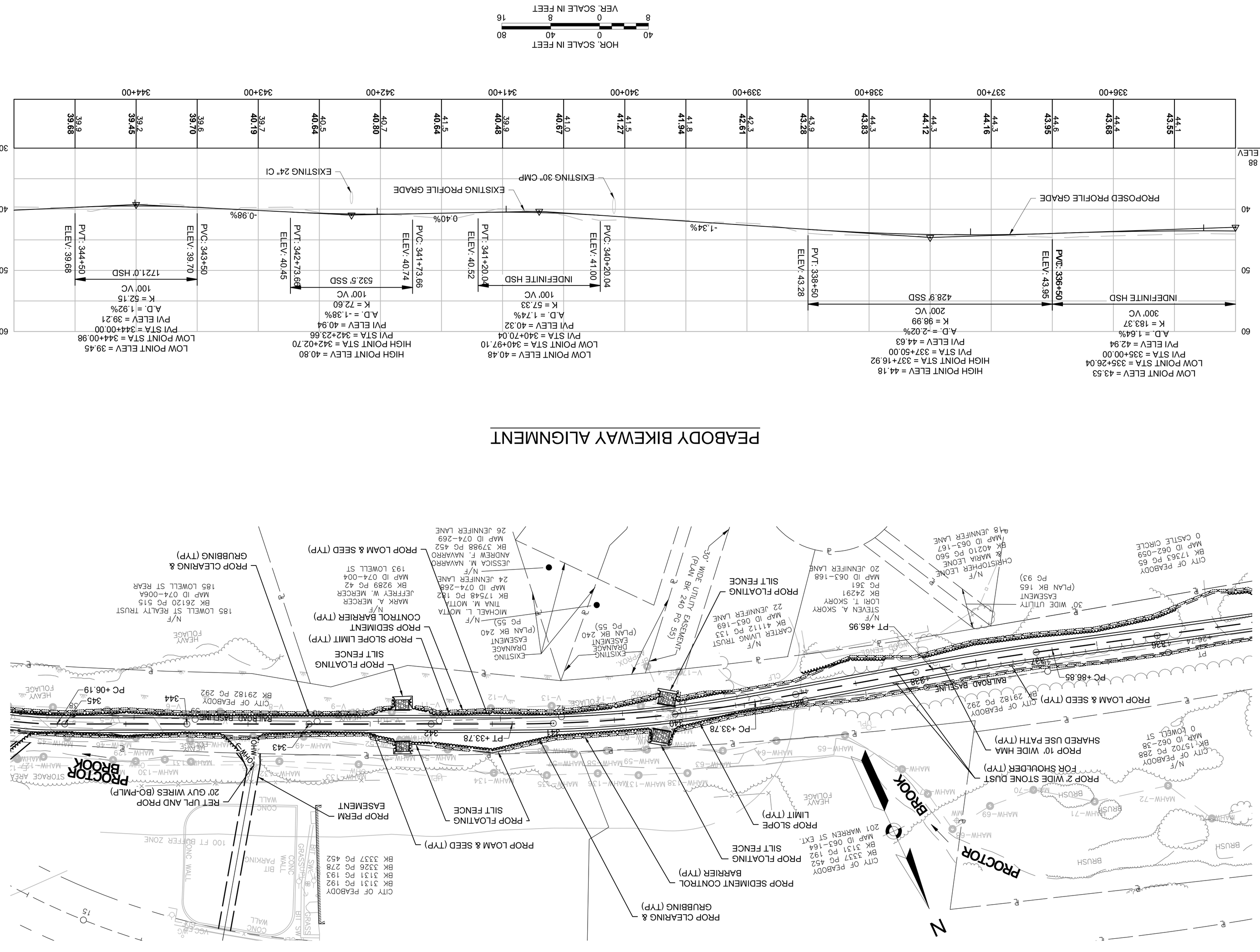
CONTINUED ON SHEET NO. 13

HIGHWAY GUARD DETAILS
NONE

TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SHEET 23



CONTINUED ON SHEET NO. 15

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	14	140

PROJECT FILE NO. 609211

CONSTRUCTION PLAN & PROFILE - 6

SHT005_HDICONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:13 PM

Proposal No. 609211-132091

HIGHWAY GUARD DETAILS

STA. 347+72 LT - STA. 348+07 LT TANGENT END TREATMENT
STA. 348+07 LT - STA. 348+32 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 348+32 LT - STA. 348+41 LT TRAILING ANCHORAGE
STA. 348+70 LT - STA. 349+11 LT TANGENT END TREATMENT
STA. 349+11 LT - STA. 349+61 LT GUARDRAIL, TL-2 (SINGLE FACED)
STA. 349+61 LT - STA. 347+70 LT TRAILING ANCHORAGE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

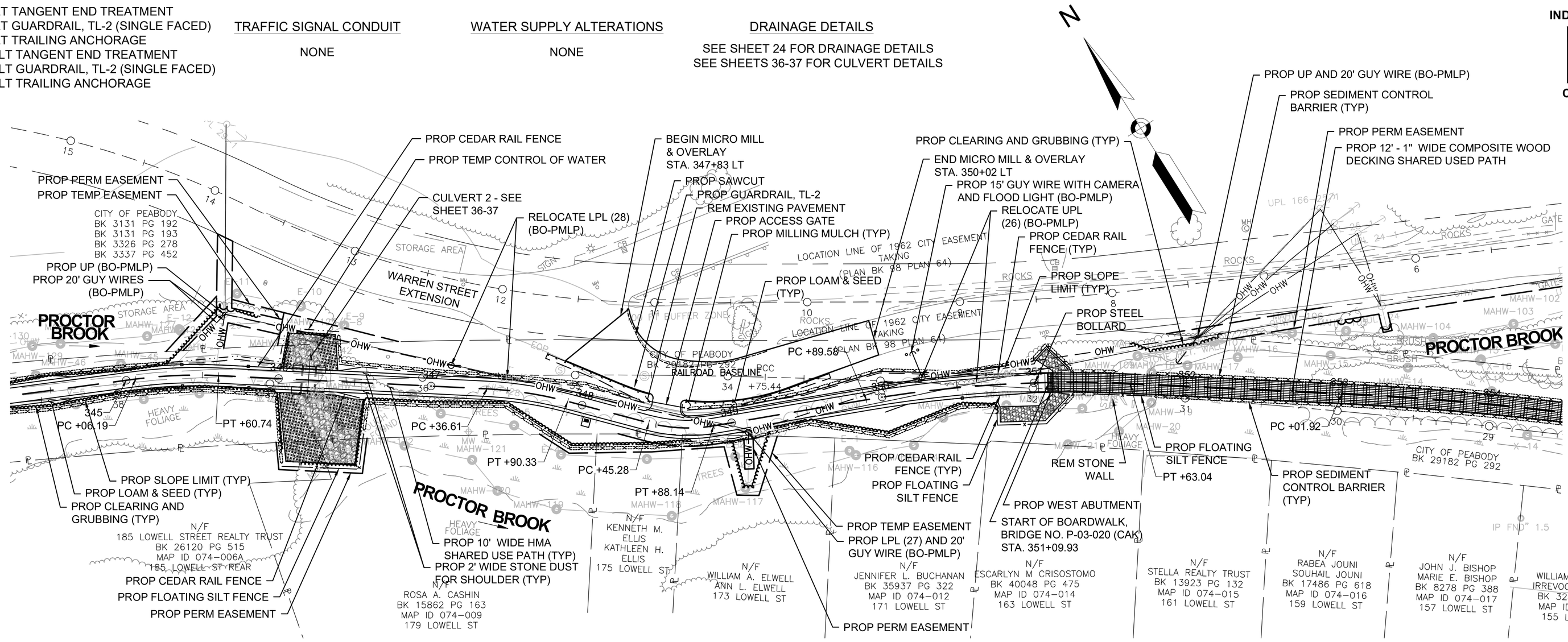
SEE SHEET 24 FOR DRAINAGE DETAILS
SEE SHEETS 36-37 FOR CULVERT DETAILS

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	140
PROJECT FILE NO.		609211	

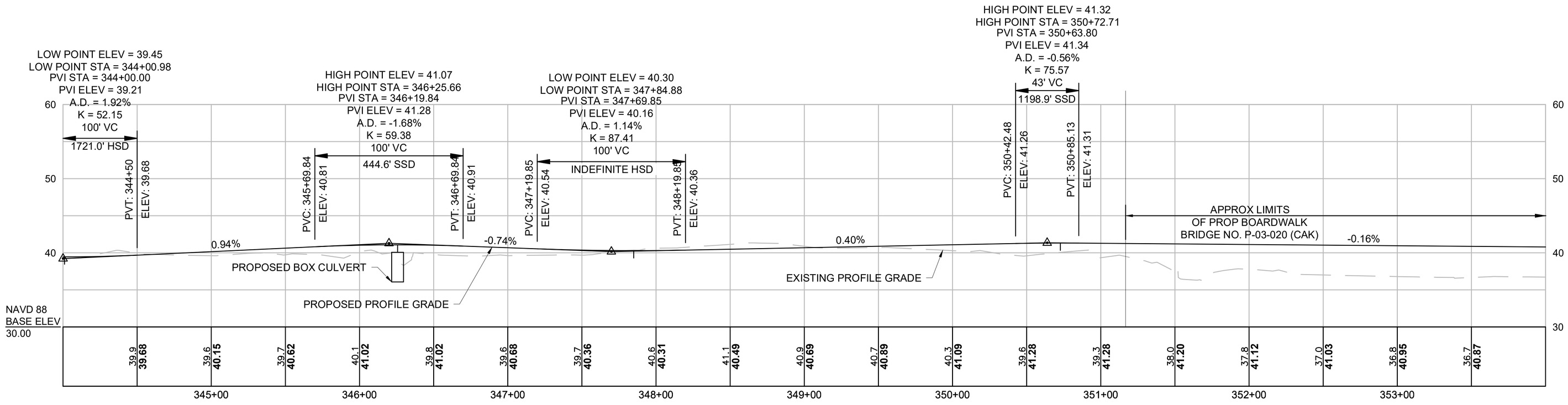
CONSTRUCTION PLAN & PROFILE - 7

SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:14 PM



NOTES:
1. CONTRACTOR SHALL PERFORM PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE SEWER MAIN BETWEEN SEWER MANHOLES LOCATED AT STA. 348+35 AND STA. 356+35.

PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

A00860 - 440

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	140
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 8

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

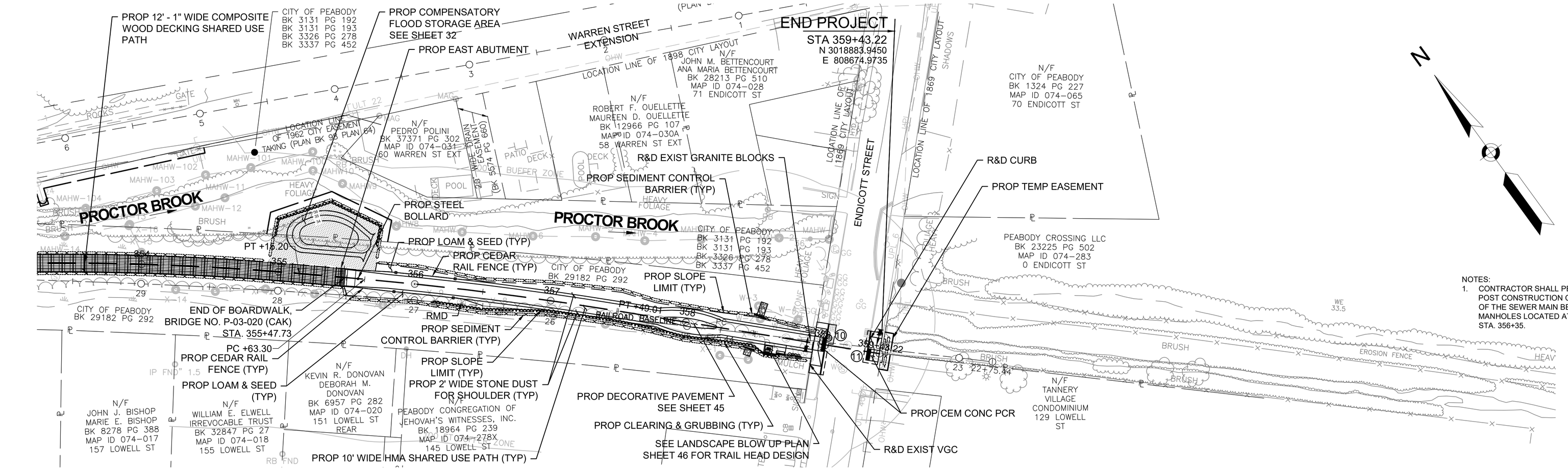
NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

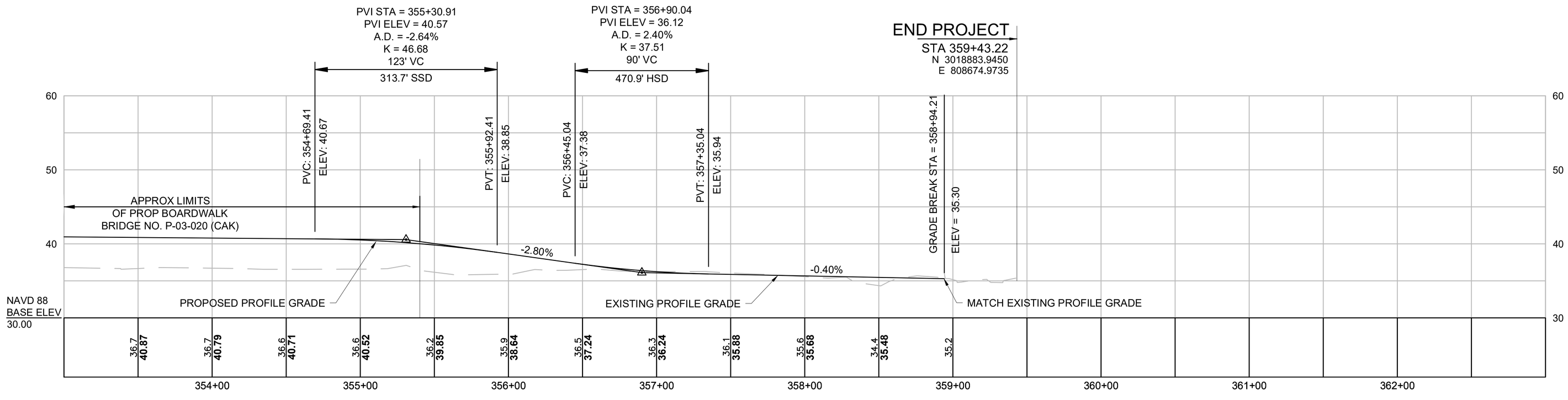
SEE SHEET 24



NOTES:
1. CONTRACTOR SHALL PERFORM PRE AND POST CONSTRUCTION CCTV INSPECTION OF THE SEWER MAIN BETWEEN SEWER MANHOLES LOCATED AT STA. 348+35 AND STA. 356+35.

CONTINUED ON SHEET NO. 15

PEABODY BIKEWAY ALIGNMENT



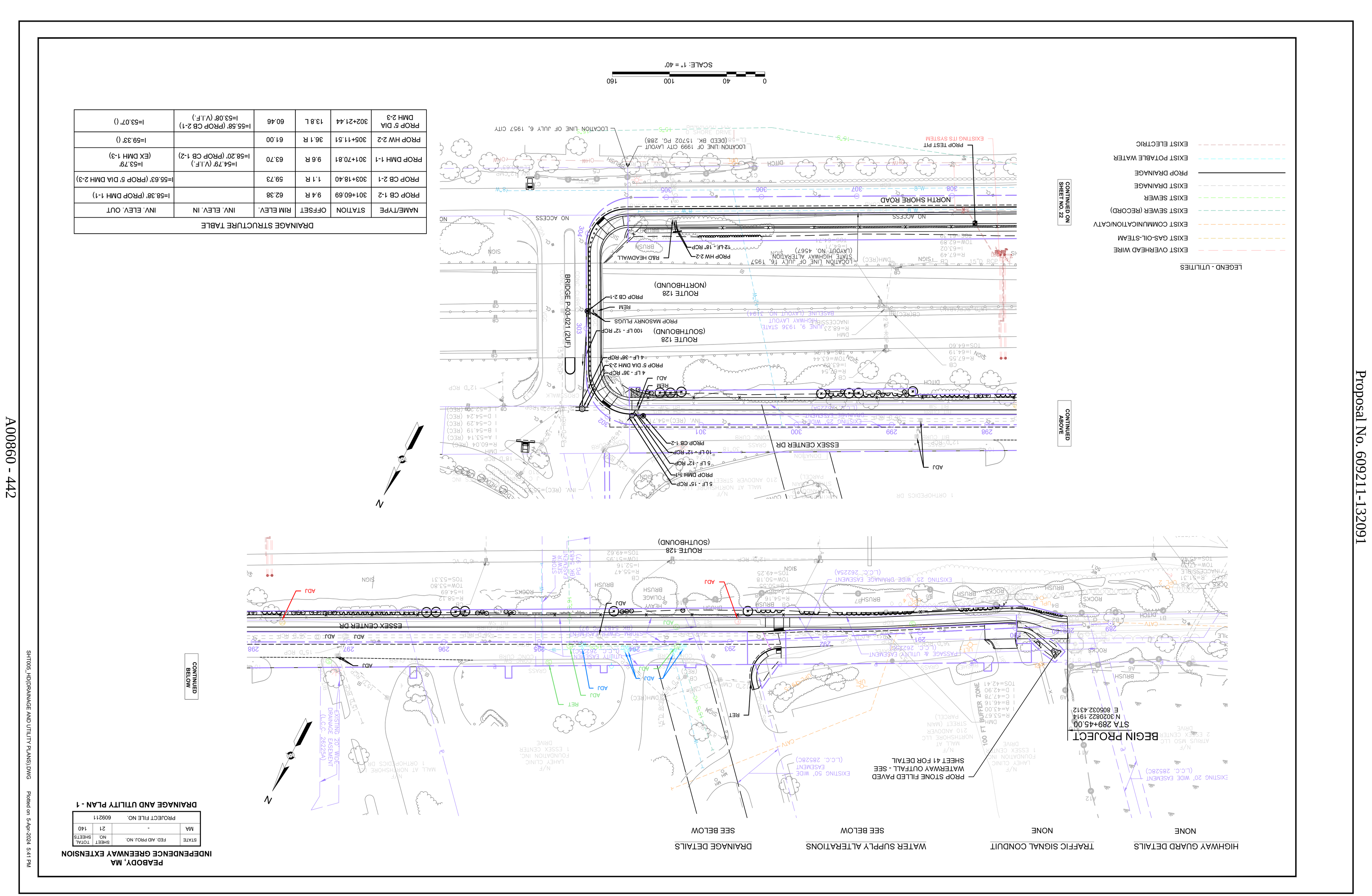
NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
40 0 40 80
8 0 8 16
VER. SCALE IN FEET

Proposal No. 609211-132091

SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG Plotted on 9-Apr-2024 12:16 PM

A00860 - 441



DRAINAGE STRUCTURE TABLE					
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 1-2	301+60.69	9.4 R	62.38		I=58.38' (PROP DMH 1-1)
PROP CB 2-1	303+18.40	1.1 R	59.73		I=55.63' (PROP 5' DIA DMH 2-3)
PROP DMH 1-1	301+70.81	9.6 R	63.70	I=54.79' (V.I.F.) I=58.20' (PROP CB 1-2)	I=53.79' (EX DMH 1-3)
PROP HW 2-2	305+11.51	36.1 R	61.00		I=59.33' ()
PROP 5' DIA DMH 2-3	302+21.44	13.8 L	60.46	I=55.58' (PROP CB 2-1) I=53.08' (V.I.F.)	I=53.07' ()

DRAINAGE AND UTILITY PLAN - 1

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	140
PROJECT FILE NO. 609211			

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

A00860 - 442

SHT005_HDJDRAINAGE AND UTILITY PLANS).DWG Plotted on 5-Apr-2024 5:41 PM

Proposal No. 609211-132091

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

SEE BELOW

DRAINAGE DETAILS

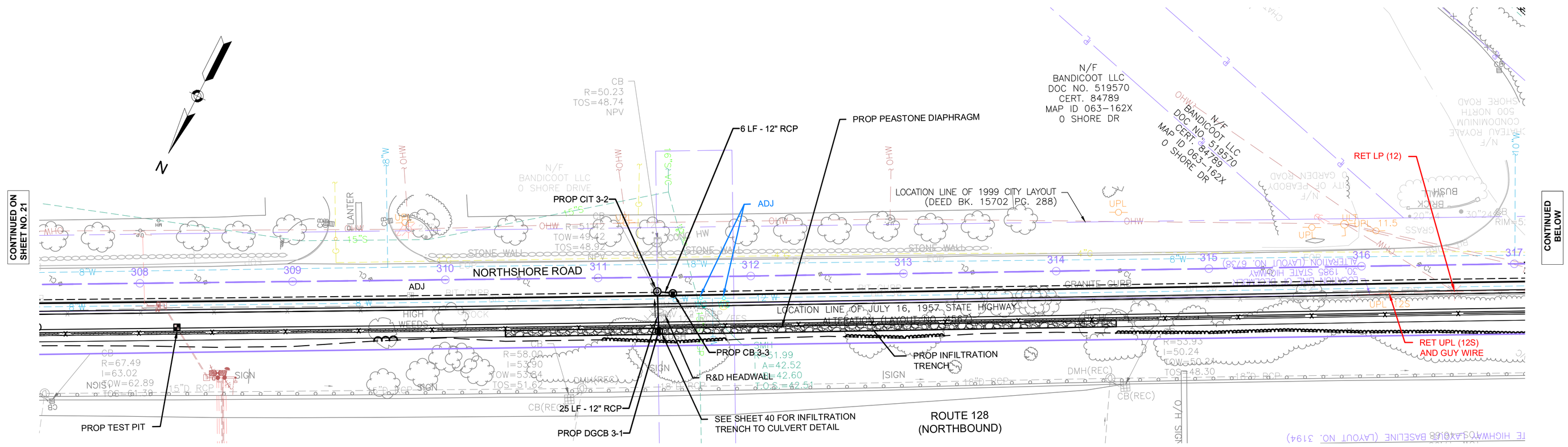
SEE BELOW

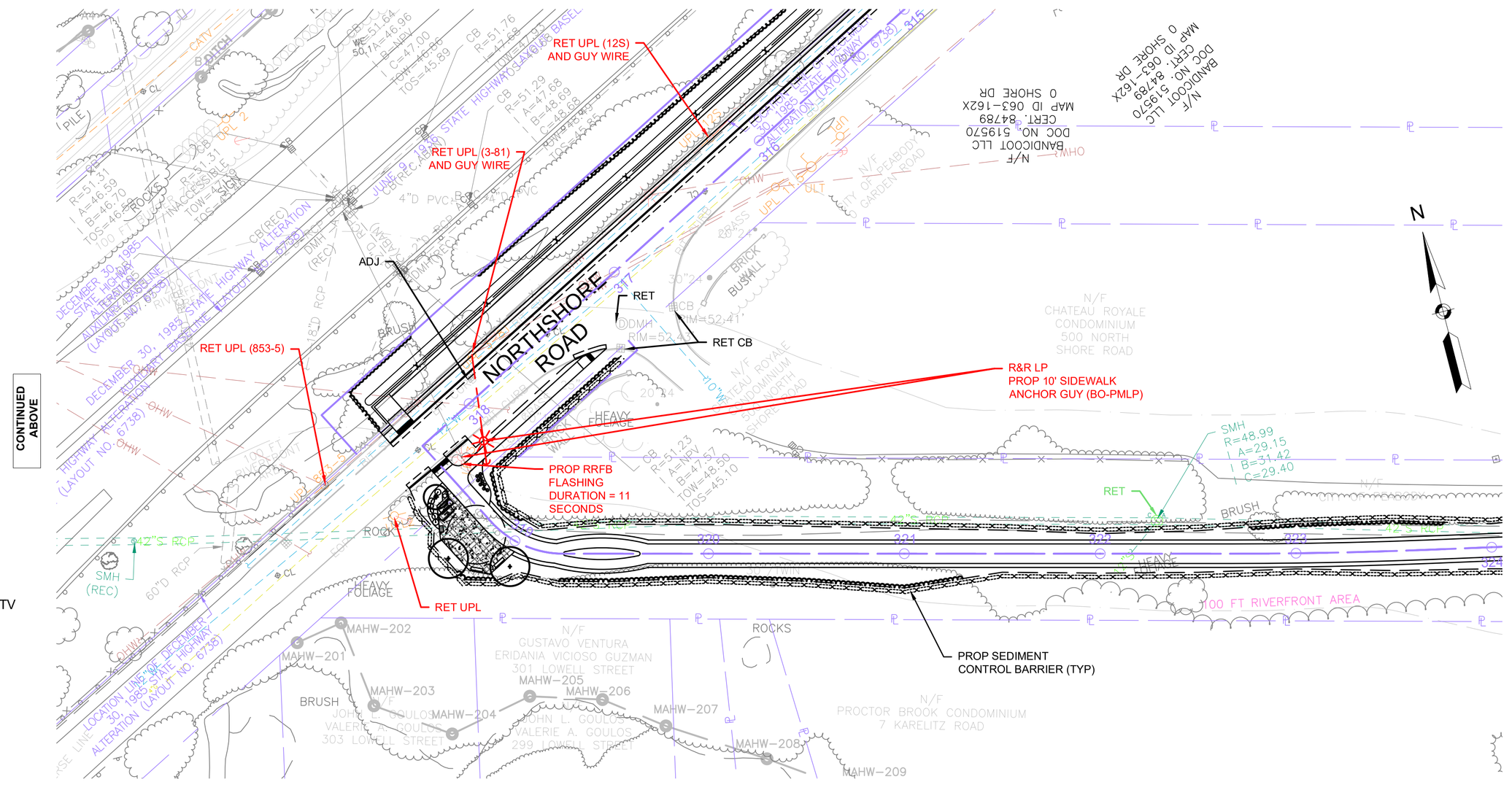
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	140
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 2

SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 5-Apr-2024 5:42 PM





LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

SCALE: 1" = 40'

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP DGCB 3-1	311+39.44	38.4 R	51.26		I=48.61' (PROP CIT 3-2)
PROP CIT 3-2	311+38.53	9.5 R	51.42	I=48.40' (PROP DGCB 3-1) I=48.40' (PROP CB 3-3)	I=48.30' (V.I.F.)
PROP CB 3-3	311+48.84	10.7 R	51.41		I=48.60' (PROP. CIT 3-2)

NOTE:
THE EXACT LOCATION AND ELEVATION OF THE EXISTING INTELLIGENT TRANSPORTATION SYSTEM (ITS) MUST BE FIELD VERIFIED VIA TEST PIT. THE ENGINEER SHALL BE NOTIFIED PRIOR TO PROCEEDING WITH ANY OF THE PROPOSED WORK THAT MAY BE IN CONFLICT WITH THE EXISTING ITS.

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

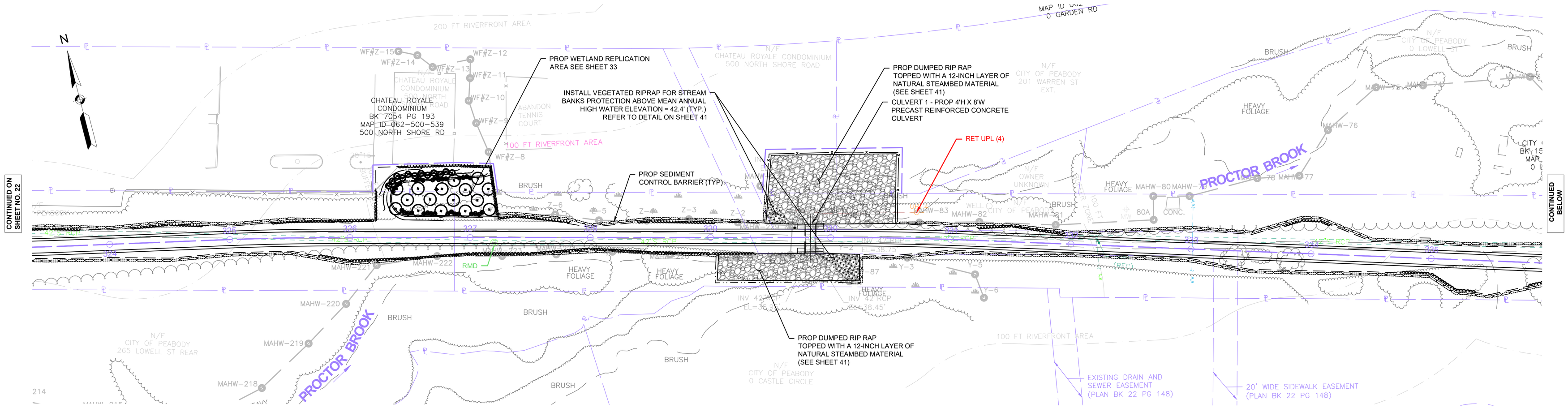
DRAINAGE DETAILS

SEE BELOW

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

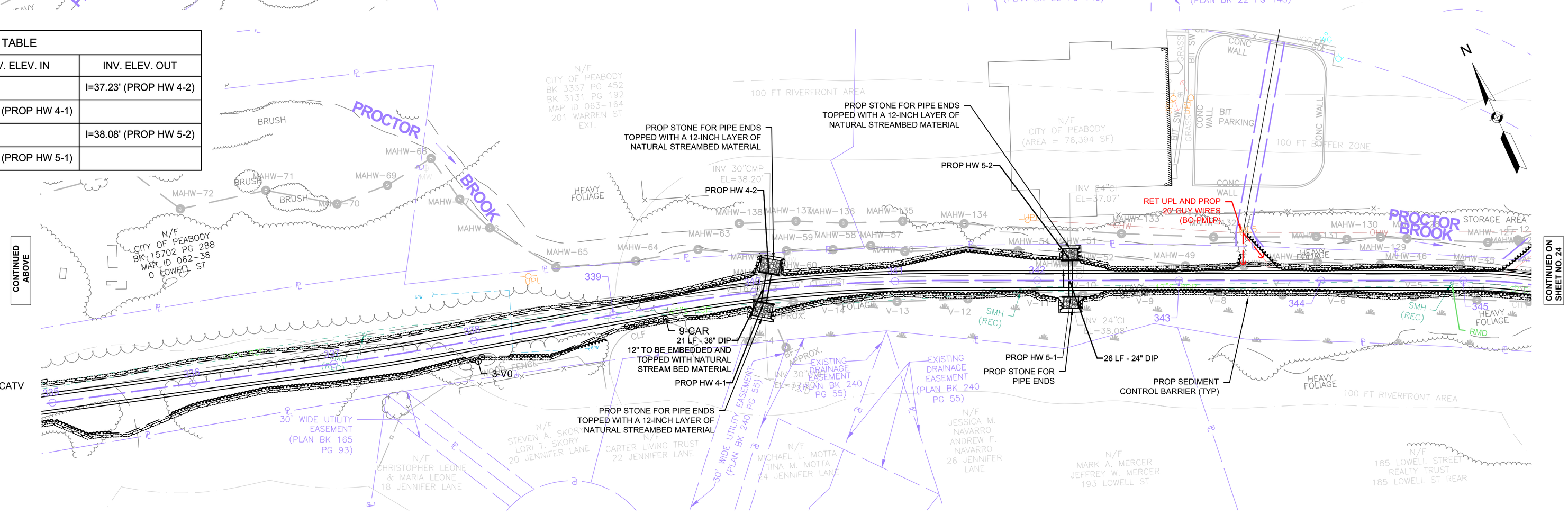
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	140
PROJECT FILE NO.		609211	

DRAINAGE AND UTILITY PLAN - 3



DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 4-1	340+06.33	8.3 R	41.49		I=37.23' (PROP HW 4-2)
PROP HW 4-2	340+12.19	11.7 L	41.39	I=37.02' (PROP HW 4-1)	
PROP HW 5-1	342+23.80	11.4 R	39.75		I=38.08' (PROP HW 5-2)
PROP HW 5-2	342+23.48	14.2 L	39.62	I=37.07' (PROP HW 5-1)	



LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

0 40 100 160

SCALE: 1" = 40'

SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 5-Apr-2024 5:42 PM

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	140
PROJECT FILE NO.	609211		

DRAINAGE AND UTILITY PLAN - 4

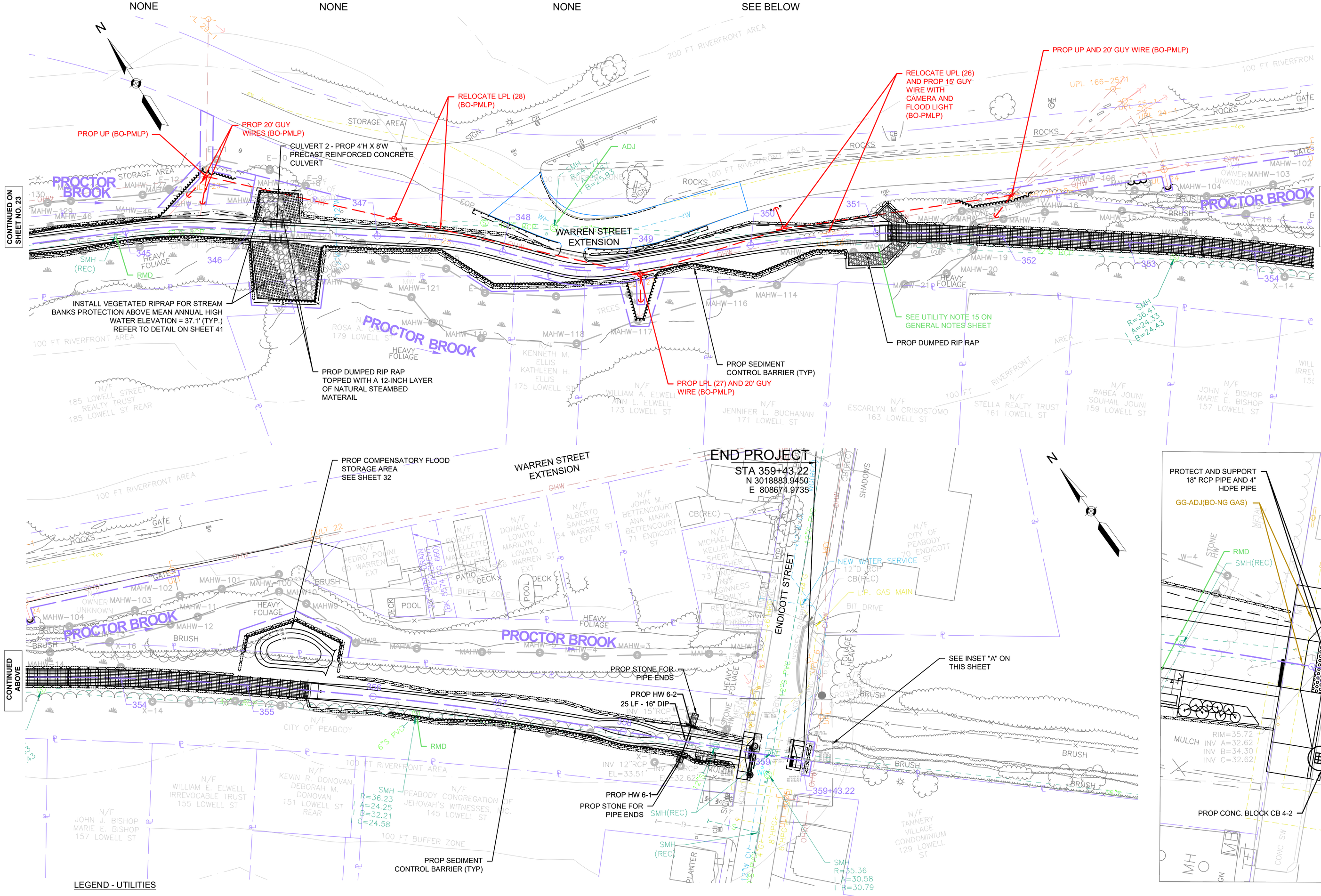
SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 5-Apr-2024 5:42 PM

HIGHWAY GUARD DETAILS
NONE

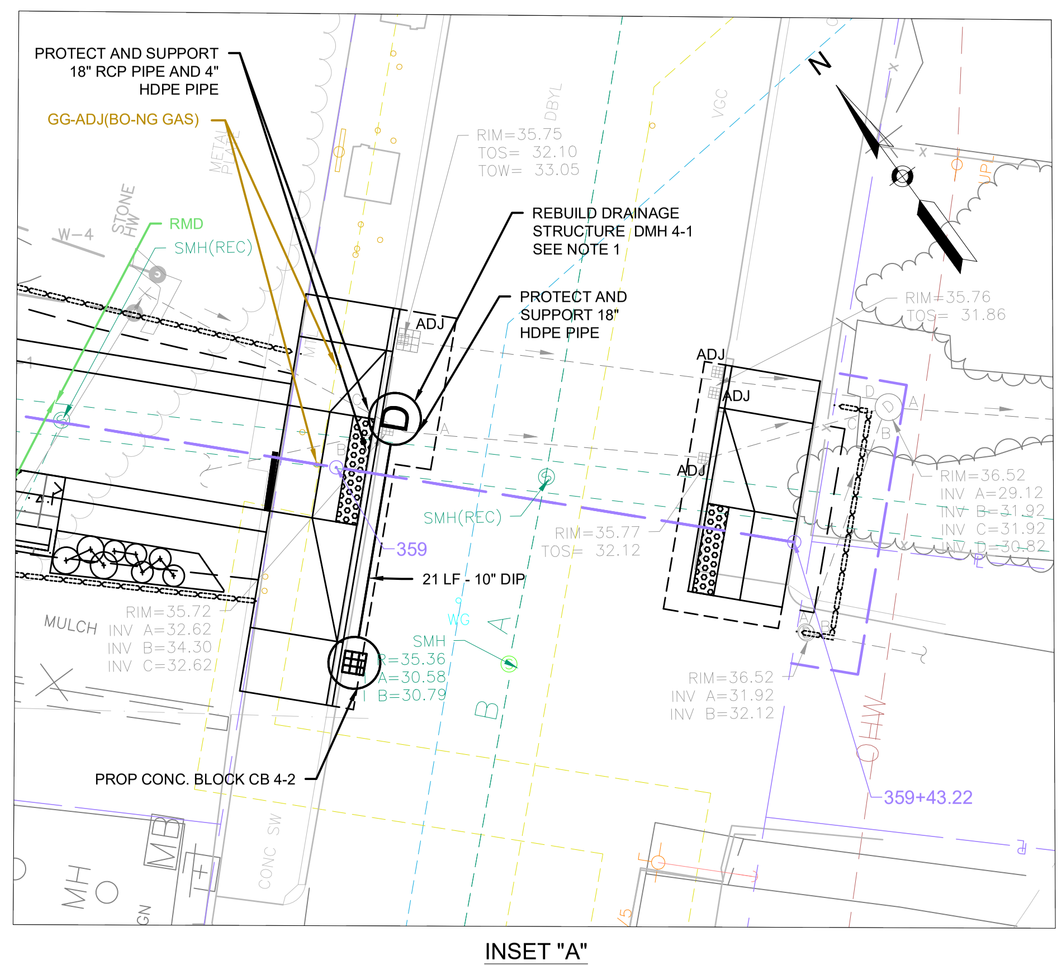
TRAFFIC SIGNAL CONDUIT
NONE

WATER SUPPLY ALTERATIONS
NONE

DRAINAGE DETAILS
SEE BELOW



NOTE:
1. REBUILD DRAINAGE STRUCTURE DMH 4-1 AS CONCRETE BLOCK STRUCTURE. REMOVE AND DISPOSE EXISTING FRAMEAND GRATE AND REPLACE WITH FRAME AND COVER. LOCATE FRAME AND COVER OUTSIDE OF CURB OPENING.



INSET "A"

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

SCALE: 1" = 40'

SCALE: 1" = 10'

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 6-1	358+48.46	11.6 R	35.47		I=33.51' (PROP HW 6-2)
PROP HW 6-2	358+52.79	12.9 L	34.88	I=32.92' (PROP HW 6-1)	

DRAINAGE STRUCTURE TABLE

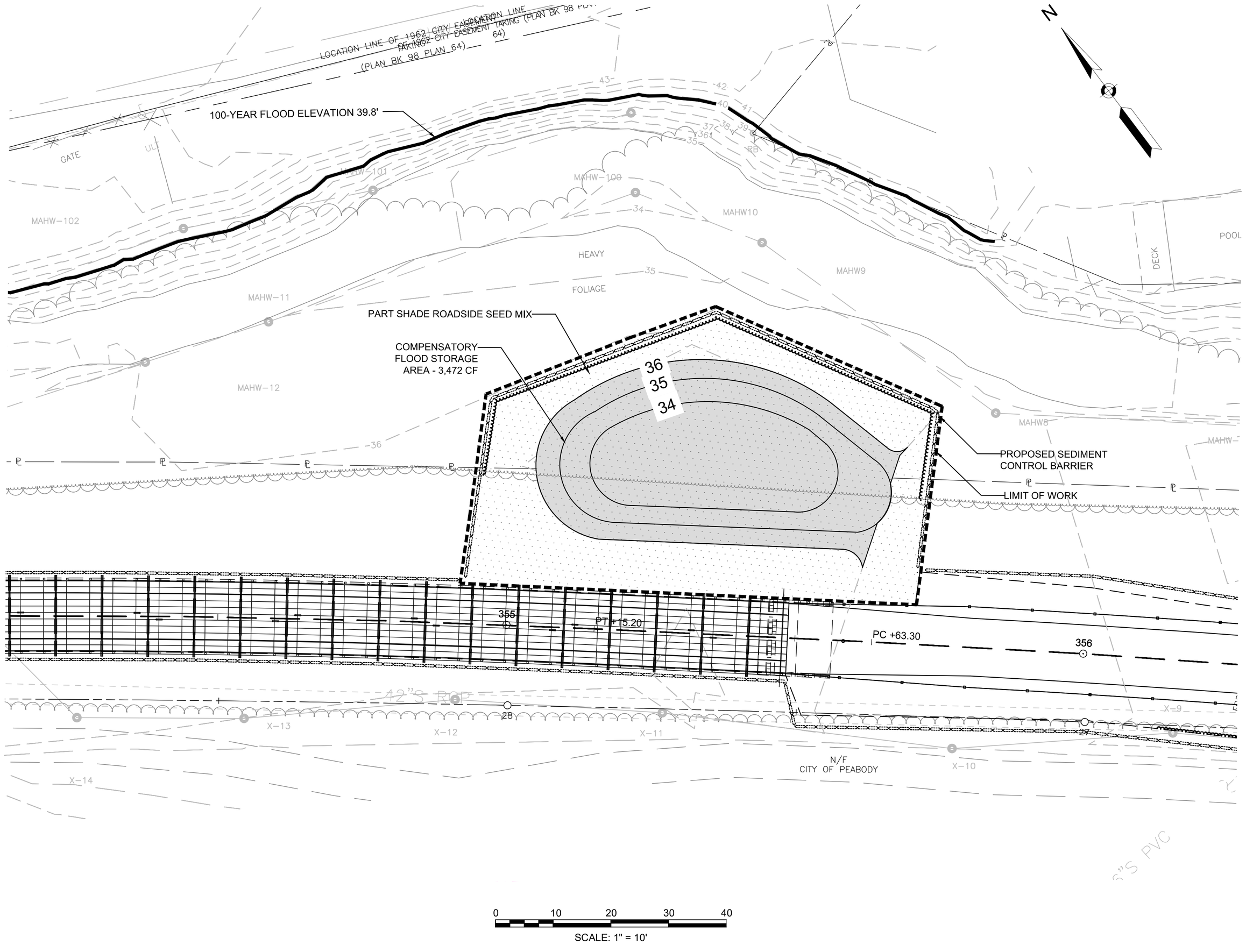
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 4-2	359+04.67	17.6 R	35.63		I=33.50' (PROP DMH 4-1)
PROP DMH 4-1 (DRAINAGE STRUCTURE REBUILT)	359+04.67	5.3 L	34.76	I=33.29 (PROP CB 4-2) I=MATCH EXISTING	I=MATCH EXISTING

A00860 - 445

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	140
PROJECT FILE NO.	609211		

COMPENSATORY FLOOD STORAGE



0 10 20 30 40
SCALE: 1" = 10'

LEGEND

- LIMIT OF WORK
- SEDIMENT CONTROL BARRIER
- 100 PROPOSED CONTOUR
- 100 EXISTING CONTOUR
- LIMIT OF CLEARING
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPENSATORY FLOOD STORAGE

144 FT LENGTH OF SEDIMENT CONTROL BARRIER

3,244 SQ FT AREA OF PART SHADE ROADSIDE SEED MIX

NOTES:

1. PRIOR TO ANY CLEARING AND GRUBBING, THE CONTRACTOR SHALL STAKE THE LIMITS OF THE FLOOD COMPENSATION AREA AS SHOWN ON THIS PLAN.
2. THE CONTRACTOR SHALL ARRANGE WITH THE ENGINEER TO HAVE THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION ON SITE DURING CONSTRUCTION.
3. THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION FOR THIS PROJECT IS MAXWELL MCNULTY - MAXWELL.R.MCNULTY@DOT.STATE.MA.US

COMPENSATORY FLOOD STORAGE NET CUT 100 YEAR FLOOD ELEVATION =39.8'		
ELEVATION	ELEVATION	INCREMENTAL NET CUT VOLUME
34-35	34	921
	35	
35-36	35	1,401
	36	
36-37	36	1,151
	37	
Total		3,472

SHT0XX_EV(COMPENSATORY FLOOD STORAGE).DWG Plotted on 8-Apr-2024 4:44 PM

Proposal No. 609211-132091

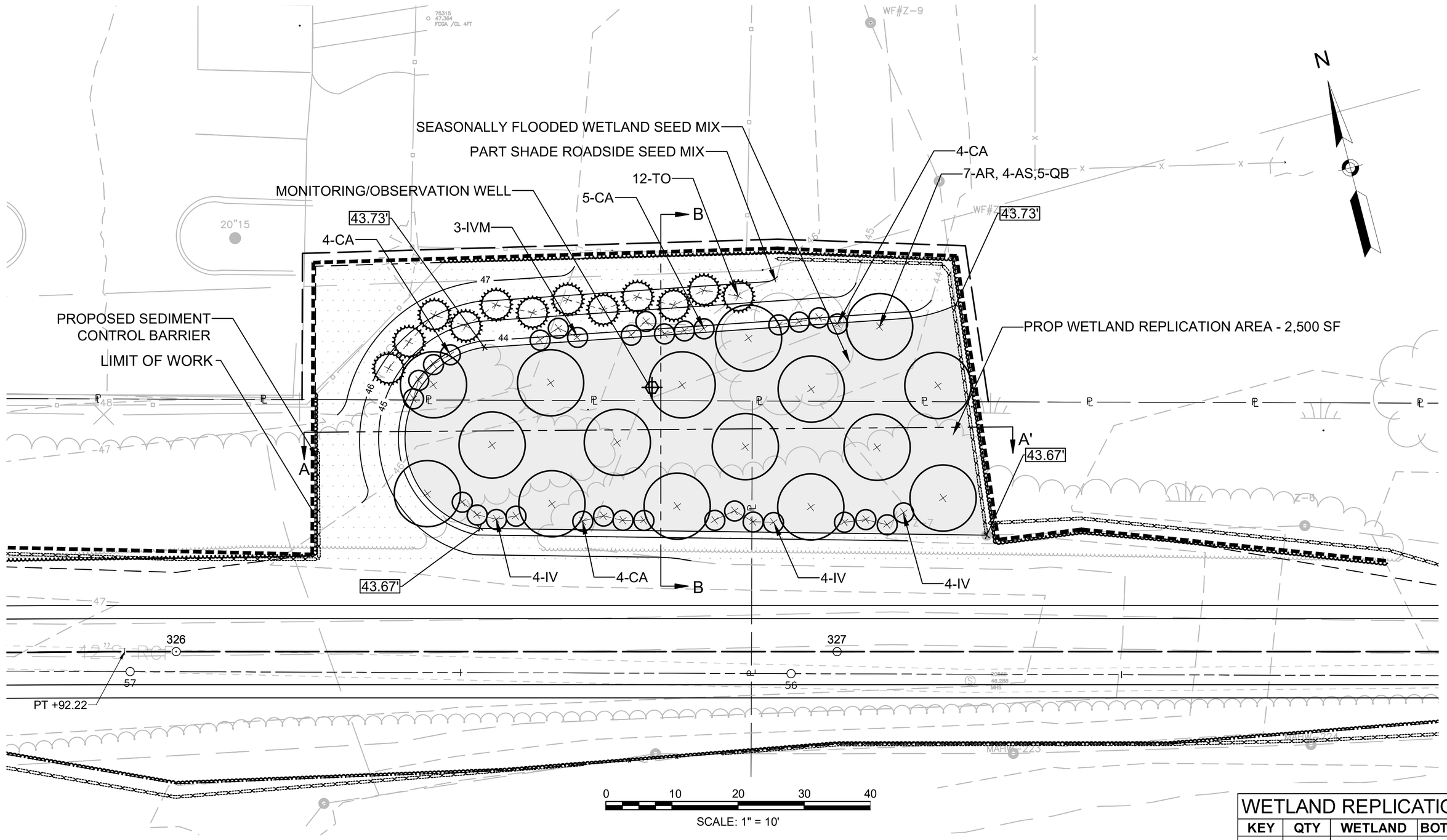
A00860 - 447

SHT0XX_EV(WETLAND REPLICATION PLAN).DWG Plotted on 8-Apr-2024 4:53 PM

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	140
PROJECT FILE NO.	609211		

WETLAND REPLICATION PLAN



NOTES:

1. IMPACTS TO EXISTING TREES AND SOILS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
2. CONTACT THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION PRIOR TO THE START OF CONSTRUCTION. THE REPRESENTATIVE FOR THIS PROJECT IS MAXWELL R. MCNULTY MAXWELL.R.MCNULTY@DOT.STATE.MA.US.
3. FINAL GRADES TO BE TO MATCH ADJACENT WETLAND. MINOR ADJUSTMENTS IN FINAL GRADES SHALL BE MADE IN THE FIELD BY THE WETLAND SPECIALIST.
4. REPLICATION AREA SHALL BE EXCAVATED BELOW PROPOSED GRADES TO ALLOW FOR THE PLACEMENT OF WETLAND SOILS. THE DEPTH OF WETLAND SOILS SHALL BE 18" MAXIMUM AND SHALL MATCH THE DEPTH OF WETLAND SOIL IN THE ADJACENT WETLAND. DEPTH OF WETLAND SOIL SHALL BE DETERMINED BY THE WETLAND SPECIALIST. THE SALVAGED TOPSOIL MATERIAL AND B-HORIZON SUBSOIL MATERIAL EXCAVATED FROM THE WETLAND IMPACT AREAS SHALL BE PLACED IN SEPARATE STOCKPILES TO BE REUSED IN THE PROPOSED REPLICATION AREA IF SUITABLE.
5. REPLICATION AREA GRADES SHALL MATCH THE ELEVATIONS OF THE ABUTTING WETLAND TO MAINTAIN A HYDROLOGIC CONNECTION. WETLAND SPECIALIST SHALL INSPECT THE SUB-GRADE OF THE REPLICATION AREA TO ENSURE THAT THE PROPER HYDROLOGY HAS BEEN ESTABLISHED. MINOR MODIFICATIONS TO THIS GRADING PLAN MAY BE MADE IN THE FIELD BY THE QUALIFIED WETLAND SPECIALIST IN RESPONSE TO SUBSURFACE HYDROLOGIC CONDITIONS.
6. TREES AND SHRUBS IN THE REPLICATION AREA AND ADJACENT UPLAND AREA SHALL BE FIELD LOCATED BY THE WETLAND SPECIALIST.

PLANTING & SEEDING NOTES:

1. SEED SHALL BE MANUALLY BROADCAST. LIMITS SHOWN ARE APPROXIMATE. ACTUAL LIMITS SHALL BE AS DIRECTED BY THE WETLAND SPECIALIST.

LEGEND

- LIMIT OF WORK
- SEDIMENT BARRIER
- 100 EXISTING CONTOUR
- 44 PROPOSED CONTOUR
- LIMIT OF CLEARING
- 124.694 PROPOSED SPOT GRADE
- MONITORING/OBSERVATION WELL
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

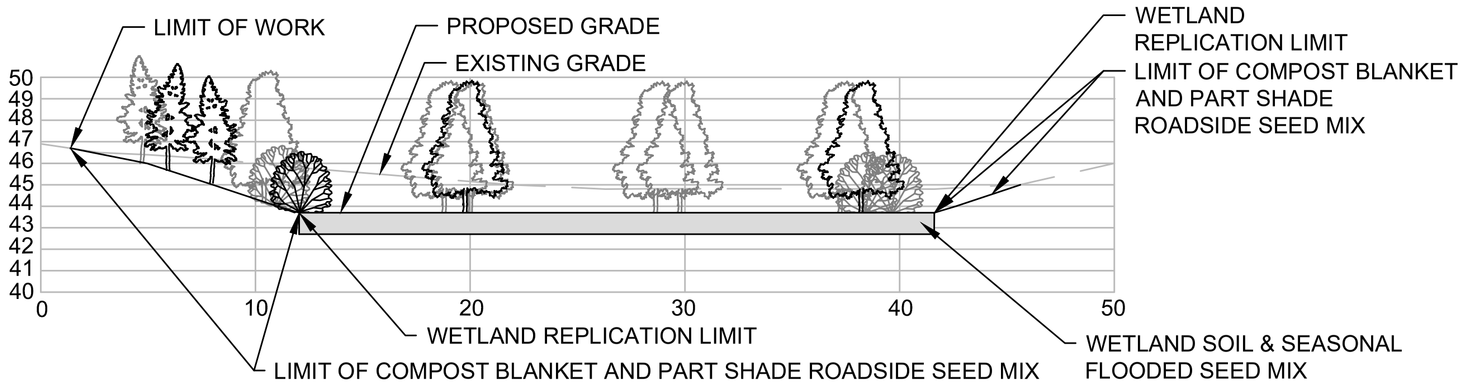
84 FT LENGTH OF SEDIMENT CONTROL BARRIER

2,084 SQ FT OF PART SHADE ROADSIDE SEED MIX

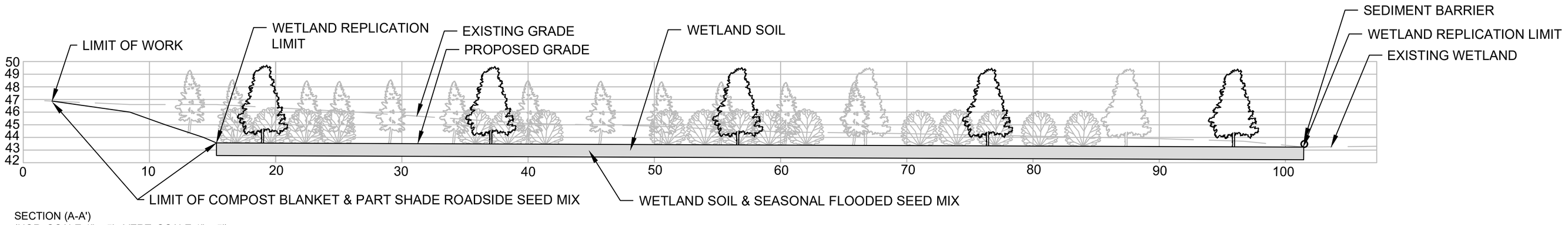
2,500 SQ FT WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

WETLAND REPLICATION PLANT LIST

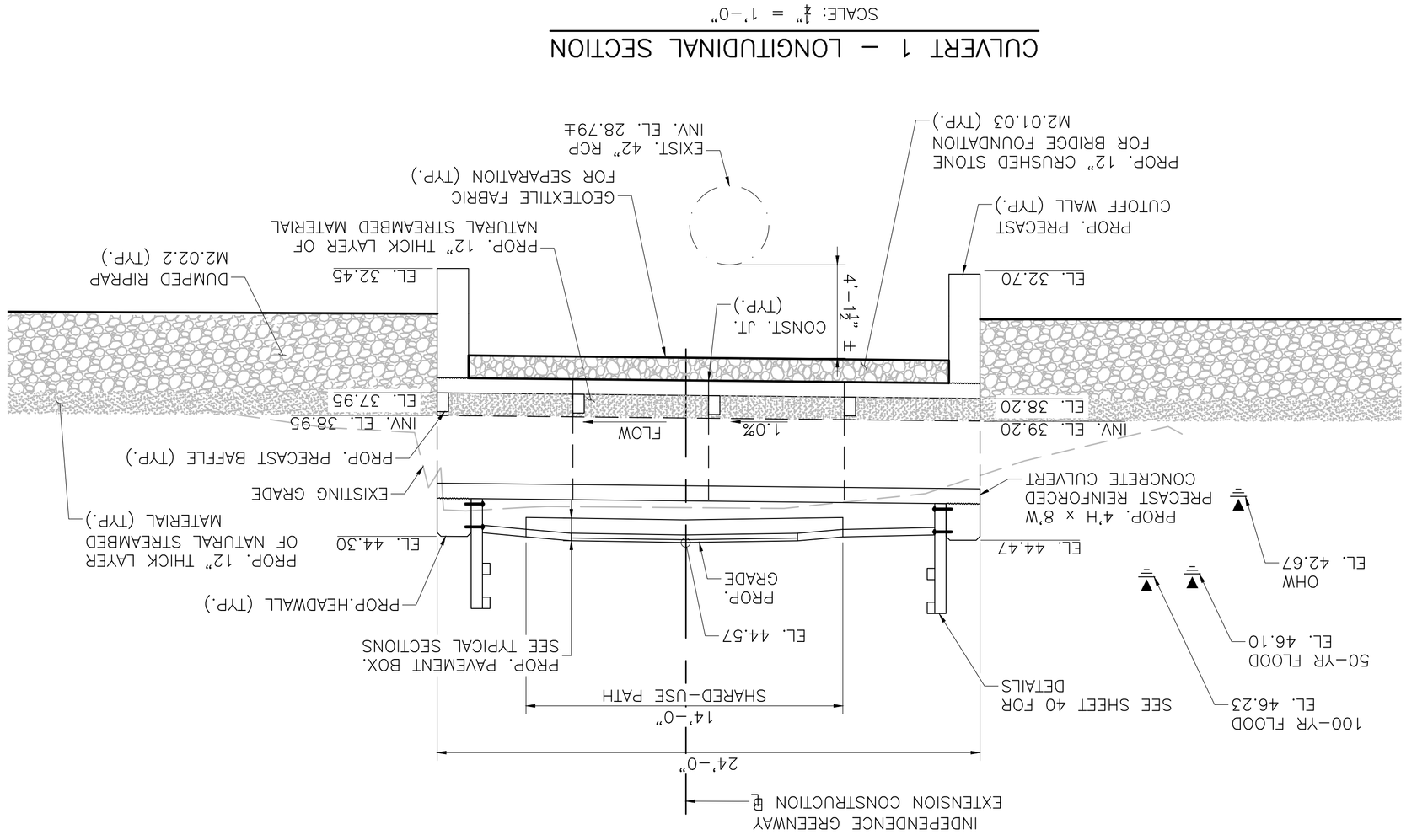
KEY	QTY	WETLAND STAUS	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
			DECIDUOUS TREES			
AR	7	FAC	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	4	FACW	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
QB	5	FACW	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
			EVERGREEN TREES			
TO	12	FACW	THUJA OCCIDENTALIS	AMERICAN ARBORVITAE	4-5 FEET	B&B
			DECIDUOUS SHRUBS			
CA	17	FACW	CORNUS AMOMUM	SILKY DOGWOOD	2-3 FEET	#2 CONT.
IV	12	FACW	ILEX VERTICILATA	WINTERBERRY	2-3 FEET	#2 CONT.
IVM	3	FACW	ILEX VERTICILATA -MALE	MALE WINTERBERRY	2-3 FEET	#2 CONT.



SECTION (B-B')
(HOR. SCALE 1" = 5' , VERT. SCALE 1" = 5')

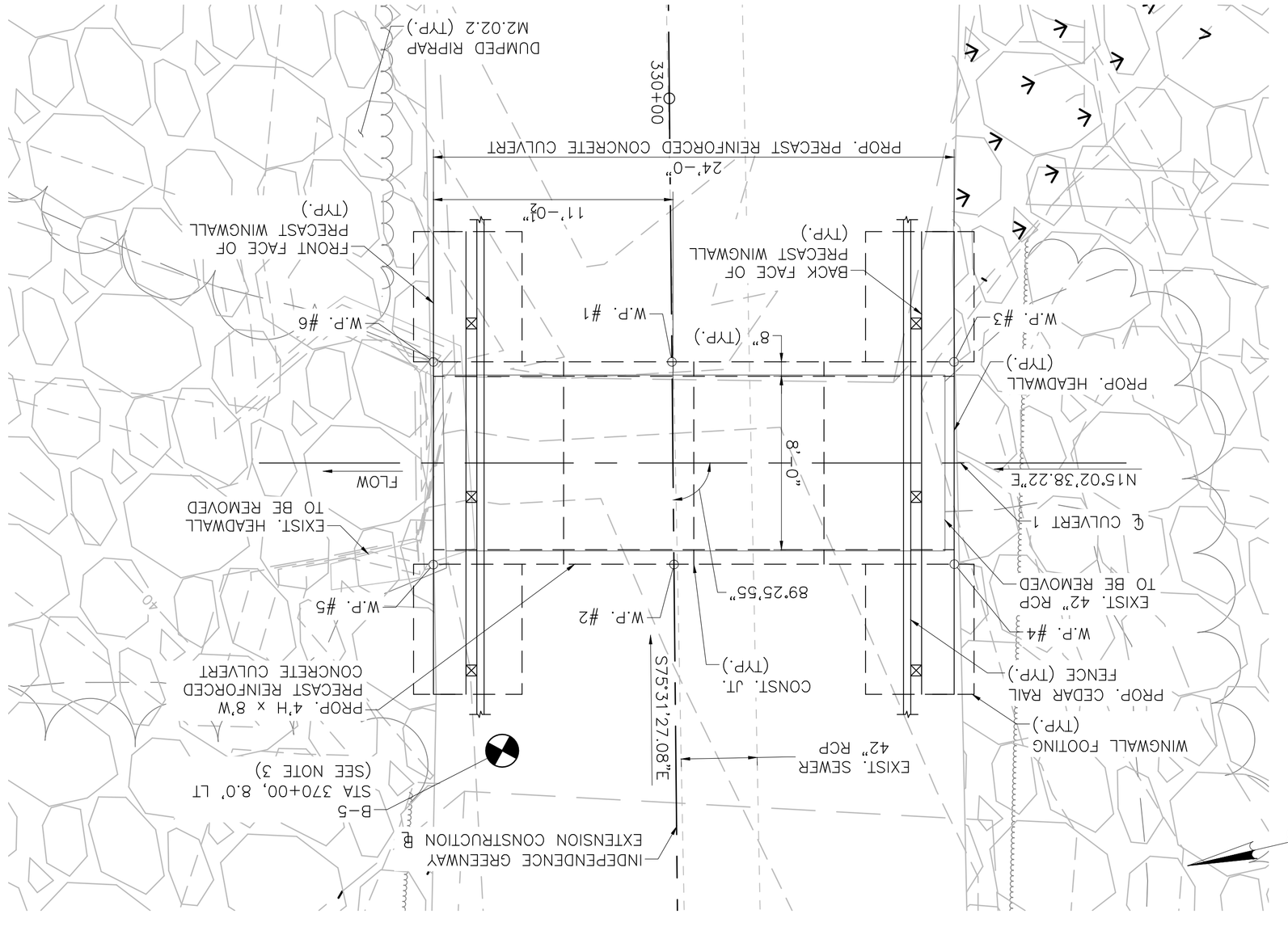


SECTION (A-A')
(HOR. SCALE 1" = 5' , VERT. SCALE 1" = 5')



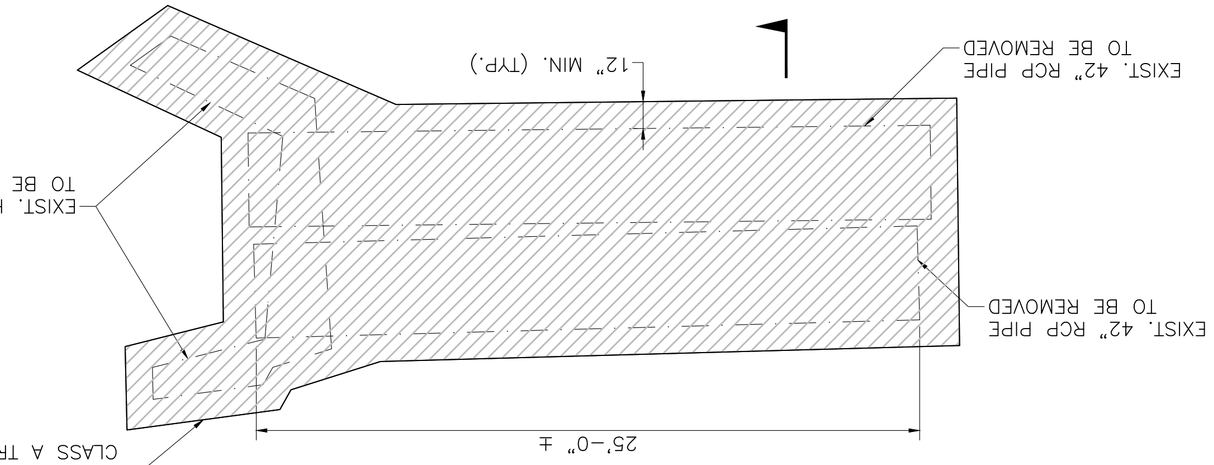
CULVERT 1 – LONGITUDINAL SECTION

SCALE: ¾" = 1'-0"



CULVERT 1 – PLAN

SCALE: ¾" = 1'-0"



CULVERT 1 – DEMOLITION PLAN

SCALE: ¾" = 1'-0"

SECTION

SCALE: ¾" = 1'-0"

CULVERT NO.1 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
1	329+87.85	0.00 LT	3020223.57	8060990.03
2	329+78.52	0.00 LT	3020225.91	8060899.99
3	329+87.72	45.41 RT	3020211.01	8060955.66
4	329+78.39	45.37 RT	3020213.43	8060864.64
5	329+78.63	44.89 LT	3020236.61	8060992.87
6	329+87.96	44.87 LT	3020234.18	8061018.88

NOTES:

1. SEE SHEET 40 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'-0" MAXIMUM.
3. CONTRACTOR TO PERFORM DRIVE SAMPLE BORING (ITEM NO. 191.) FOR B-5 AS EARLY ACTION ITEM TO VERIFY SOIL CONDITIONS ASSUMED IN THE GEOTECHNICAL REPORT FOR CULVERT 1.

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	140

PROJECT FILE NO. 609211

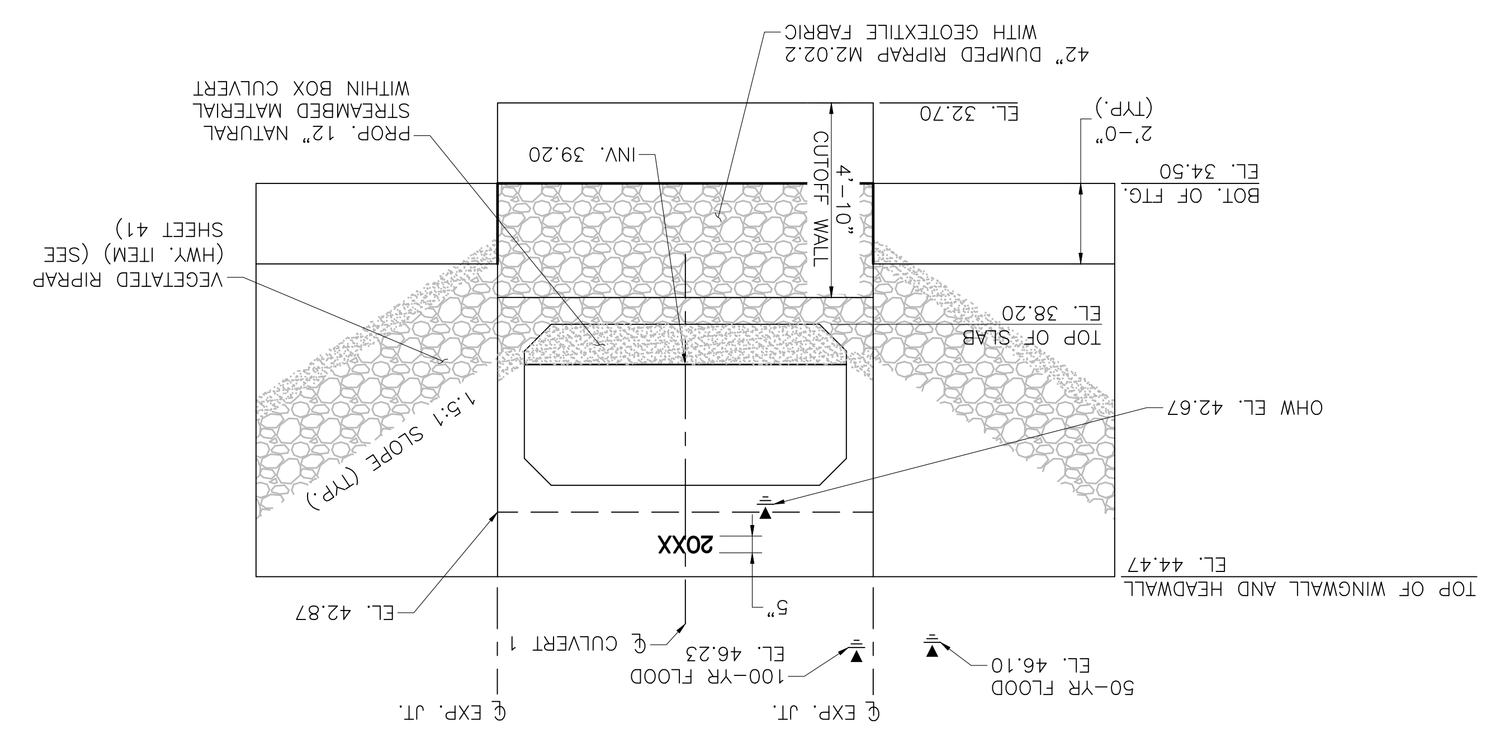
CULVERT 1 - PLAN AND LONGITUDINAL SECTION

NOTES:

1. SEE SHEET 34 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

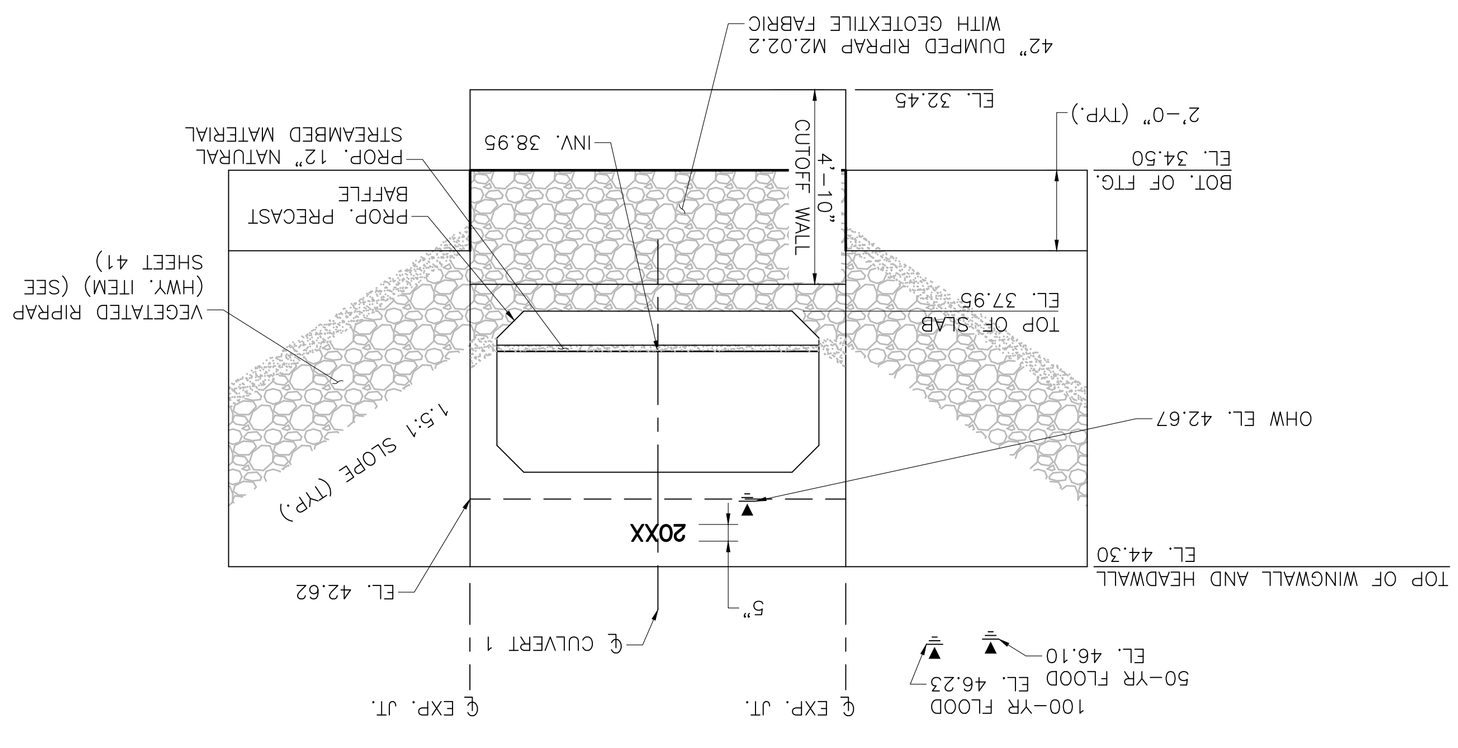
CULVERT 1 – UPSTREAM ELEVATION

SCALE: 3/8" = 1'–0"



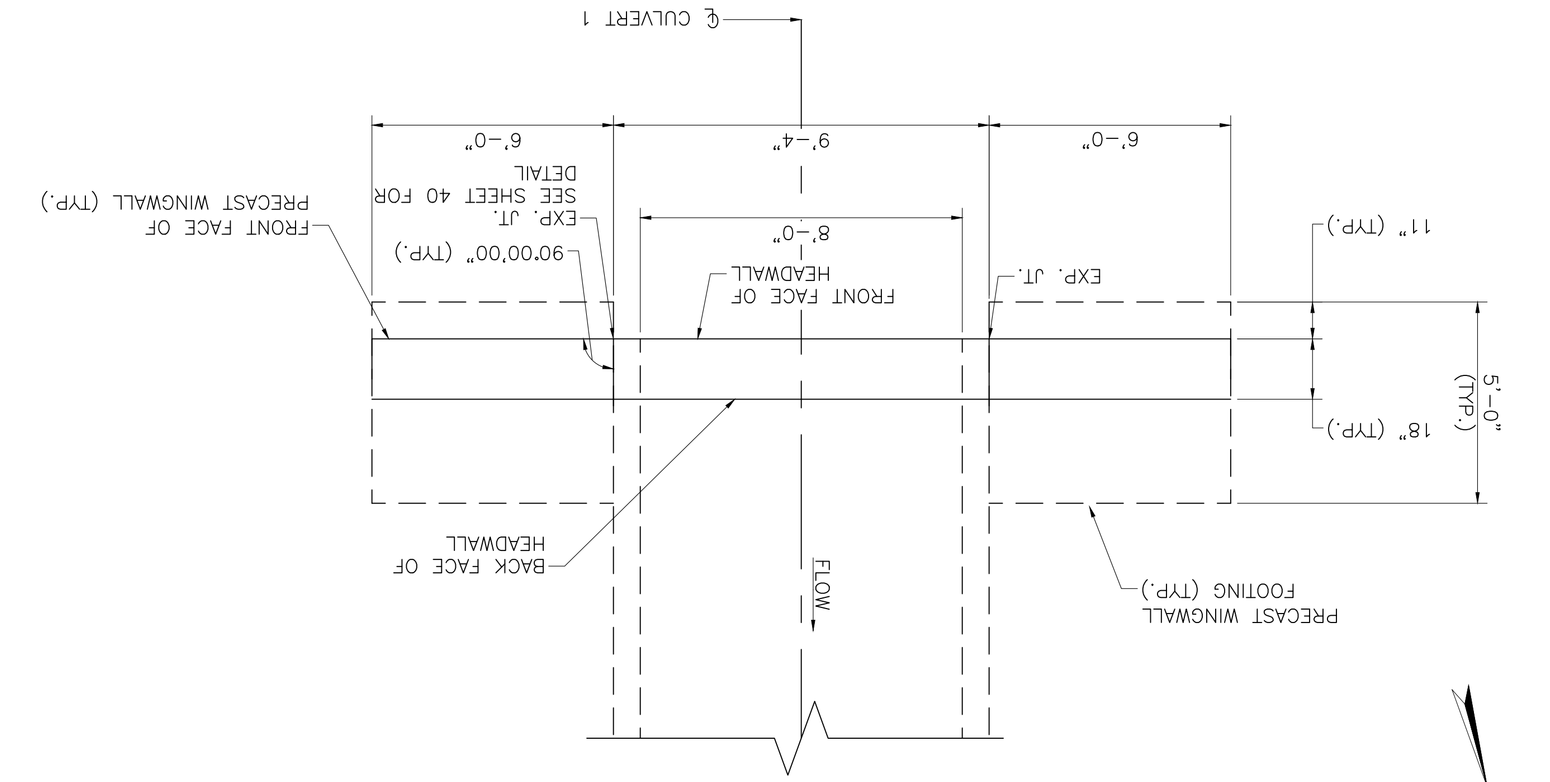
CULVERT 1 – DOWNSTREAM ELEVATION

SCALE: 3/8" = 1'–0"



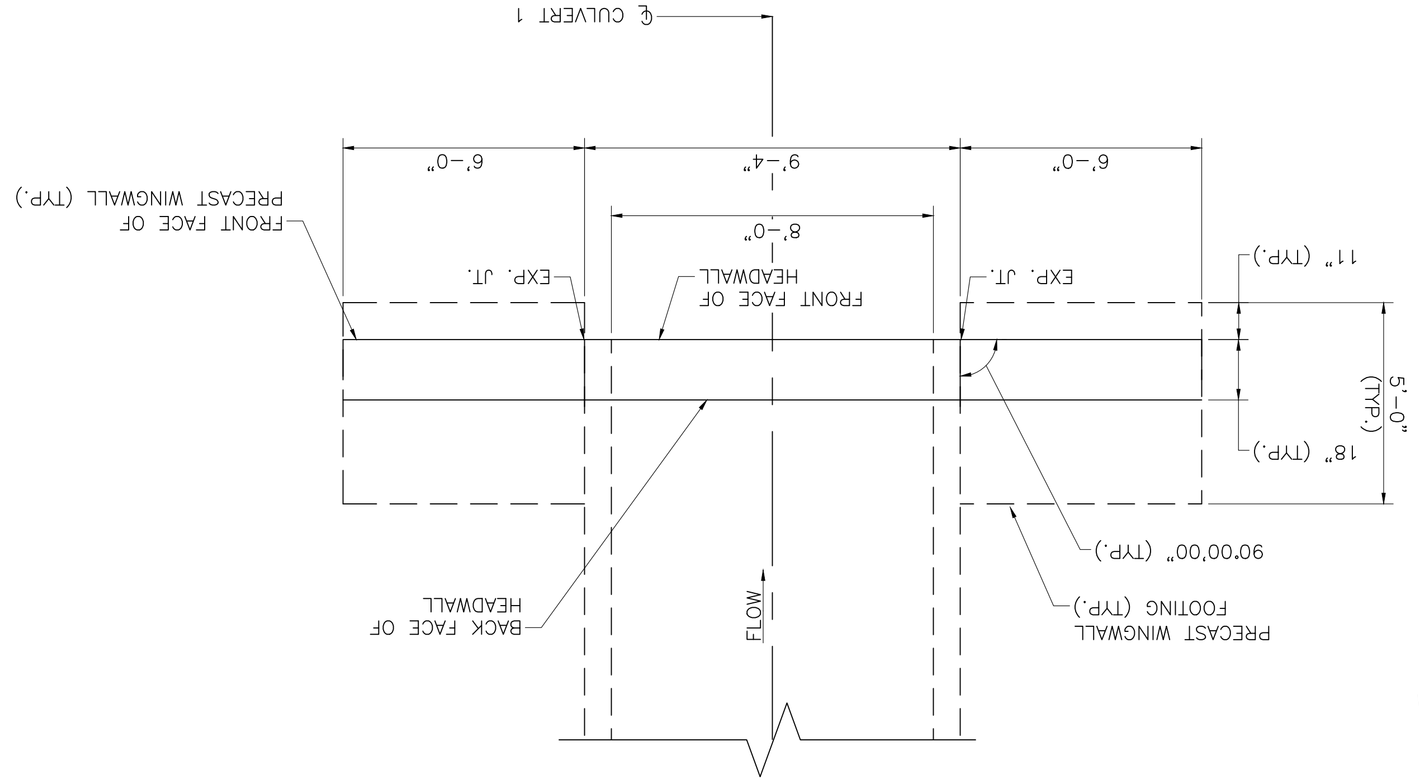
CULVERT 1 – UPSTREAM PLAN

SCALE: 3/8" = 1'–0"



CULVERT 1 – DOWNSTREAM PLAN

SCALE: 3/8" = 1'–0"



CULVERT 1 - HEADWALL ELEVATIONS

PROJECT FILE NO. 609211			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	35	140

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

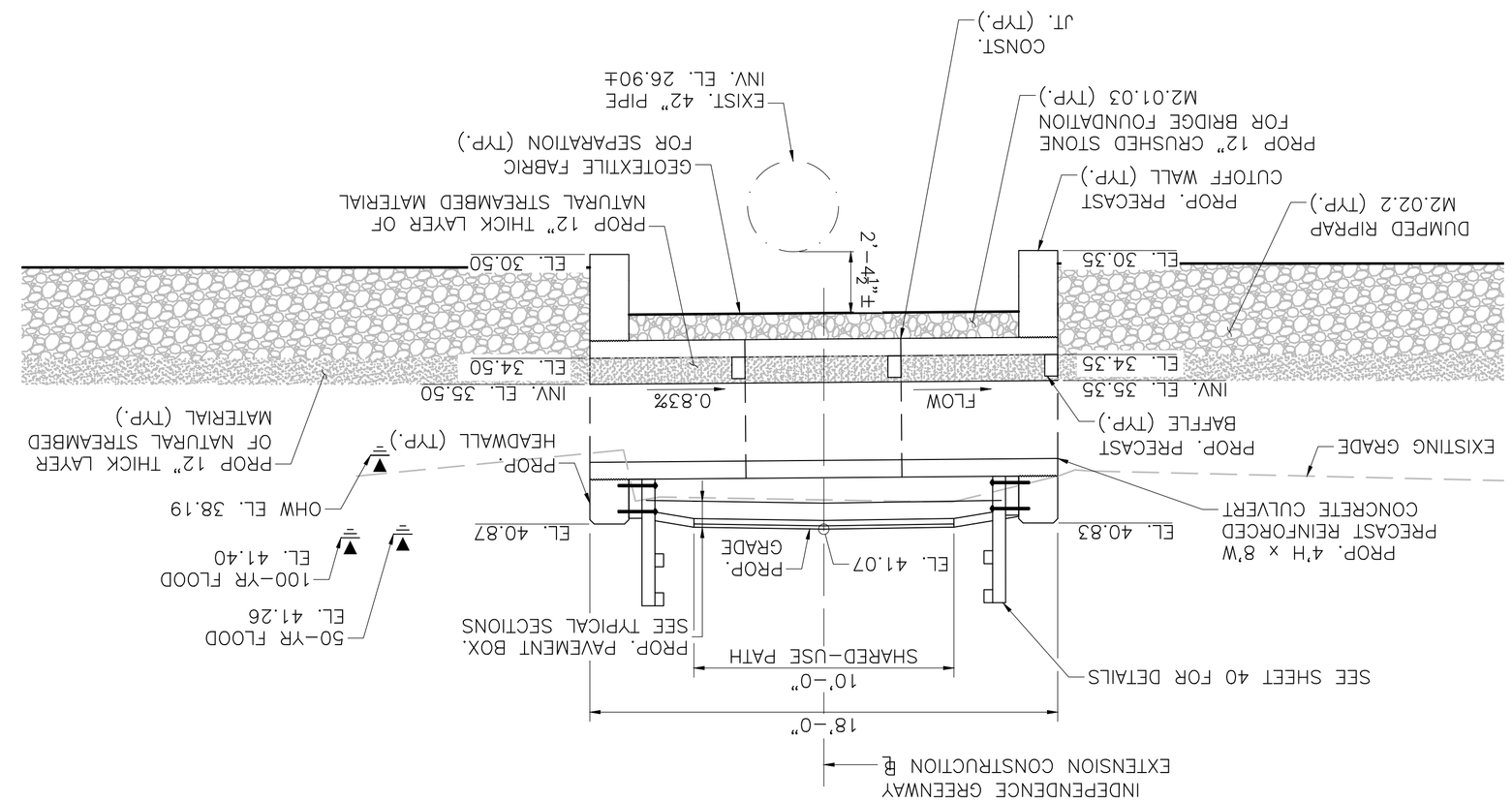
Proposal No. 609211-132091

A00860 - 449

609211_BR02.DWG Plotted on 5-Apr-2024 5:47 PM

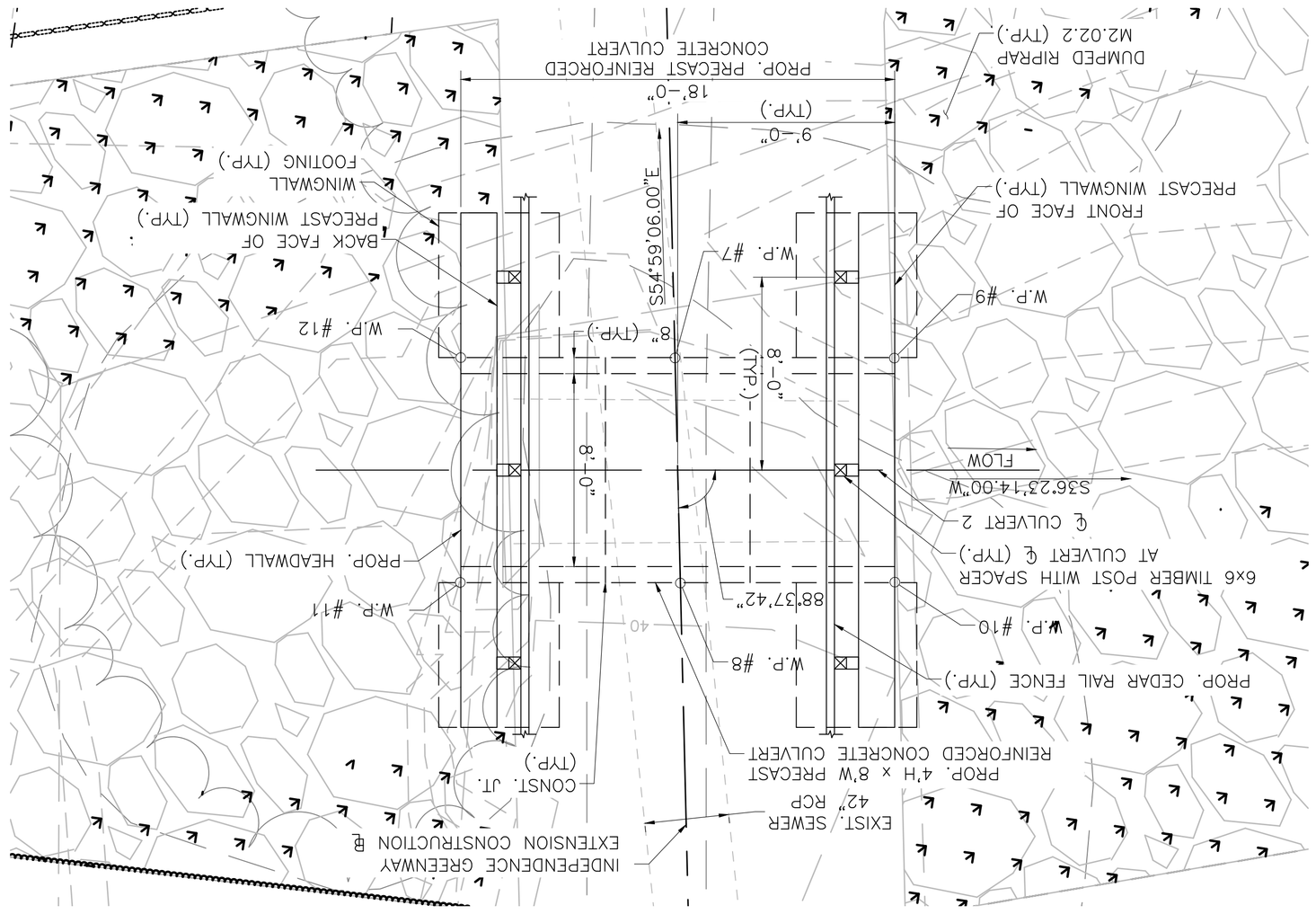
CULVERT 2 – LONGITUDINAL SECTION

SCALE: ¼" = 1'–0"



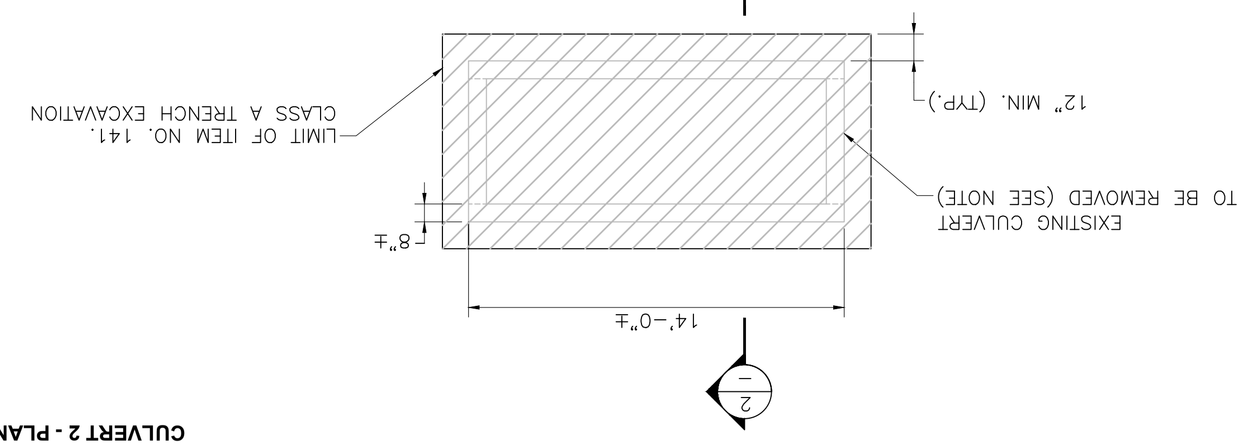
CULVERT 2 – PLAN

SCALE: ¼" = 1'–0"



CULVERT 2 – DEMOLITION PLAN

SCALE: ¼" = 1'–0"



NOTE:
THE EXISTING CULVERT HAS FAILED AND THE REMNANTS REMAIN IN THE CHANNEL. ALL THE EXISTING REMNANTS OF THE EXISTING CULVERT TO BE REMOVED FROM THE CHANNEL. REMOVAL SHALL BE MEASURED AND PAID UNDER ITEM NO. 141. CLASS A TRENCH EXCAVATION.

SECTION

SCALE: ¼" = 1'–0"

CULVERT NO.2 WORKING POINTS:

W.P.	STATION	OFFSET	NORTHING	EASTING
7	346+24.36	0.00 LT	3019677.22	807634.33
8	346+15.02	0.00 LT	3019682.58	807626.68
9	346+9.11	9.11 RT	3019677.35	807634.15
10	346+14.81	8.89 RT	3019682.70	807626.51
11	346+15.24	9.11 LT	3019689.92	807632.09
12	346+24.57	8.89 LT	3019677.10	807634.50

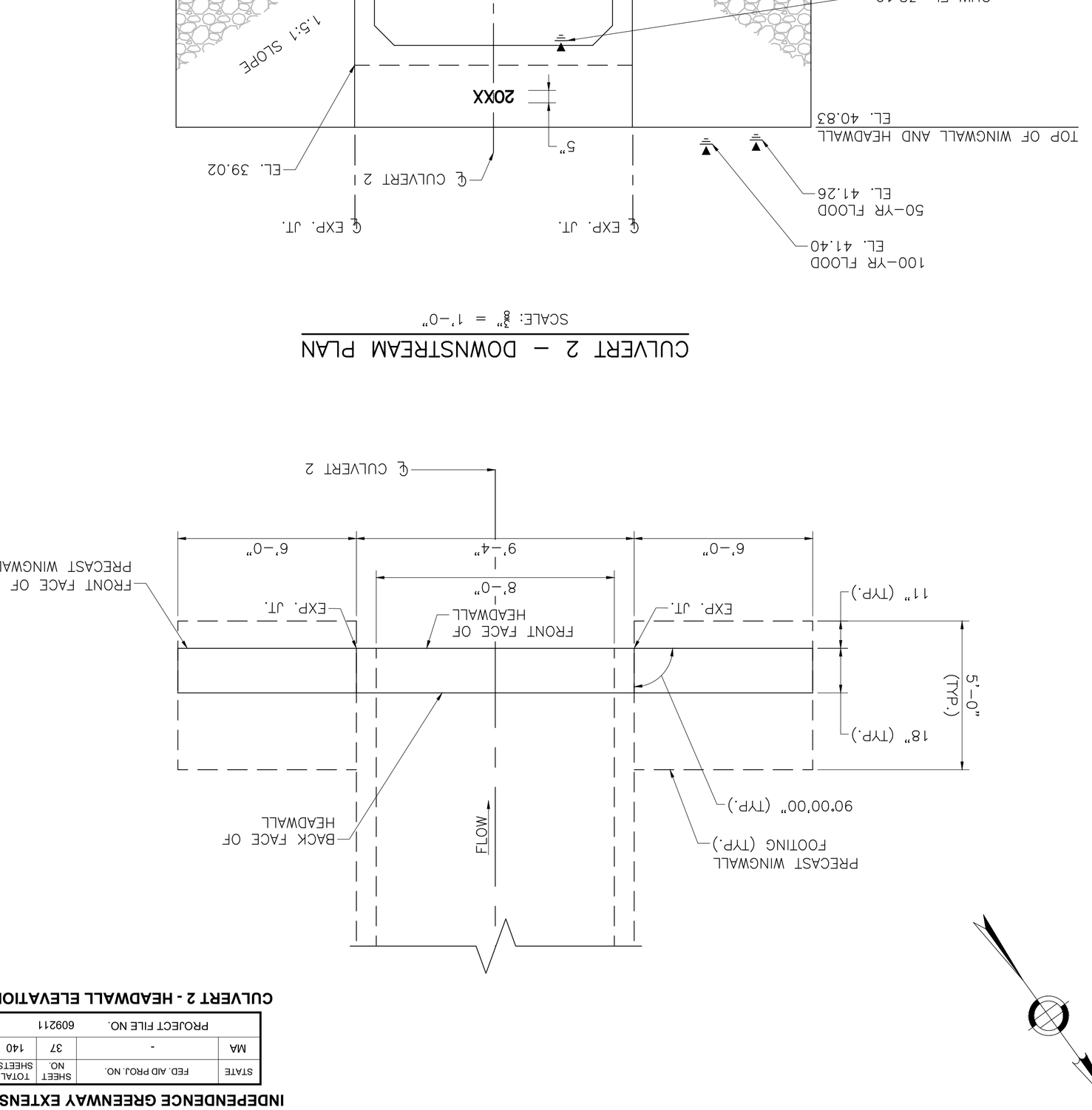
NOTES:
1. SEE SHEET 40 FOR CEDAR RAIL FENCE ATTACHMENT TO THE PRECAST CONCRETE HEADWALLS.
2. PRECAST BOX CULVERT CONSTRUCTION JOINT SPACING MAY VARY PER PRECASTER, UP TO 7'–0" MAXIMUM.

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	36	140
	PROJECT FILE NO.	609211	

CULVERT 2 - PLAN AND LONGITUDINAL SECTION

609211_BR03.DWG Plotted on 5-Apr-2024 5:48 PM



NOTES:

1. SEE SHEET 36 FOR GENERAL PLAN AND LONGITUDINAL SECTION OF STRUCTURE.
2. SEE SHEET 39 FOR HEADWALL AND WINGWALL REINFORCEMENT DETAILS.

CULVERT 2 - HEADWALL ELEVATIONS

PROJECT FILE NO. 609211		
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	37	140

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

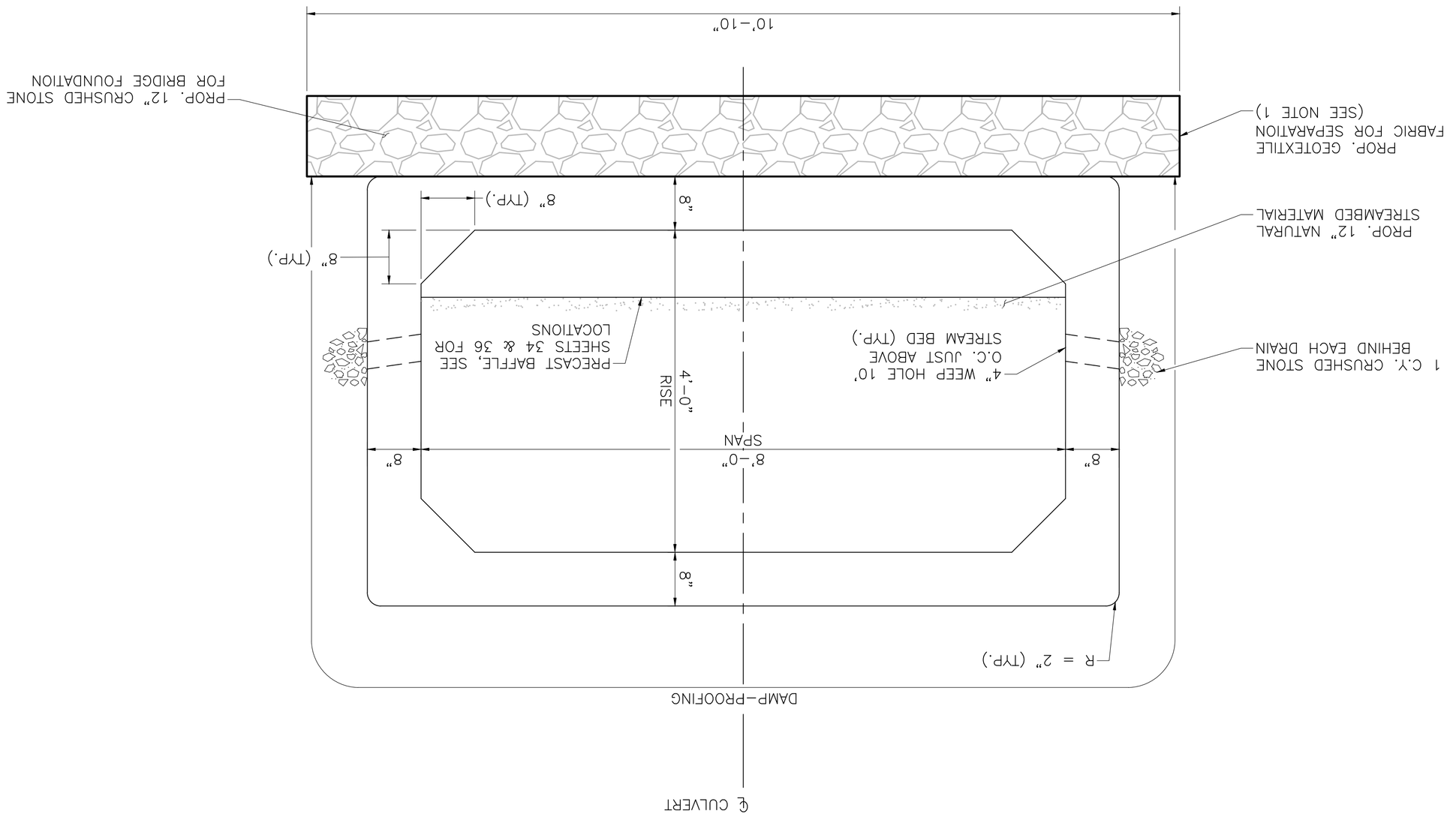
609211_BR04.DWG Plotted on: 5-Apr-2024 5:48 PM

NOTES:

1. PROPOSED GEOTEXTILE FABRIC TO ENVELOP LIMITS OF 12" CRUSHED STONE FOR BRIDGE FOUNDATION WITH MINIMUM 2'-0" OVERLAP AT SEAM.
2. ALL CONCRETE TO BE 5000 PSI, ¾ IN, 685 HP CEMENT CONCRETE.
3. THE MAXIMUM FACTORED BEARING PRESSURE = 2.33 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. FACTORED BEARING RESISTANCE = 5.00 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.
4. TRANSVERSE REINFORCING SHALL BE PLACED NORMAL TO THE ℄ OF THE CULVERT.
5. ALL REINFORCING SHALL BE GRADE 60 EPOXY COATED.

BOX CULVERT TYPICAL SECTION

SCALE: 1" = 1'-0"

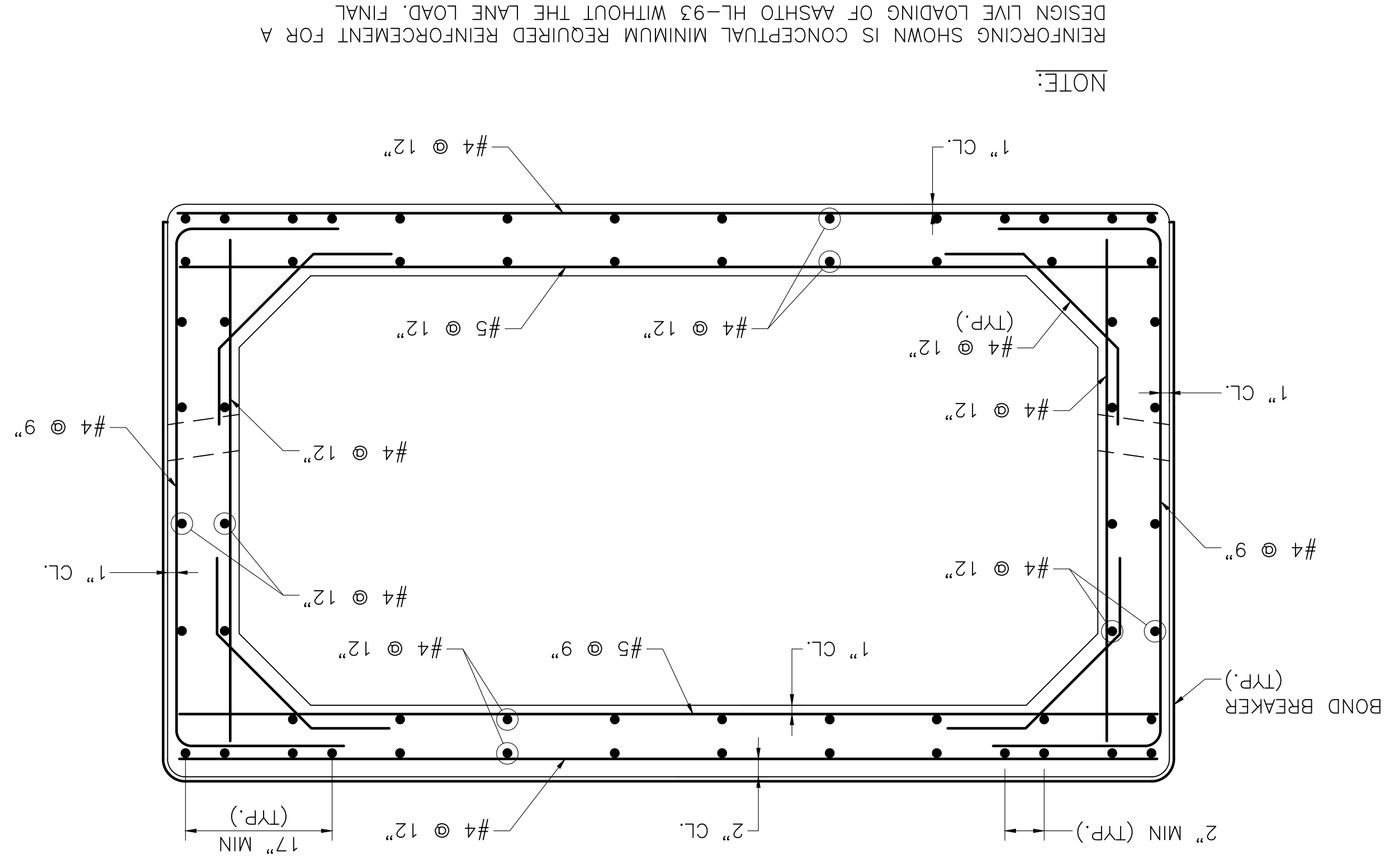


BOX CULVERT REINFORCING DETAILS

SCALE: 1" = 1'-0"

NOTE:

REINFORCING SHOWN IS CONCEPTUAL MINIMUM REQUIRED REINFORCEMENT FOR A DESIGN LIVE LOADING OF AASHTO HL-93 WITHOUT THE LANE LOAD. FINAL REINFORCEMENT SHALL BE DESIGNED AND DETAILED BY THE CONTRACTOR.



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	38	140
PROJECT FILE NO. 609211			

BOX CULVERT SECTIONS

609211_BR06.DWG Plotted on 5-Apr-2024 5:48 PM

Proposal No. 609211-132091

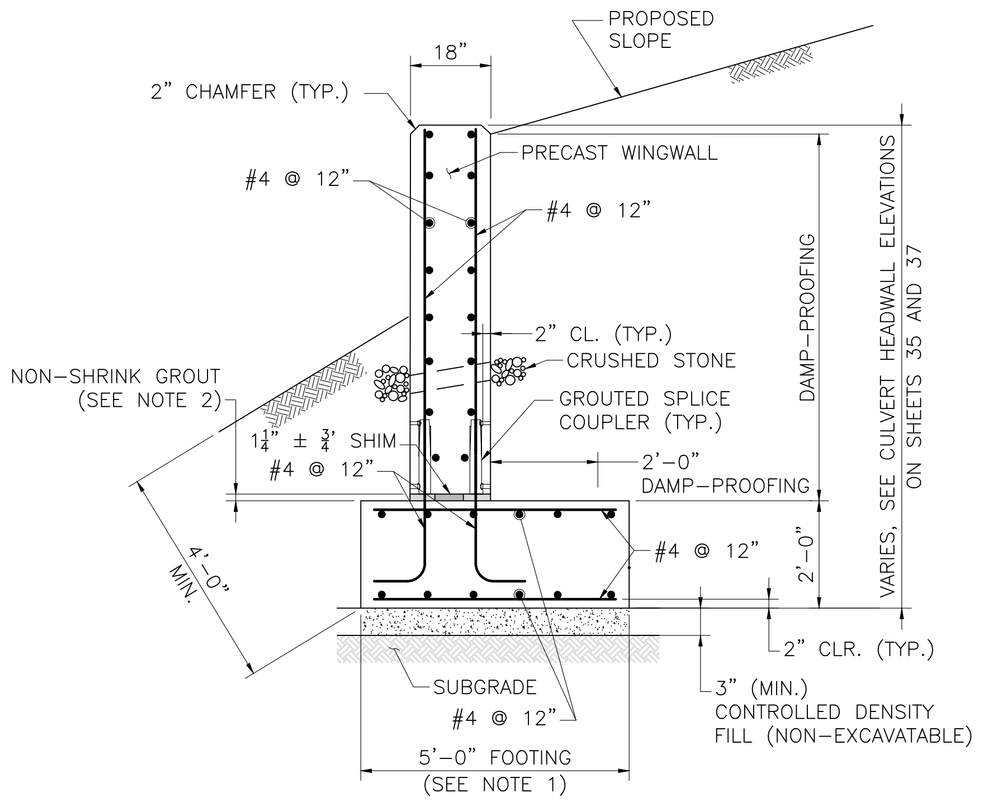
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	39	140
PROJECT FILE NO.	609211		

HEADWALL AND MISCELLANEOUS DETAILS

600211_BR06.DWG Plotted on 5-Apr-2024 5:48 PM

Proposal No. 609211-132091

A00860 - 453

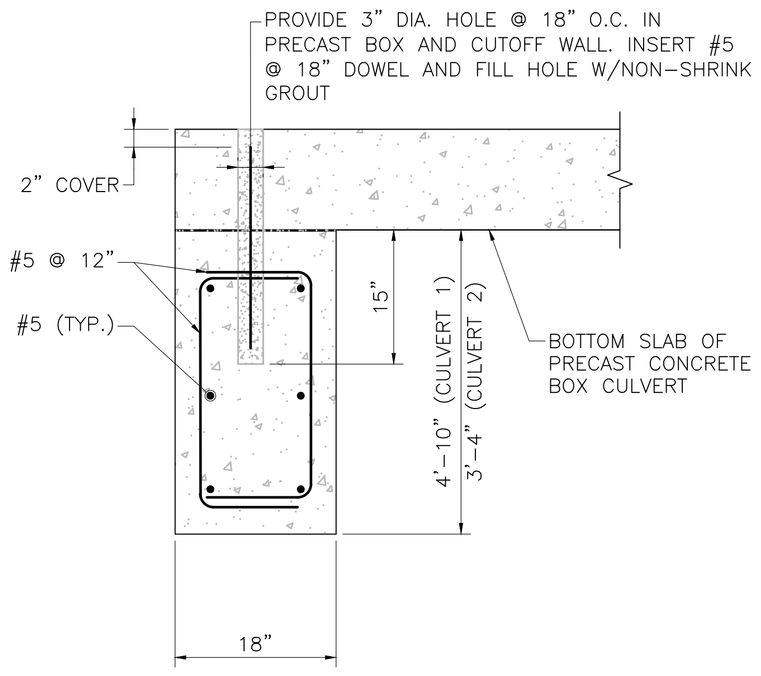


NOTES:

1. THE CONTRACTOR MAY ELECT TO USE PRECAST FOOTINGS, OR MODULAR WINGWALLS IN LIEU OF PRECAST WINGWALL STEMS DEPICTED HERE. DESIGN OF WINGWALLS AND FOOTINGS WHETHER PRECAST OR MODULAR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. PRE-BED PRECAST ELEMENT WITH NON-SHRINK GROUT WITH THICKNESS MORE THAN SHIM STACK.
3. TIMBER RAILING POST ATTACHMENT NOT SHOWN FOR CLARITY, SEE DETAIL ON THIS SHEET.

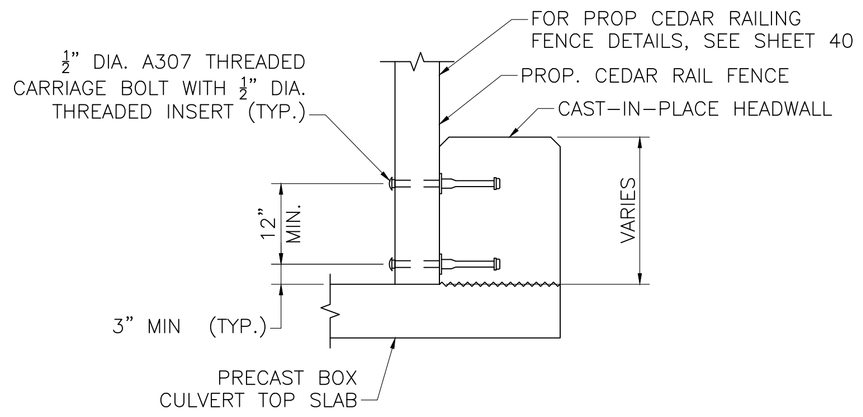
TYPICAL PRECAST WINGWALL SECTION

SCALE: ½" = 1'-0"



CUTOFF WALL DETAIL

SCALE: 1" = 1'-0"

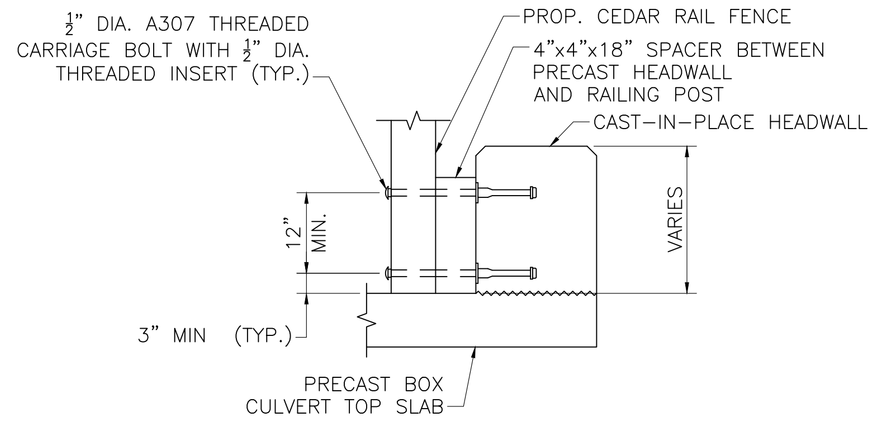


NOTES:

1. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR

CULVERT 1 HEADWALL – POST ATTACHMENT DETAIL

SCALE: ¾" = 1'-0"

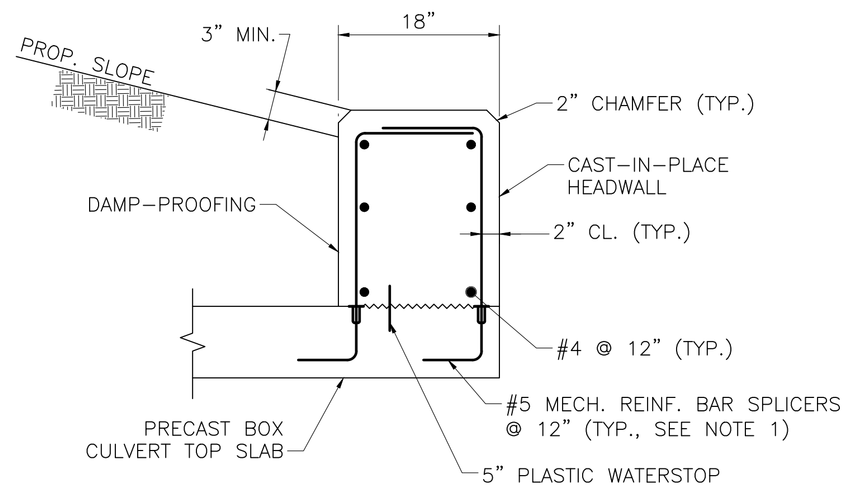


NOTES:

1. CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.
2. DETAIL AT HEADWALL SHOWN, WINGWALL POST ATTACHMENT SIMILAR
3. PROPOSED TIMBER SPACER TO BE PROVIDED AND CUT ALONG SKEW AS NEEDED TO PROVIDE FLUSH ATTACHMENT OF POST.

CULVERT 2 HEADWALL – POST ATTACHMENT DETAIL

SCALE: ¾" = 1'-0"

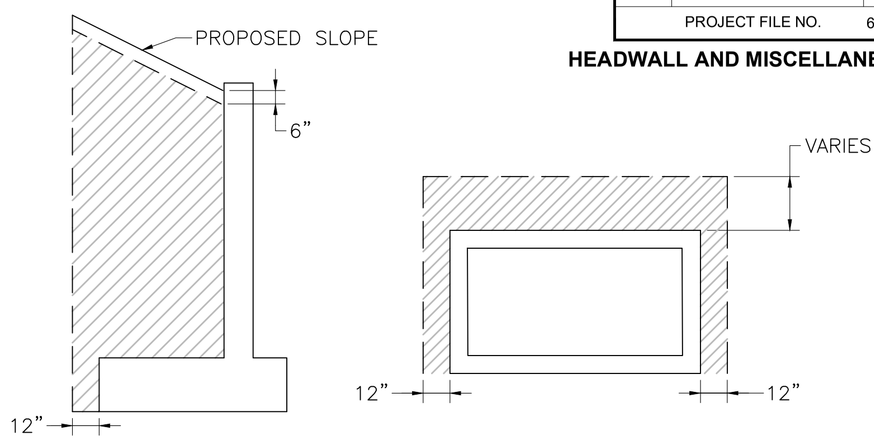


NOTES:

1. THE CONTRACTOR MAY SUBSTITUTE #5 ∫∫ DOWELS, FOR MECHANICAL REINFORCING BAR SPLICERS AND THREADED REBARS.
2. BOX CULVERT REINFORCEMENT IS NOT SHOWN FOR CLARITY.

TYPICAL CULVERT HEADWALL REINFORCEMENT DETAIL

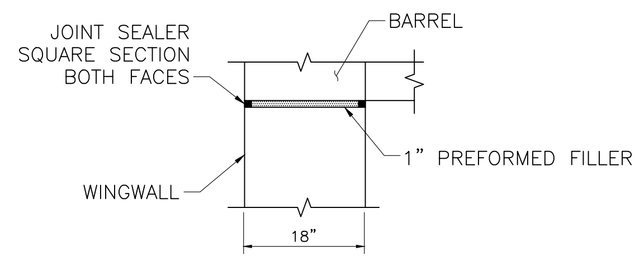
SCALE: 1" = 1'-0"



NOTE:
HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

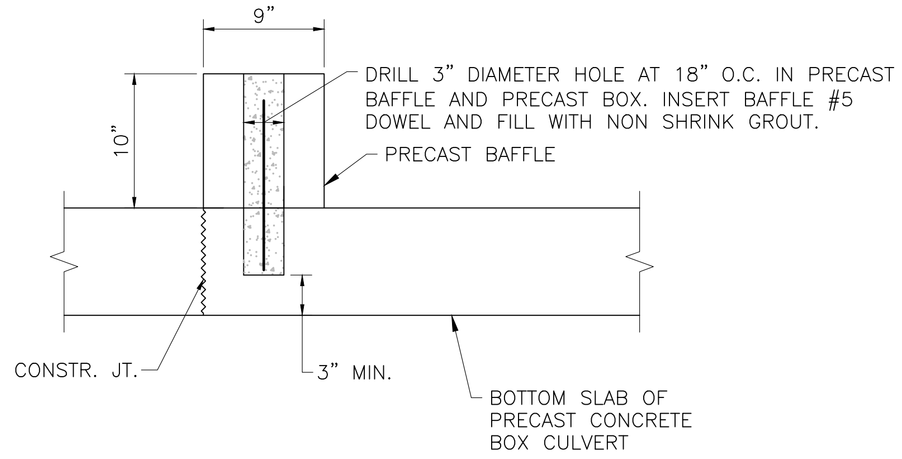
LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

SCALE: ¼" = 1'-0"



TYPICAL CULVERT EXPANSION JOINT DETAIL

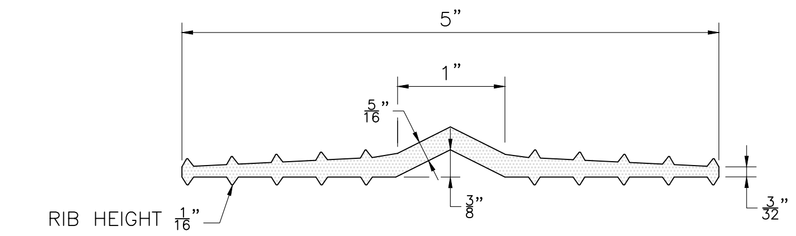
SCALE: ¾" = 1'-0"



NOTE:
PRECAST BAFFLE AND ATTACHMENT MATERIALS ARE CONSIDERED INCIDENTAL TO THE CULVERT ITEMS.

TYPICAL PRECAST BAFFLE DETAIL

SCALE: 1½" = 1'-0"



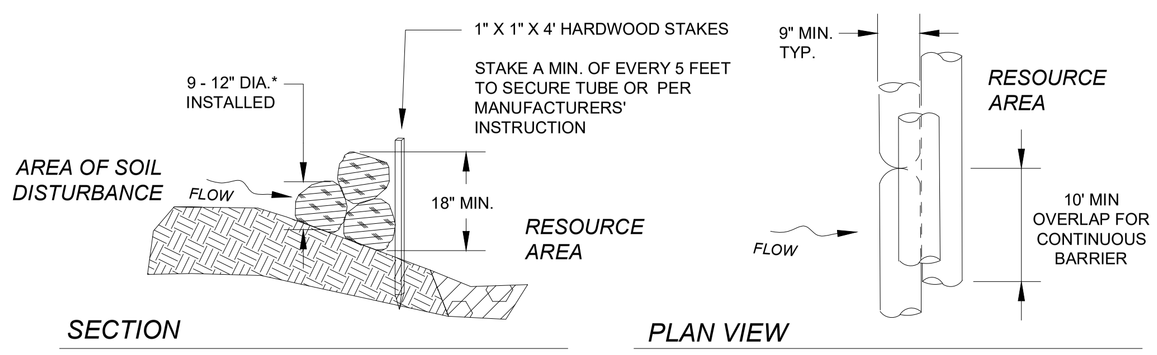
5" WATERSTOP

NOT TO SCALE

Proposal No. 609211-132091

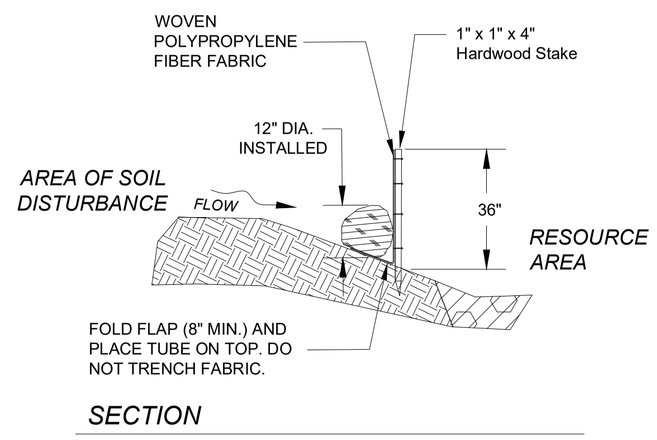
SHT014_HDICONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG Plotted on 9-Apr-2024 10:47 AM

A00860 - 454



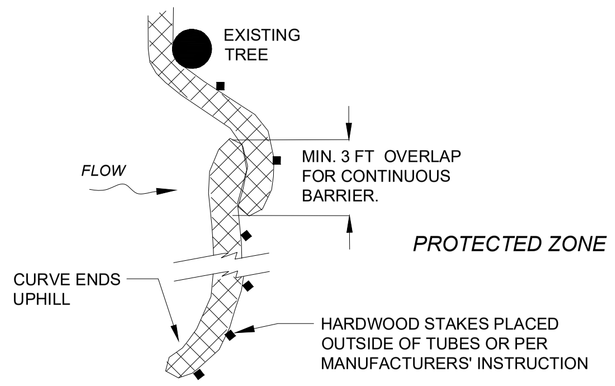
COMPOST FILTER TUBE BERM (SLOPES 2:1 OR STEEPER)

NOT TO SCALE



COMPOST FILTER TUBE & SILT FENCE

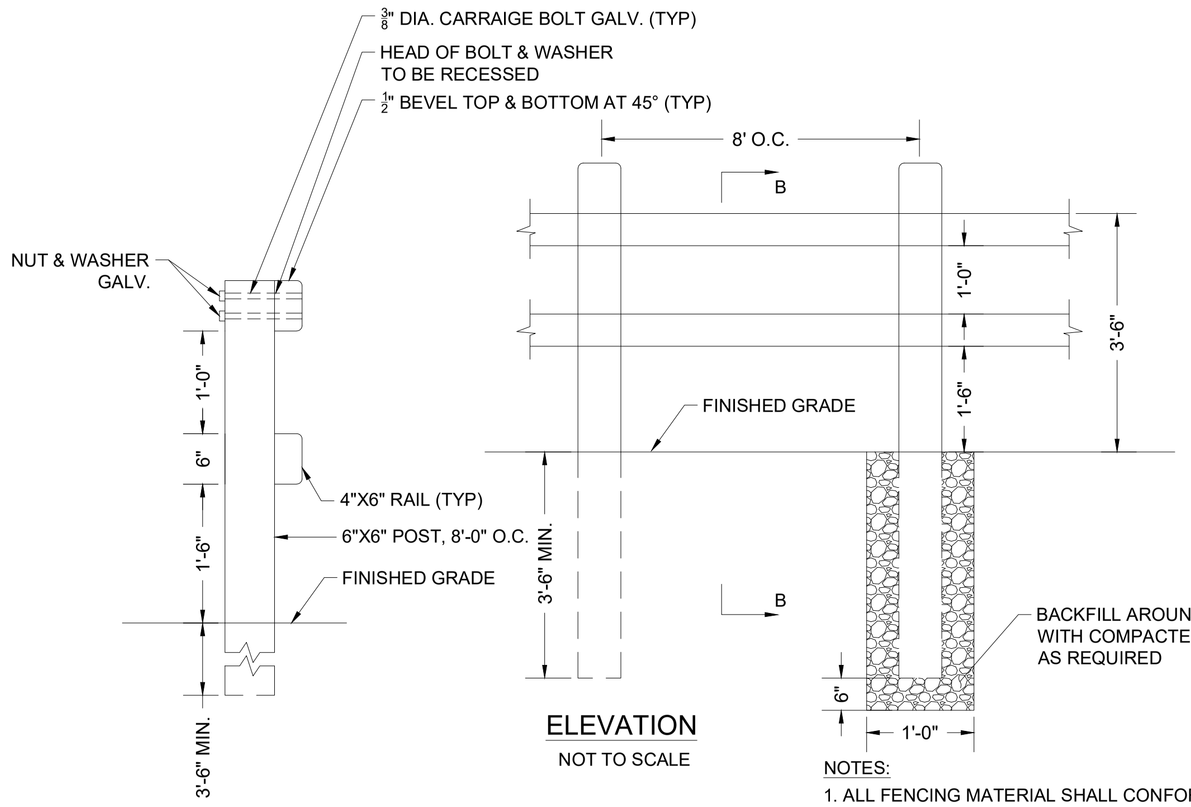
NOT TO SCALE



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

PLAN VIEW

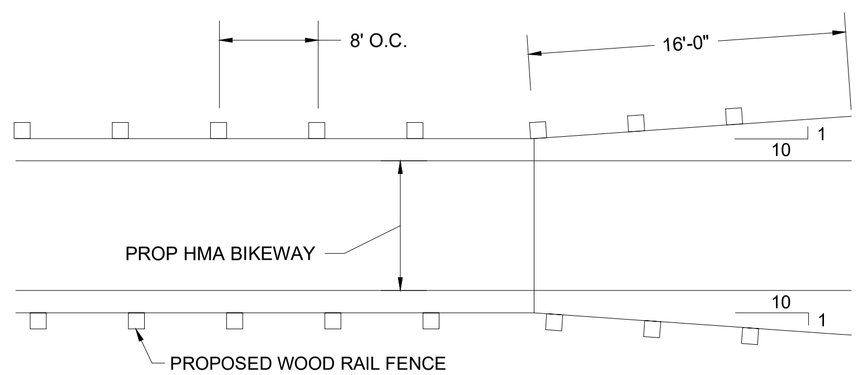


WOOD RAIL FENCE

NOT TO SCALE

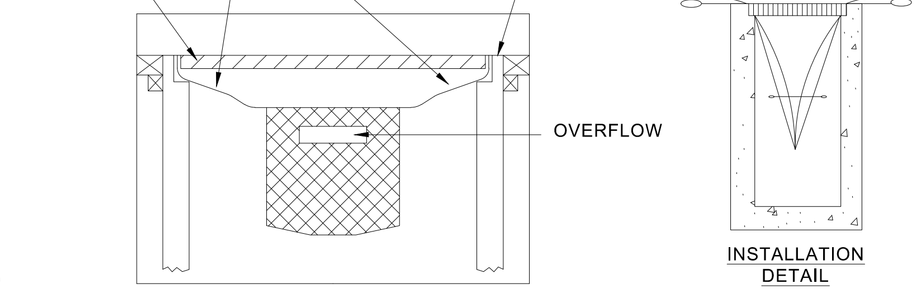
NOTES:
1. ALL FENCING MATERIAL SHALL CONFORM TO THE STANDARD SPECIFICATIONS & SPECIAL PROVISIONS INCLUDED IN THE CONTRACT DOCUMENTS.

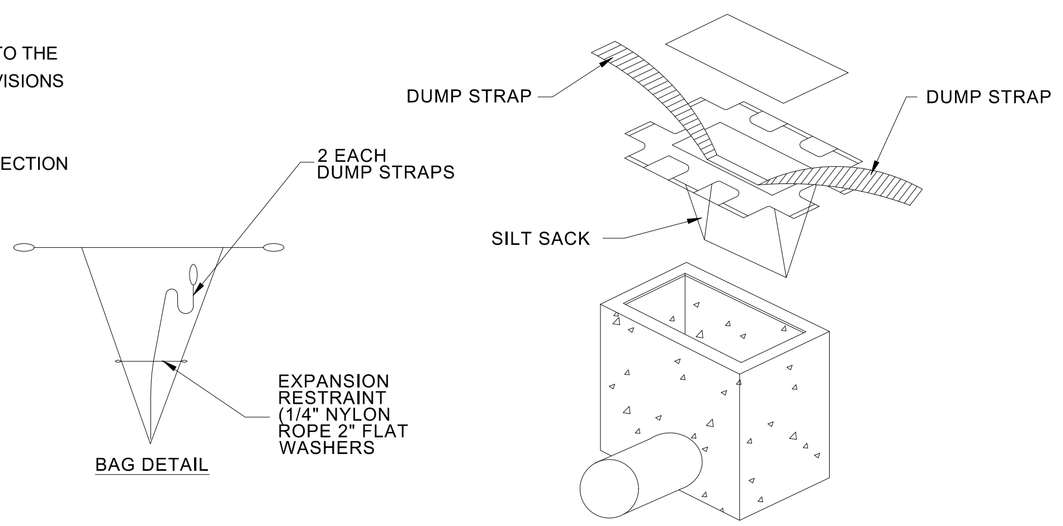
2. MOUNTING OF UPPER RAIL IS SHOWN ON SECTION B-B. MOUNT LOWER RAIL SIMILARLY.



WOOD RAIL FENCE FLARED-END TREATMENT

NOT TO SCALE

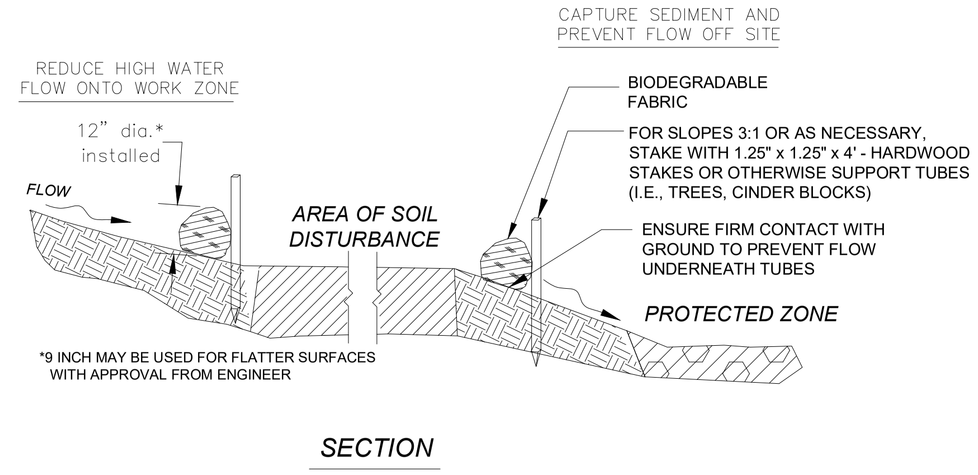




NOTE 1:
TEMPORARY INLET SEDIMENT FILTER TO BE INSTALLED ON ALL PAVED CATCH BASINS OR STORM INLETS.

INLET PROTECTION SILT SACK

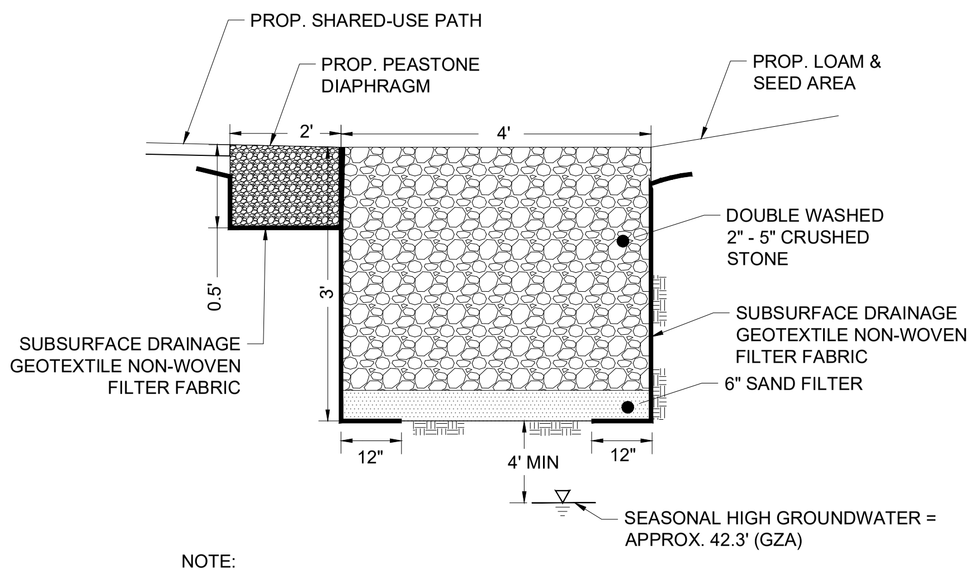
NOT TO SCALE



SECTION

SEDIMENT BARRIER - COMPOST FILTER TUBE

NOT TO SCALE



NOTE:
1. GROUNDWATER ELEVATION TAKEN AT 11:45 AM ON JANUARY 3, 2019

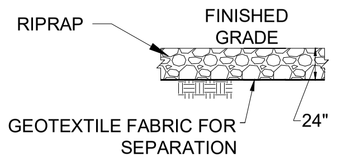
INFILTRATION TRENCH SECTION

NOT TO SCALE

Proposal No. 609211-132091

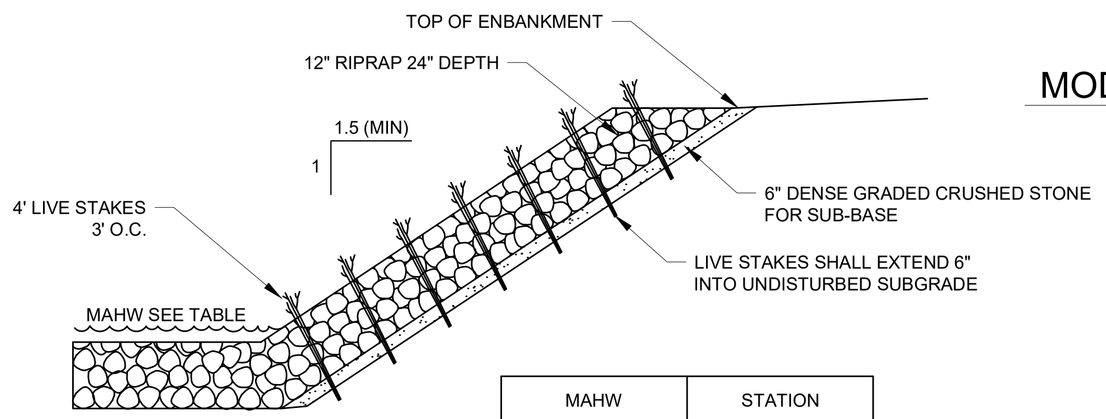
SHT0104_HDICONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG Plotted on 9-Apr-2024 10:49 AM

A00860 - 455



ABUTMENT ARMORING RIPRAP DETAIL

NOT TO SCALE



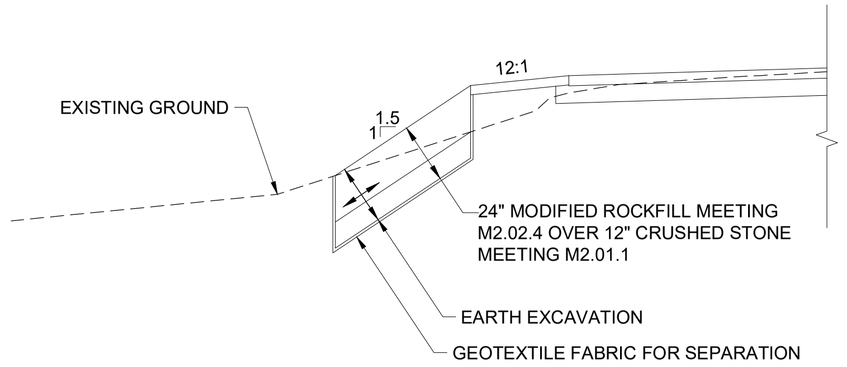
MAHW	STATION
42.4	329+85
37.1	346+20

TABLE 1

NOTES:

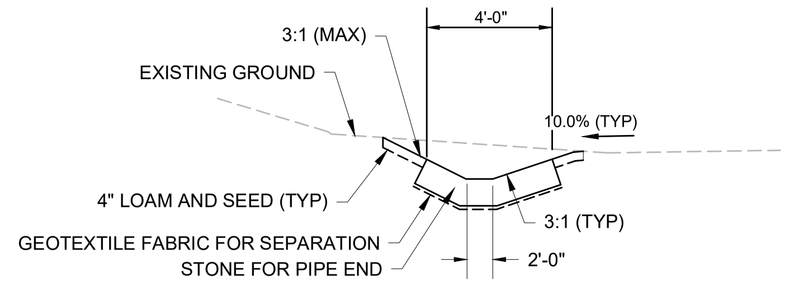
1. DRIVE REBAR INTO VOIDS BETWEEN RIP RAP.
2. HOLES SHALL EXTEND 12" BELOW RIP RAP INTO SUBGRADE OR GRANULAR FILL LAYER.
3. LIVE STAKES SHALL BE PLACED IN HOLES SO THAT THEY EXTEND 6" INTO SUBGRADE.
4. LIVE STAKES SHALL BE LOCATED APPROXIMATELY 3 FEET ON CENTER STARTING 6" ABOVE MEAN HIGH WATER.

LIVE STAKES PLANT LIST				
QTY	BOTANICAL NAME	COMMON NAME	PLANT SIZE	SPACING
100	CORNUS RACEMOSA	GREY DOGWOOD	4 FEET LENGTH	3' O.C
100	SALIX DISCOLOR	PUSSY WILLOW	4 FEET LENGTH	3' O.C
100	CORNUS SERICEA	REDOSIER DOGWOOD	4 FEET LENGTH	3' O.C



MODIFIED ROCKFILL FOR SLOPE STABILIZATION

NOT TO SCALE



PAVED WATERWAY

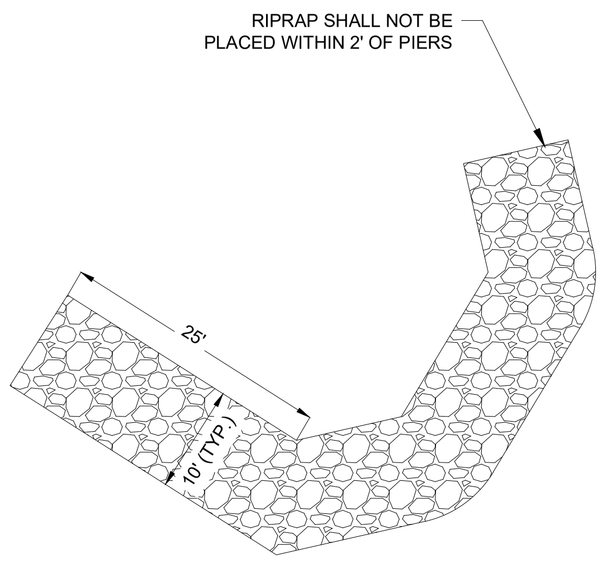
NOT TO SCALE

FHWA CLASS	LENGTH OF APRON L (FEET)	DEPTH OF APRON H (FEET)	WIDTH OF APRON (FEET)	MASSDOT RIPRAP SIZE	CULVERTS AT STATION
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	329+85
II	10.0	2.0	13.5	M2.02.3	340+10
II	8.0	2.0	11.0	M2.02.3	342+25
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	346+20
II	10.0	2.0	5.0	M2.02.3	358+51

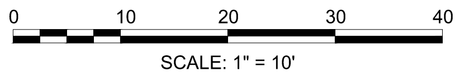
SOURCE:
FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 23
MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES

VEGETATED RIPRAP

NOT TO SCALE



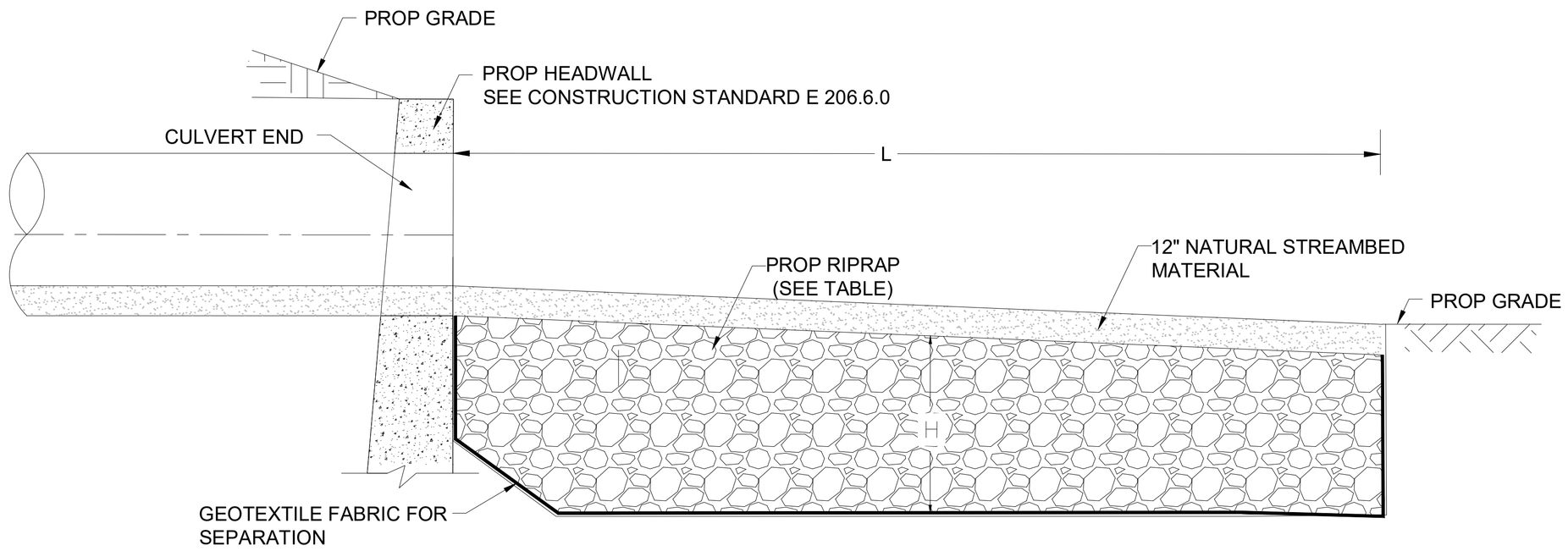
PLAN
SCALE : 1"=10'



SCALE: 1" = 10'

ABUTMENT ARMORING RIPRAP PLAN

RIPRAP CLASSES AND APRON DIMENSIONS



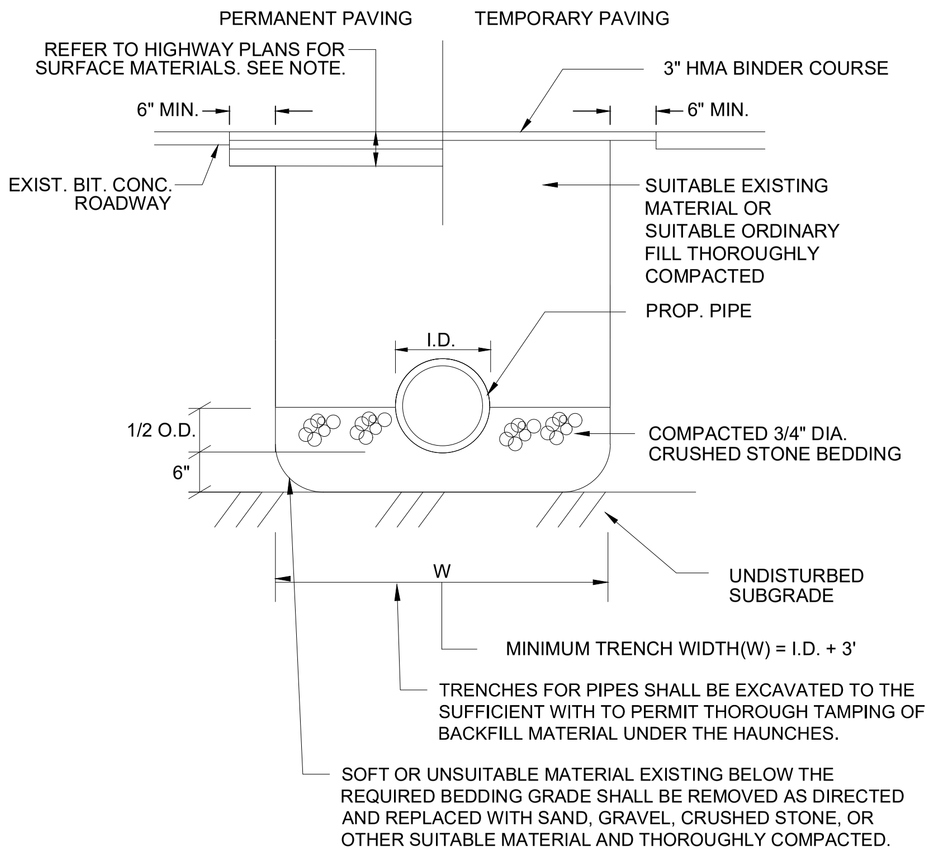
RIPRAP APRON AT INLETS AND OUTLETS OF CULVERTS

NOT TO SCALE

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	42	140
PROJECT FILE NO.	609211		

CONSTRUCTION DETAILS - 3

INFILTRATION TRENCH DETAIL_.DWG Plotted on 9-Apr-2024 10:50 AM

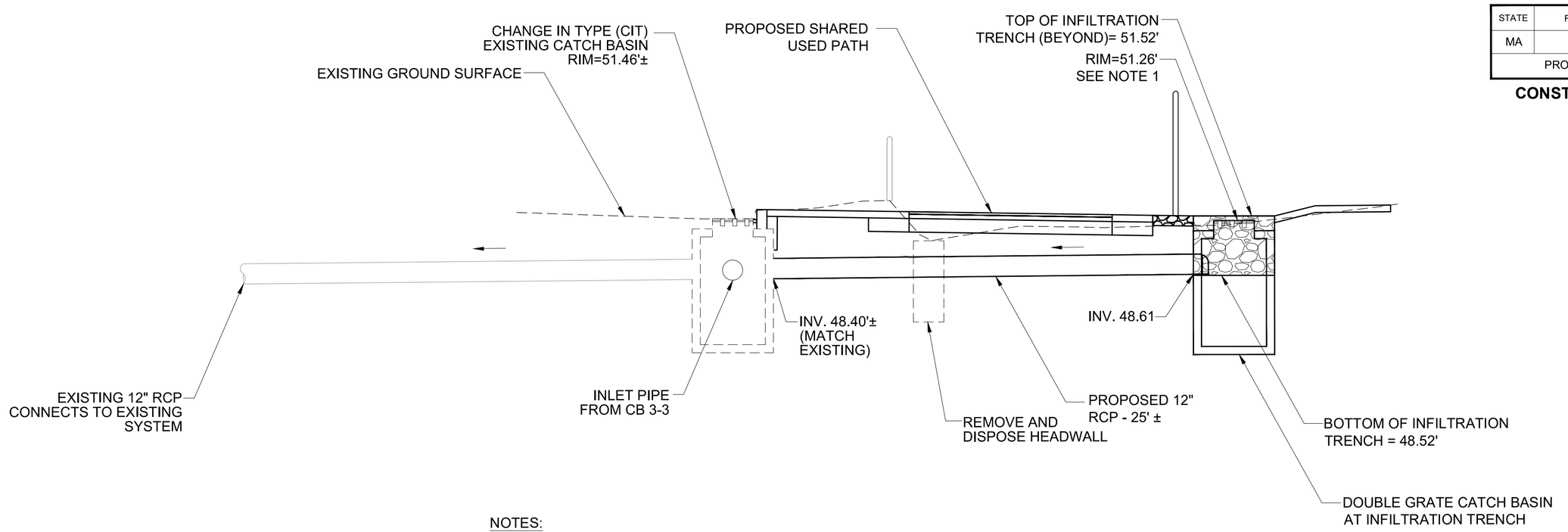


TYPICAL PIPE TRENCH

NOT TO SCALE

NOTE:

1. PERMANENT PAVING TO BE USED IN ALL AREAS OF MILL AND OVERLAY. MATERIALS SHALL MATCH CORRESPONDING FULL DEPTH SECTION. REFER TO TYPICAL ROADWAY SECTIONS.
2. HMA FOR PATCHING TO BE USED IN AREAS OF FUTURE FULL DEPTH CONSTRUCTION.
3. EXISTING MATERIAL OBTAINED FROM EXCAVATION THAT IS DETERMINED TO BE SUITABLE, AND APPROVED BY THE ENGINEER, OR SATISFACTORY BORROW SHALL BE USED. BACKFILL SHALL BE PLACED IN LAYERS NO MORE THAN 6 INCHES IN DEPTH AND THOROUGHLY COMPACTED. BACKFILLING TO A POINT 2 FEET OVER THE PIPE SHALL CONTAIN NO STONES LARGER THAN 3 INCHES.

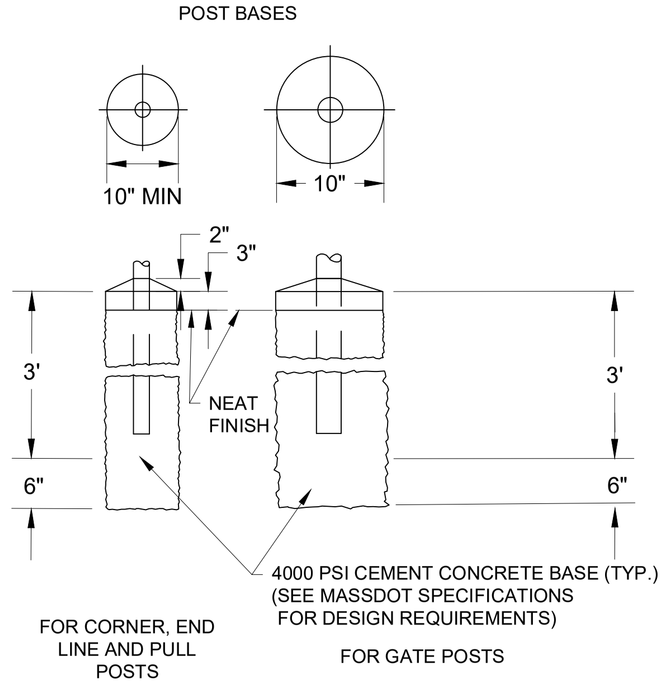


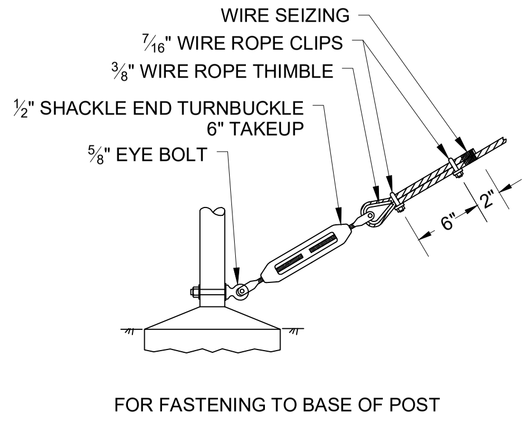
NOTES:

1. THE CRUSHED STONE SHALL BE PLACED AT A 3:1 SLOPE FROM THE GRATE TO THE TOP OF THE INFILTRATION TRENCH TO PREVENT DEBRIS FROM ENTERING THE GRATE

INFILTRATION TRENCH TO CULVERT DETAIL

SCALE: 1" = 4'



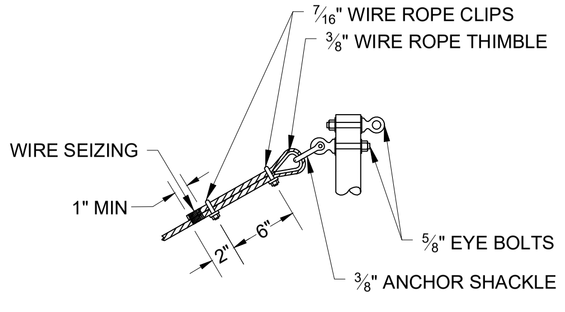


FOR FASTENING TO BASE OF POST

NOTE:

1. FOR EYE BOLT INSTALLATION THROUGH PIPE SECTIONS, USE 2 WASHERS ON "SHOULDER SIDE" AND 1 WASHER WITH LOCK WASHER ON "NUT SIDE" OF POSTS.

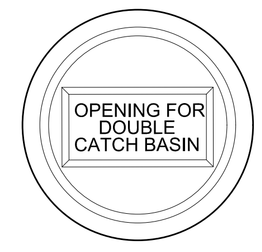
DETAILS OF CABLE ATTACHMENTS

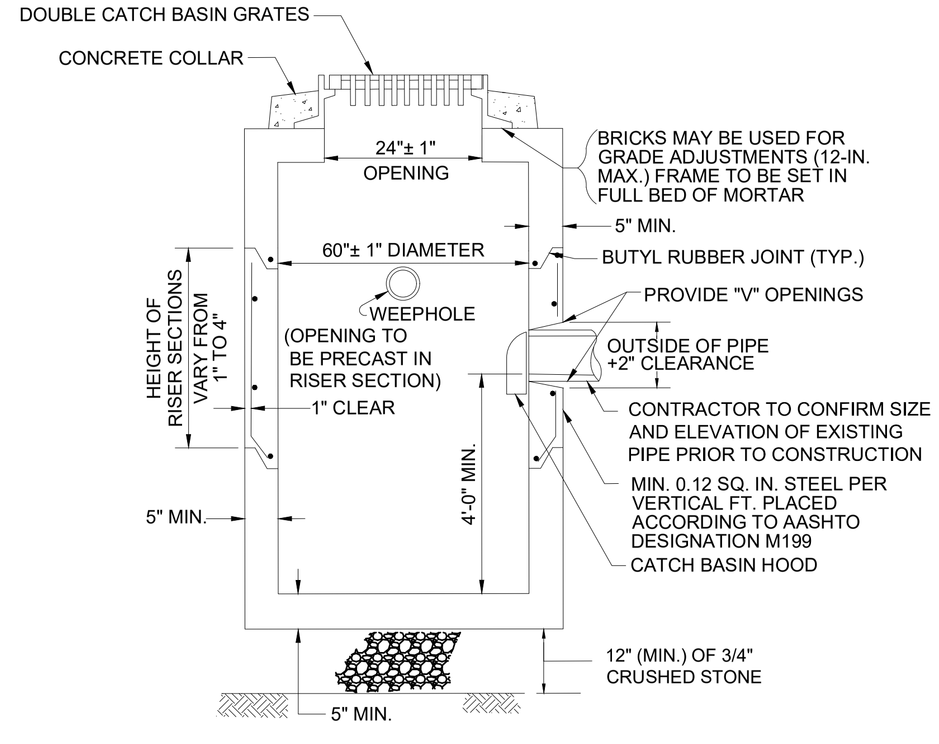


FOR END PULL POST

CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS AND POST BASES

NOT TO SCALE





DOUBLE GRATE CATCH BASIN

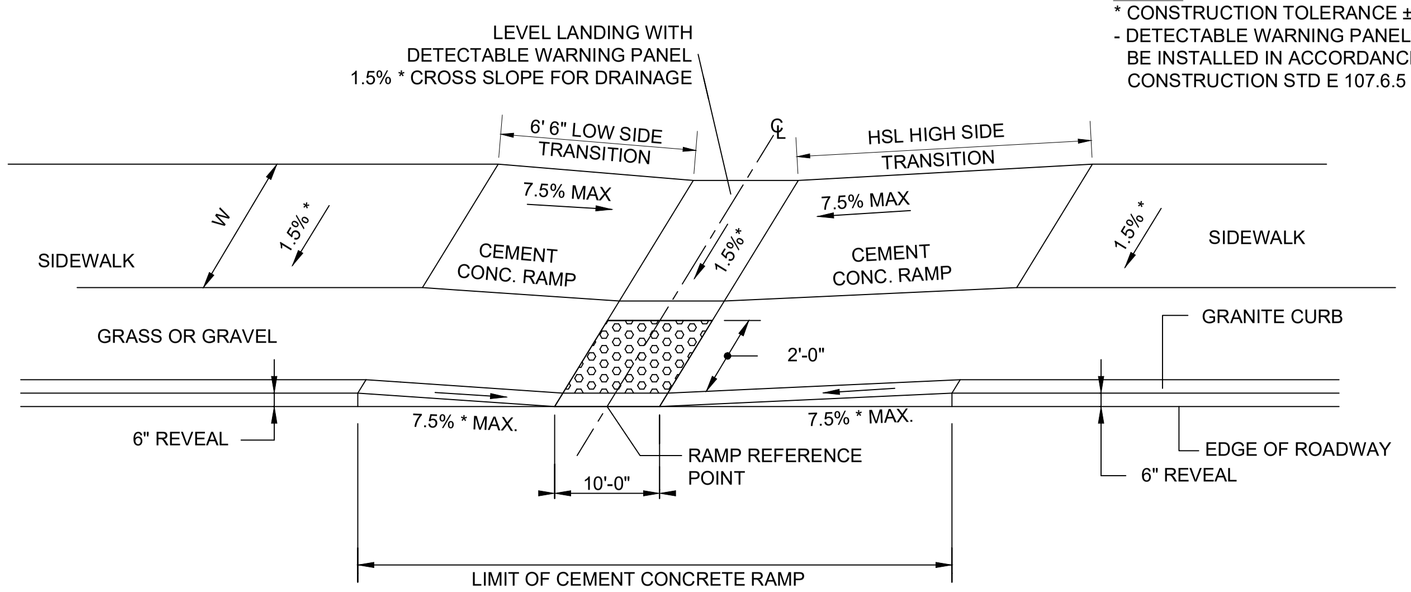
NOT TO SCALE

Proposal No. 609211-132091

A00860 - 456

Plotted on 5-Apr-2024 5:49 PM
SHT014_HDICONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG
Proposal No. 609211-132091
A00860 - 457

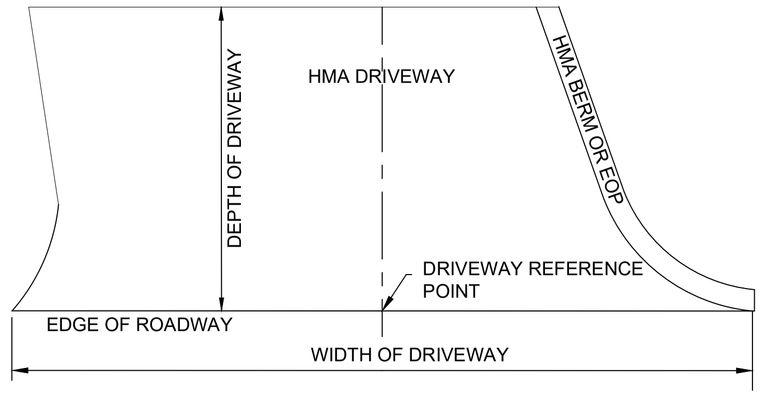
NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5



CURB CUT RAMP (NARROW SIDEWALK WITH GRASS STRIP)

NOT TO SCALE

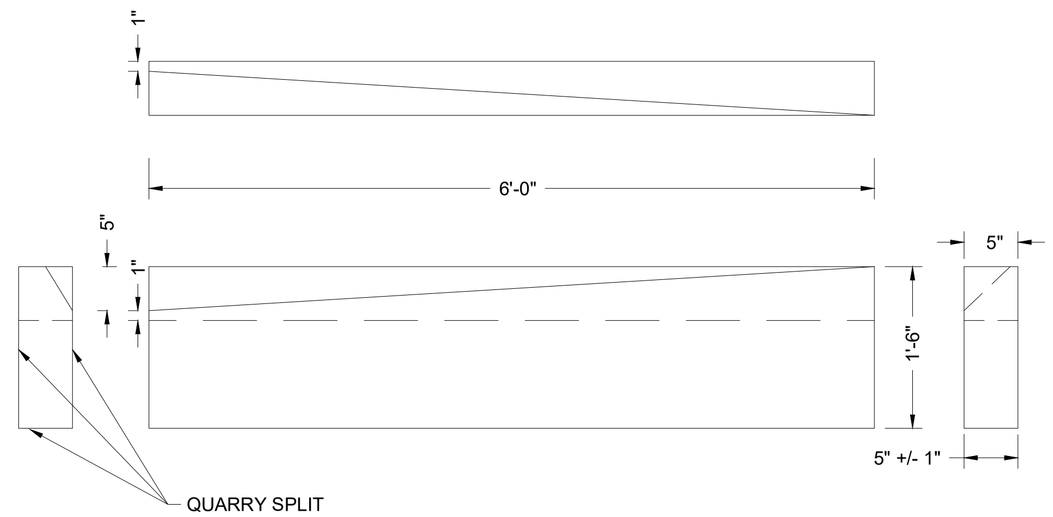
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		WIDTH OF RAMP (FT.)	WIDTH OF SIDEWALK (W) (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
5	NORTHSHORE RD	304+13	74.30 LT	5'-0"	5'-0"	+4.60	-	-
3	ESSEX CENTER DR	302+10	7.67 RT	10'-0"	10'-0"	-3.42	6'-6"	14'-0"
1	ESSEX CENTER DR	292+48.08	8.72 RT	10'-0"	10'-0"	-1.71	9'-0"	6'-6"

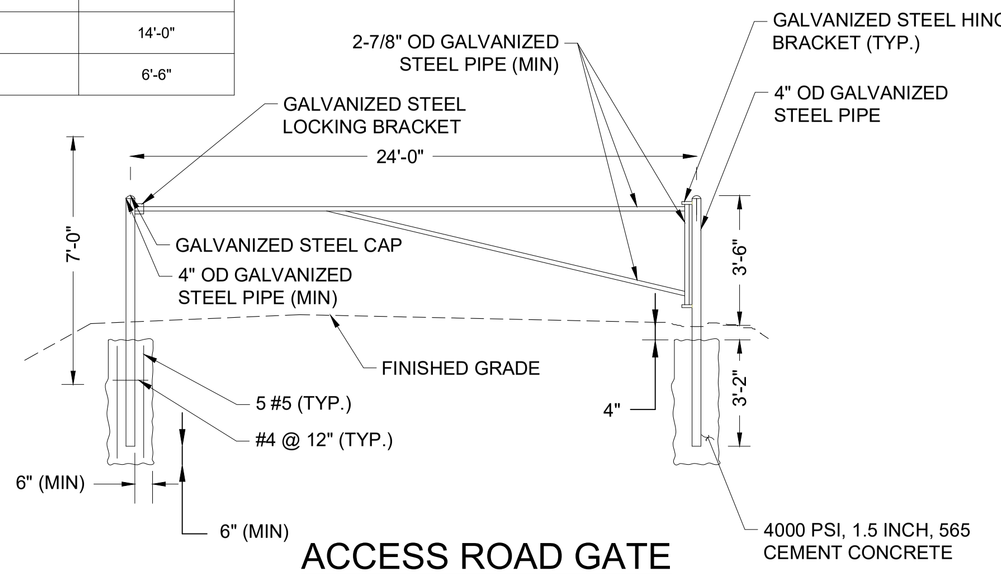


HMA DRIVEWAY WITHOUT SIDEWALK

NOT TO SCALE

CURB CUT DRIVEWAY DETAIL TABLE			
STATION	OFFSET	WIDTH OF DRIVEWAY	DEPTH OF DRIVEWAY
290+16.30	10.90 LT	31'-7"	10'-0"

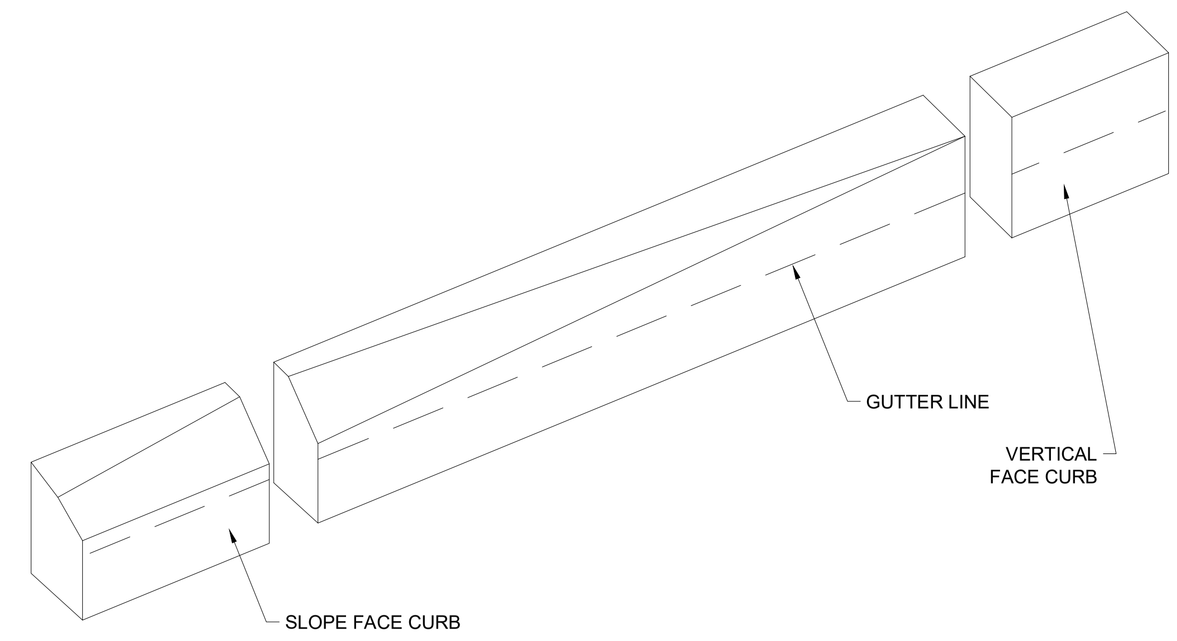




ACCESS ROAD GATE

NOT TO SCALE

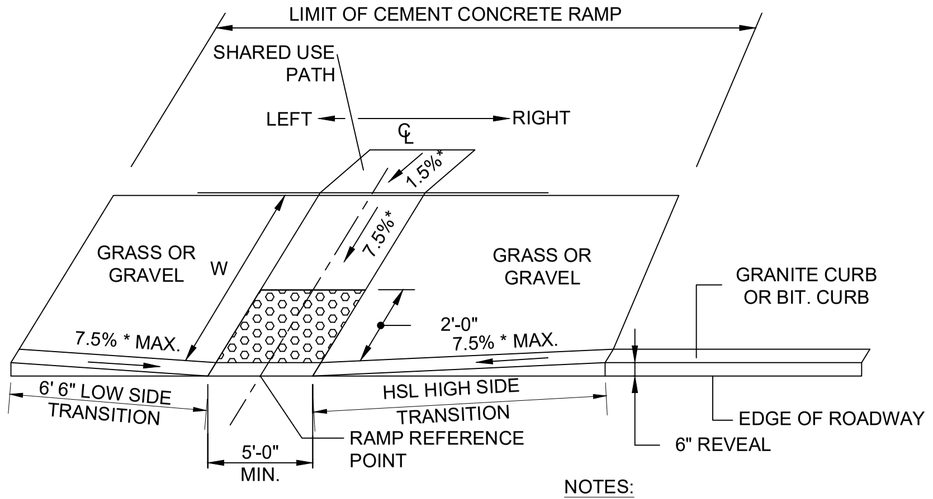
NOTE:
1. ALL GALVANIZED STEEL SHALL MEET GRADE B, Fy = 33,000 KSI AND SHALL BE IN ACCORDANCE WITH SUBSECTION 960.
2. THE GALVANIZED STEEL HINGE BRACKET AND GALVANIZED STEEL LOCKING BRACKET SHALL BE $\frac{1}{4}$" (MIN) COLD ROLLED GALVANIZED STEEL.
3. VENT HOLES SHALL BE INSTALLED IN GALVANIZED TUBES, PER MANUFACTURER'S RECOMMENDATIONS.
4. CONCRETE SHALL MEET THE REQUIREMENTS OF SUBSECTION 901 OF THE STANDARD SPECIFICATIONS.
5. STEEL REINFORCEMENT SHALL BE GRADE 60 REINFORCING LEVEL I.



GRANITE TRANSITION TYPE VB - SPLAYED END

NOT TO SCALE

NOTE:
1. TOP SURFACE AND SLOPED SURFACE TO BE DRESSED BY SAW. REMAINDER TO BE QUARRY SPLIT.
2. DETAIL SHOWS TRANSITION CURB FOR ONE DIRECTION. FOR OTHER DIRECTION USE OPPOSITE HAND.

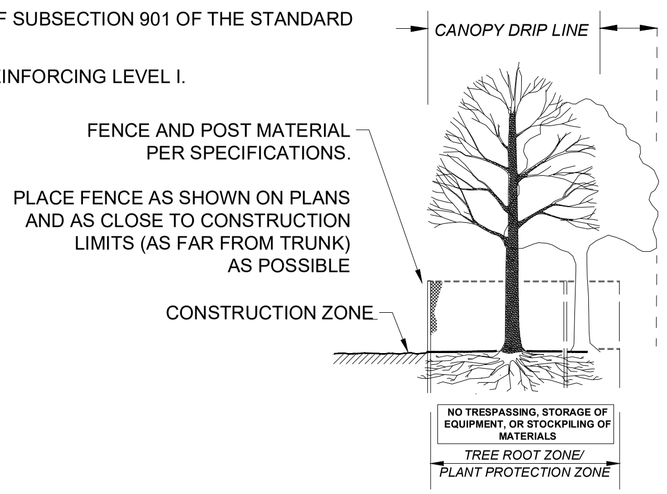


NOTES:
* CONSTRUCTION TOLERANCE ± 0.5%
- DETECTABLE WARNING PANELS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STD E 107.6.5
- PCR 9 LANDING TO BE CONSTRUCTED WITH HMA TO MATCH SHARED USE PATH
** TRANSITION LENGTHS FOR CURBS ONLY

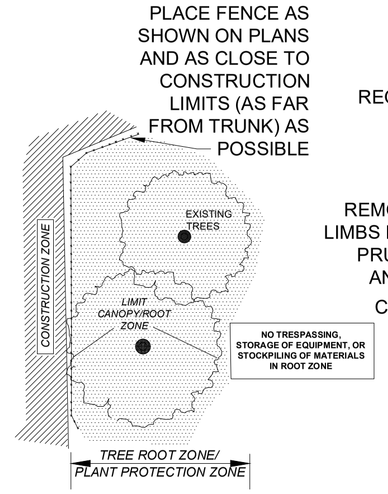
CORNER CURB CUT RAMP (ADJACENT TO SHARED USE PATH)

NOT TO SCALE

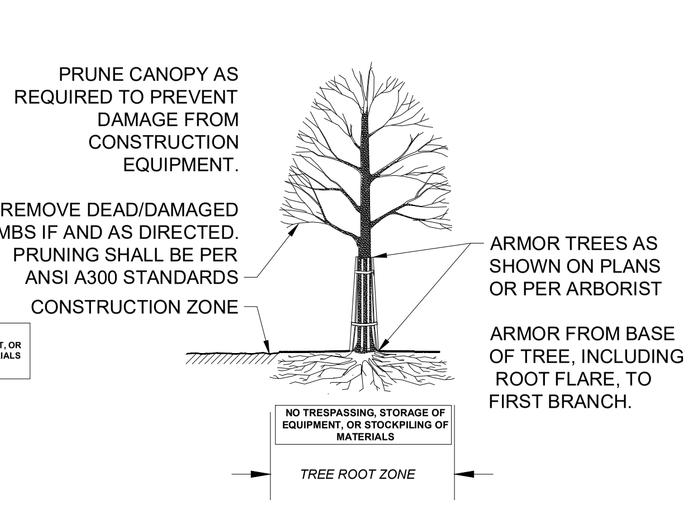
PCR #	CROSSING ROAD	RAMP REFERENCE POINT		LENGTH OF RAMP (W) (FT.)	WIDTH OF RAMP (FT.)	ROADWAY GUTTER SLOPE (%)	TRANSITION LENGTH	
		STATION	OFFSET				LEFT SIDE	RIGHT SIDE
6	NORTHSHORE RD	304+19	5.00 RT	8'-0"	10'-0"	-0.86	7'-8"	6'-6"
8	NORTHSHORE RD	318+32	12.00 RT	9'-0"	10'-0"	+0.04	7'-8"	6'-6"
9	NORTHSHORE RD	318+45	0.00	4'-6"	10'-0"	-0.64	6'-6"**	7'-8"**



SECTION - FENCE PROTECTION OF ROOT ZONE



PLAN VIEW - FENCE PROTECTION OF ROOT ZONE



SECTION - TRUNK ARMORING & PRUNING

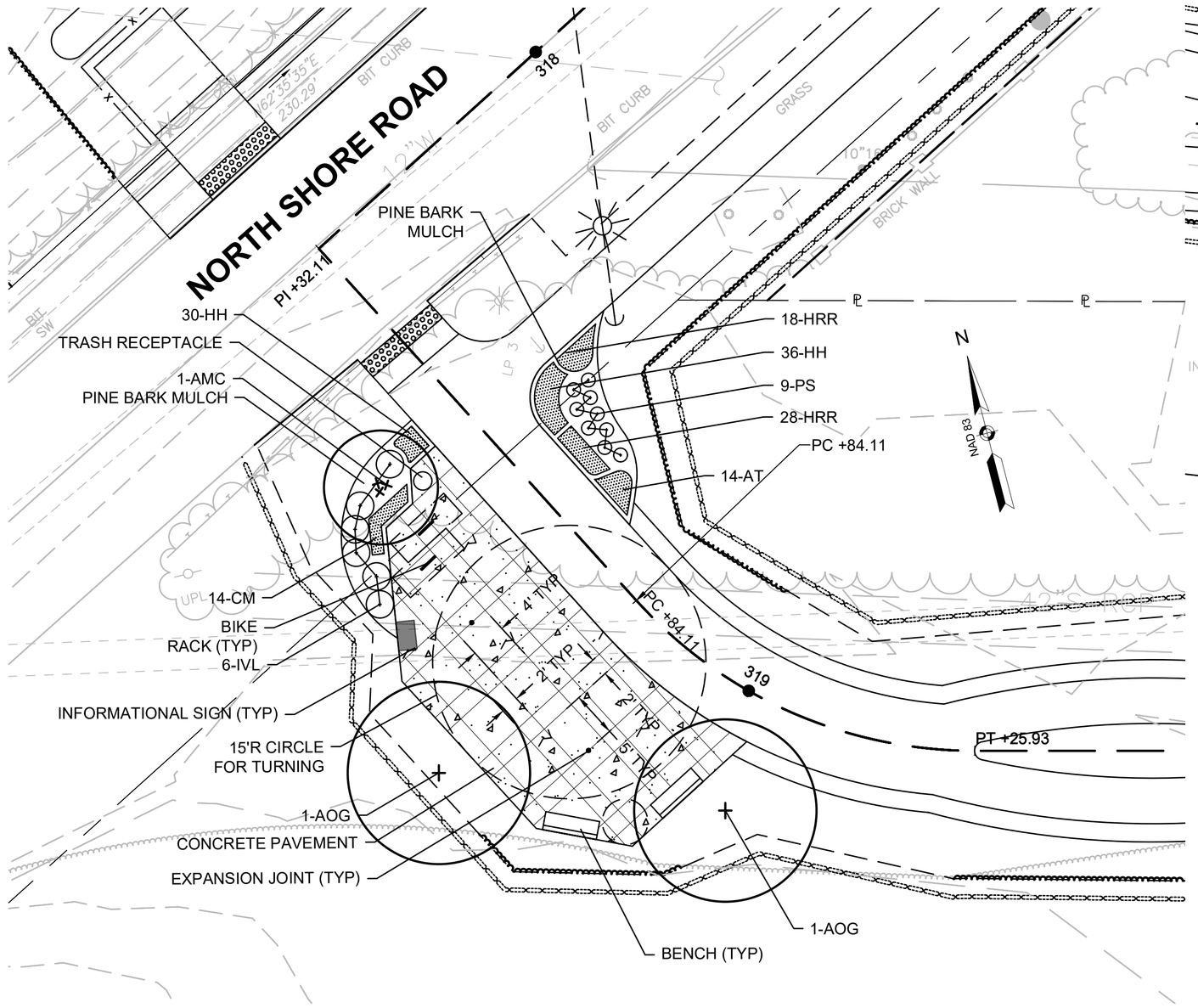
TREE PROTECTION DETAILS

NOT TO SCALE

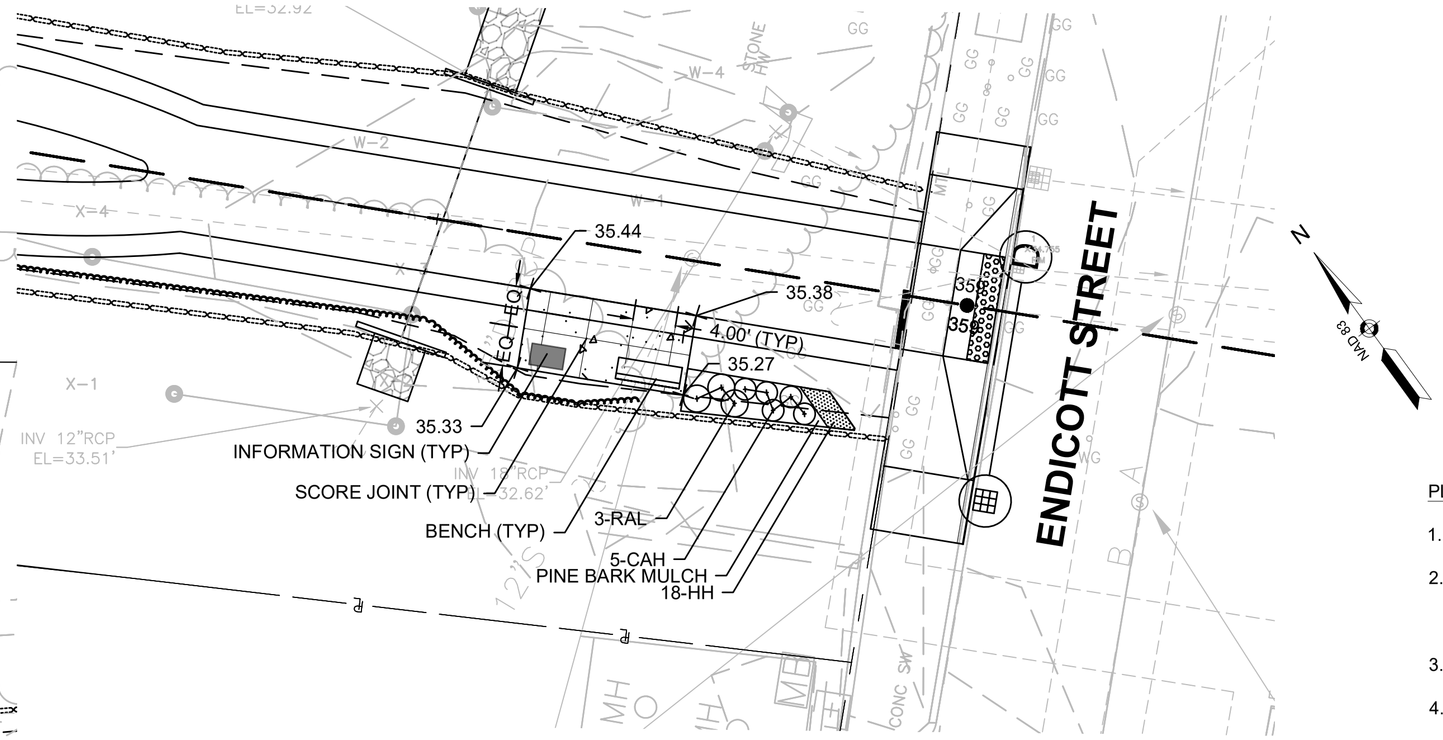
PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	46	140
PROJECT FILE NO.		609211	

LANDSCAPE PLAN - 1



1 BLOW UP PLAN TRAILHEAD AT NORTHSHORE ROAD
SCALE 1" = 10'-0"



2 BLOW UP PLAN TRAILHEAD AT ENDICOTT STREET
SCALE 1" = 10'-0"

PLANTING NOTES

1. CONTRACTOR SHALL HAVE ALL SUBSURFACE UTILITIES MARKED PRIOR TO THE START OF WORK.
2. PLANT LOCATIONS ARE APPROXIMATE. PRIOR TO PLANTING, LOCATION OF ALL PLANT MATERIAL WILL BE APPROVED BY THE RESIDENT ENGINEER AND THE LANDSCAPE ARCHITECT.
3. ALL PLANT MATERIAL WILL HAVE TAGS INDICATING COMMON NAME, BOTANICAL NAME, CULTIVAR, & SIZE.
4. IMMEDIATELY AFTER ACCEPTANCE OF PLANTING, TAGS AND RIBBONS SHALL BE REMOVED.
5. ALL PLANTS WILL BE MULCHED PER PLANS AND SPECIFICATIONS.
6. ALL SHRUB AND PERENNIAL BEDS WILL BE WEEDED AND OTHERWISE NEATLY MAINTAINED FOR THE DURATION OF THE CONTRACT.
7. PLANTS AND PLANTING BEDS SHALL BE THOROUGHLY WATERED AS NECESSARY AND PER SPECIFICATIONS.

WATERING NOTES

1. IRRIGATION BAGS MAY BE USED FOR STREETSCAPE AND PARK PLANTINGS ONLY.
2. A SCHEDULE FOR FILLING AND REMOVAL SHALL BE SUBMITTED TO THE ENGINEER.
3. USE AND SCHEDULE MUST BE APPROVED BY THE MASSDOT LANDSCAPE ARCHITECT.
4. A MINIMUM OF 2 BAGS PER TREE SHALL BE USED. BAGS SHALL BE ATTACHED TO STAKES.
5. NO BAGS SHALL BE PLACED AROUND THE TREE TRUNK.
6. BAGS SHALL BE MAINTAINED FULL JUNE 1 - OCTOBER 1 OR AS APPROVED.
7. BAGS SHALL BE REMOVED AT THE END OF THE SEASON.

PLANT LIST - LANDSCAPE PLAN 1

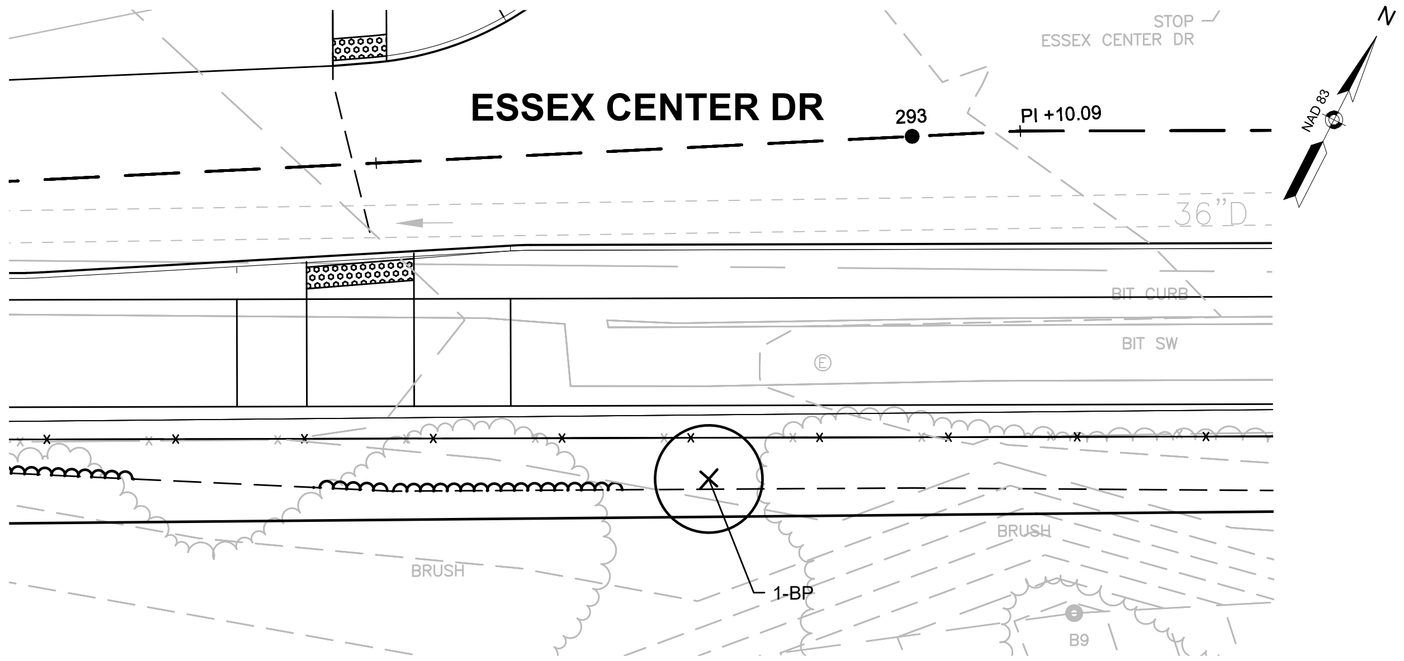
KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIERXGRANDIFLORA	AUTUMN BRILLIANCE SERVICEBERRY	4-5' FEET CLUMP	B&B	
AOG	2	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	2-2 1/2" CAL	B&B	
		DECIDUOUS SHRUBS				
IVL	6	ITEA VIRGINIANA 'SPRICH' LITTLE HENRY	LITTLE HENRY SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAH	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	HUMMINGBIRD SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	GRO-LOW SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	14	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	ICE DANCE SEDGE	#1 CONT		12" O.C.
HH	84	HEMEROCALLIS HAPPY RETURNS	HAPPY RETURNS DAY LILLY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS ROSY RETURNS	ROSY RETURNS DAY LILLY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANADOAH'	SHENANADOAH SWITCH GRASS	#2 CONT.		18"O.C.

0 10 20 30 40
SCALE: 1" = 10'

SHT005_HD(LANDSCAPE).DWG Plotted on 5-Apr-2024 5:50 PM

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	47	140
PROJECT FILE NO.	609211		

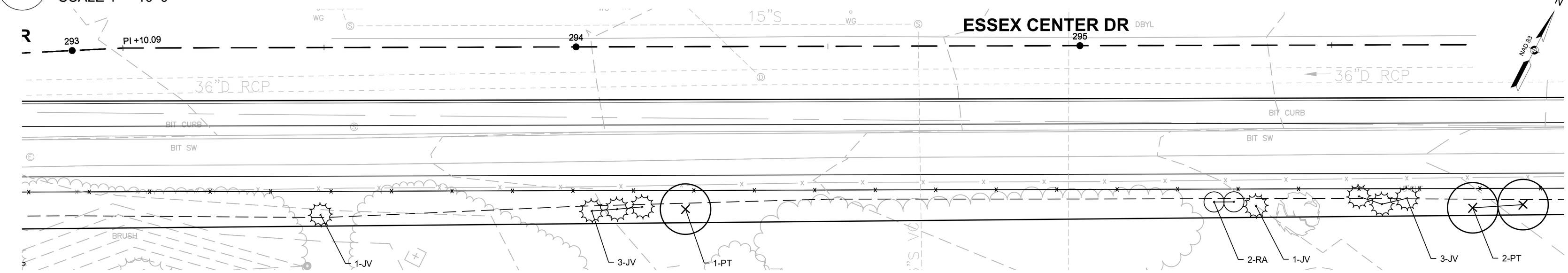
LANDSCAPE PLAN - 2



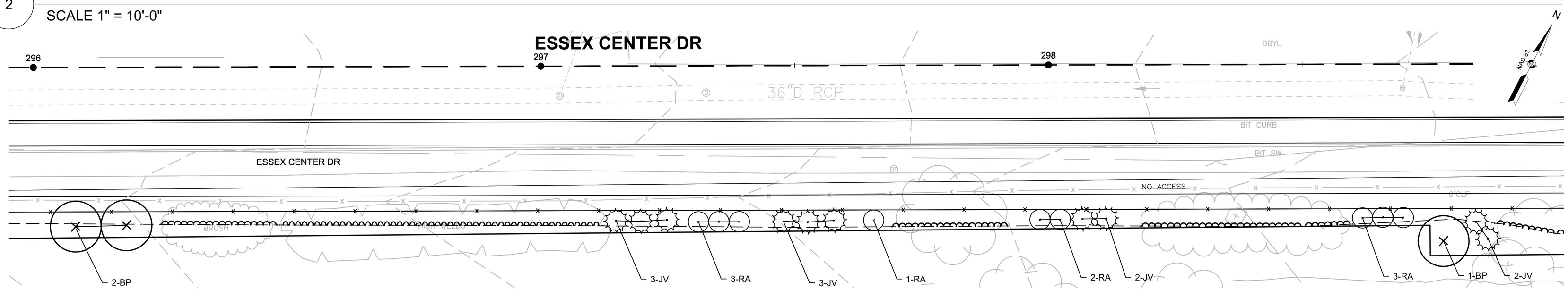
1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 292+16 TO 293+33
SCALE 1" = 10'-0"

PLANT LIST - LANDSCAPE PLAN 2

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	4	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	18	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT
		DECIDUOUS SHRUBS			
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 292+80 TO 296+00
SCALE 1" = 10'-0"



3 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 296+00 TO 299+00
SCALE 1" = 10'-0"

0 10 20 30 40
SCALE: 1" = 10'

NOTE: SEE LANDSCAPE PLAN SHEET 1 FOR PLANT LIST

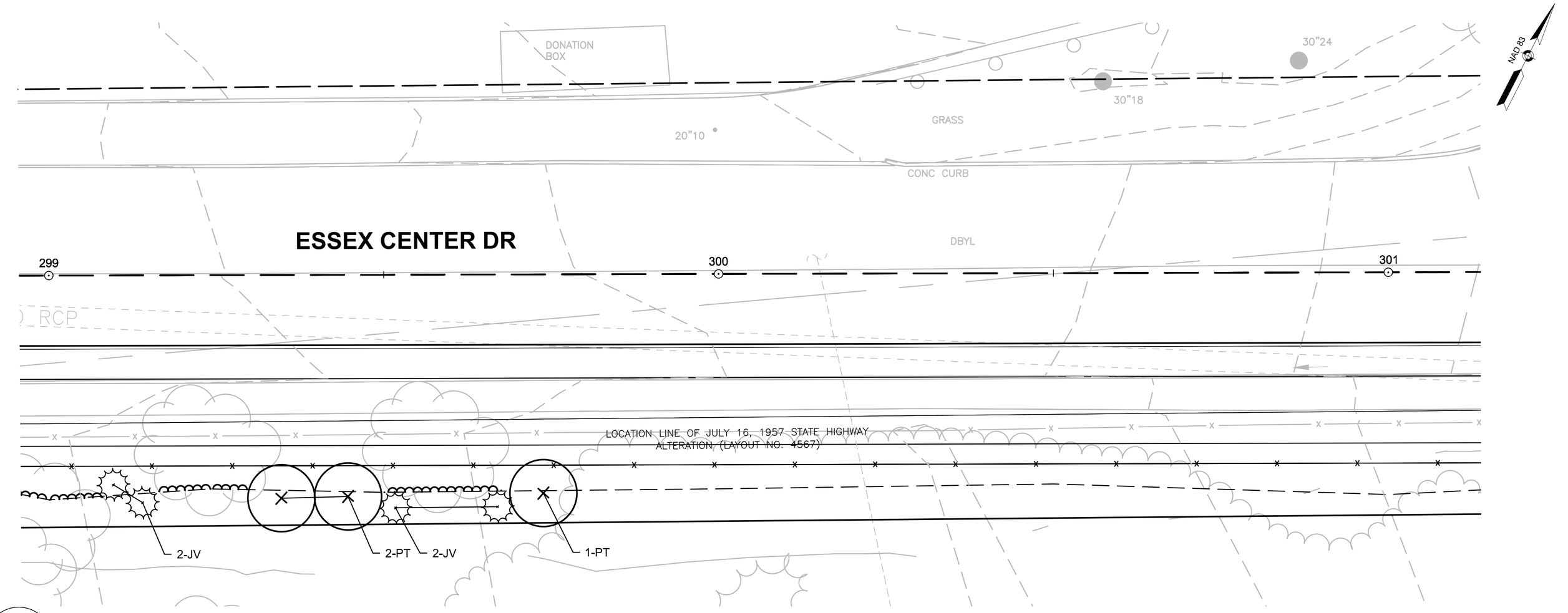
Proposal No. 609211-132091
SHT005_HD(LANDSCAPE).DWG Plotted on 5-Apr-2024 5:51 PM
A00860 - 459

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	48	140
PROJECT FILE NO.	609211		

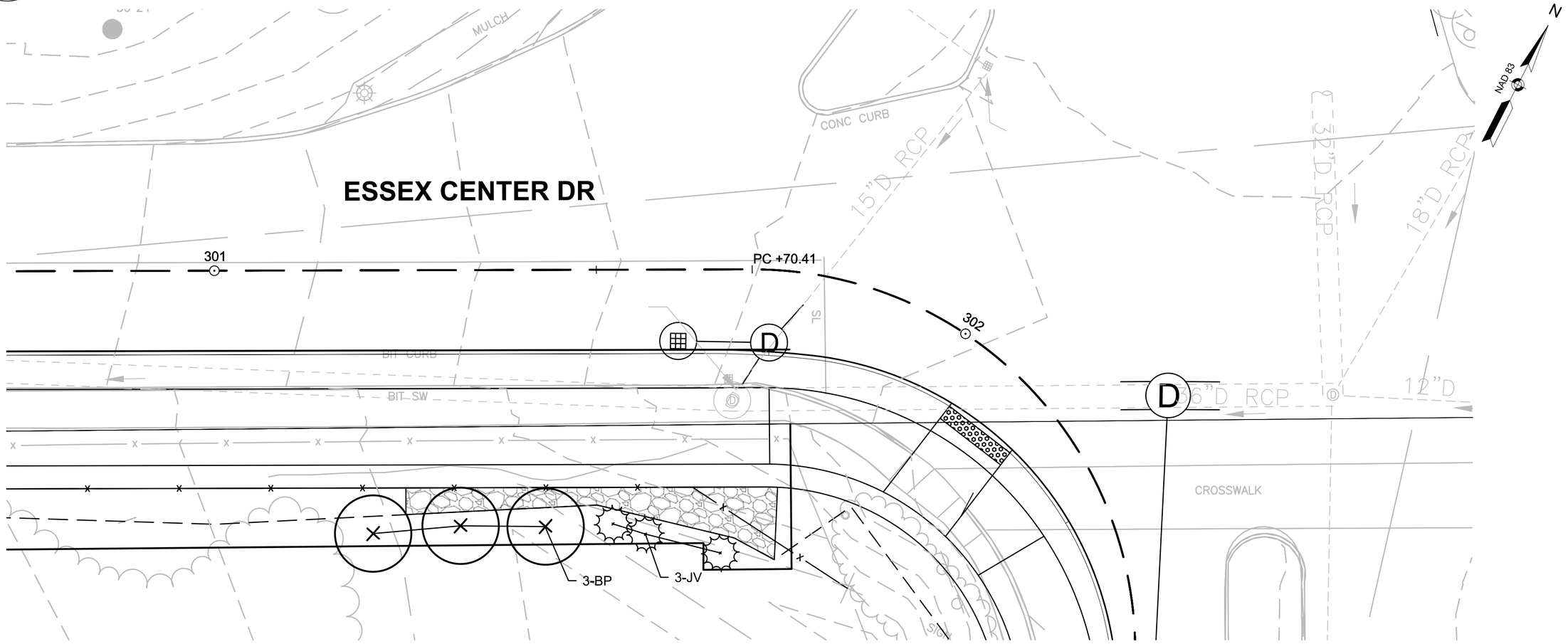
LANDSCAPE PLAN - 3

SHT005_HD(LANDSCAPE).DWG Plotted on 9-Apr-2024 10:15 AM



1 BLOW UP PLAN - TREE PLANTING ESSEX CENTER DRIVE STA. 299+00 TO 300+14

SCALE 1" = 10'-0"



2 BLOW UP PLAN - TREE PLANTING ESSEX CENTER STA. 300+78 TO 301+97

SCALE 1" = 10'-0"

0 10 20 30 40

SCALE: 1" = 10'

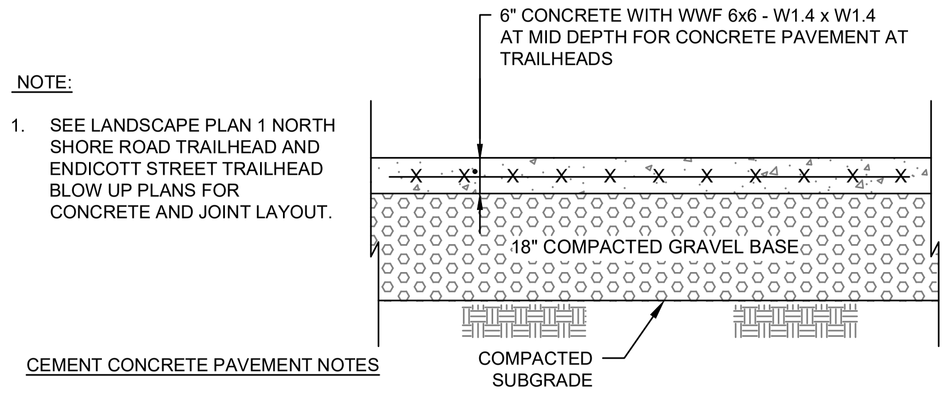
PLANT LIST - LANDSCAPE PLAN 3

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
BP	3	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT
PT	3	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT
		EVERGEEN TREES			
JV	7	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT

PLANT LIST - UPLAND PROJECT TOTAL

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT	
		DECIDUOUS TREES				
AMC	1	AMELANCHIERXGRANDIFLORA	AUTUMN BRILLIANCE SERVICEBERRY	4-5' FEET CLUMP	B&B	
AOG	2	ACER RUBRUM 'OCTOBER GLORY'	OCTOBER GLORY RED MAPLE	2-2 1/2" CAL	B&B	
BP	7	BETULA POPULIFOLIA	GRAY BIRCH	4-5 FEET	#3 CONT	
PT	6	POPULUS TREMULOIDES	QUAKING ASPEN	4-5 FEET	#3 CONT	
		EVERGEEN TREES				
JV	25	JUNIPERUS VIRGINIANA	RED CEDAR	3-4 FT	#3 CONT	
		DECIDUOUS SHRUBS				
IVL	6	ITEA VIRGINIANA 'SPRICH' LITTLE HENRY	LITTLE HENRY SWEETSPIRE	12-18" HT.	#3 CONT	2' O.C.
CAH	5	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	HUMMINGBIRD SUMMERSWEET	18-24" SP	#3 CONT	2' O.C.
RAL	3	RHUS AROMATICA 'GRO-LOW'	GRO-LOW SUMAC	2-3 FT SP	#2 CONT	2.5' O.C.
RA	11	RHUS AROMATICA	FRAGRANT SUMAC	2-3 FT SP	#2 CONT	3' O.C.
		PERENNIALS AND ORNAMENTAL GRASSES				
AT	14	ASCLEPIAS TUBEROSA	BUTTERFLYWEED	#1 CONT		12" O.C.
CM	14	CAREX MORROWII 'ICE DANCE'	ICE DANCE SEDGE	#1 CONT		12" O.C.
HH	84	HEMEROCALLIS HAPPY RETURNS	HAPPY RETURNS DAY LILLY	#1 CONT		9" O.C.
HRR	46	HEMEROCALLIS ROSY RETURNS	ROSY RETURNS DAY LILLY	#1 CONT		9" O.C.
PS	9	PANICUM VIRGATUM 'SHENANADOAH'	SHENANADOAH SWITCH GRASS	#2 CONT.		18"O.C.

Proposal No. 609211-132091
SHT005_HDLANDSCAPE DETAILS).DWG Plotted on 5-Apr-2024 5:51 PM
A00860 - 461



NOTE:

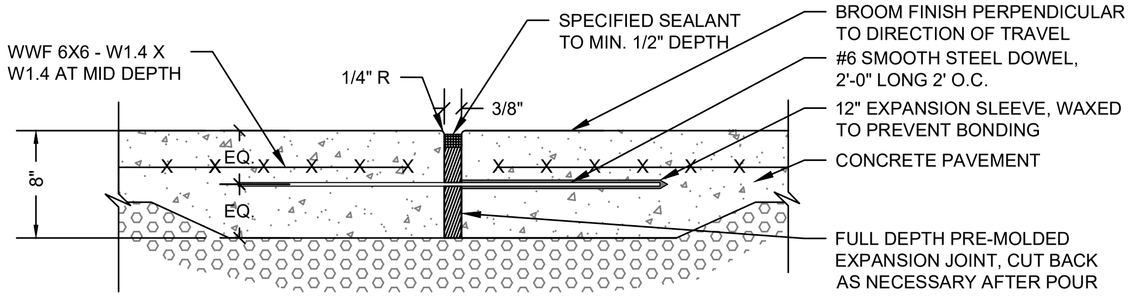
1. SEE LANDSCAPE PLAN 1 NORTH SHORE ROAD TRAILHEAD AND ENDICOTT STREET TRAILHEAD BLOW UP PLANS FOR CONCRETE AND JOINT LAYOUT.

CEMENT CONCRETE PAVEMENT NOTES

1. CEMENT CONCRETE PAVEMENT SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI WITH 6% AIR-ENTRAINMENT AND MINIMUM CEMENT CONTENT OF 610 LBS/C.Y.
2. CONTRACTOR SHALL SUBMIT CONCRETE JOINT LAYOUT PLAN FOR APPROVAL. EXPANSION JOINTS SHALL BE TRANSVERSE PREFORMED EXPANSION JOINT FILLER (AASHTO M-213-65) ½ IN. THICKNESS.
3. PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED ADJACENT TO OR AROUND EXISTING STRUCTURES AND WALKWAYS.
4. EXPANSION JOINTS SHALL BE CONSTRUCTED WITH DOWELS, AS INDICATED IN DETAIL 2 LANDSCAPE DETAIL SHEET 1.
5. AFTER CONSOLIDATION, CONCRETE DEPTH SHALL BE 6 INCHES IN DEPTH FOR TRAILHEADS.
6. ENSURE THAT NO BLED WATER OR WATER SHEEN EXISTS ON THE SURFACE OF THE CONCRETE AND THAT CONCRETE HAS STARTED TO STIFFEN BEFORE ANY FINISHING OPERATIONS ARE PERFORMED.
7. AFTER TROWELING, SURFACE SHALL BE BRUSHED BY DRAWING A SOFT-BRISTLED PUSHBROOM WITH A LONG HANDLE OVER THE SURFACE OF THE CONCRETE TO PRODUCE A NON-SLIP SURFACE.
8. THE FINISHING OF CONCRETE SURFACE SHALL BE DONE BY EXPERIENCED AND COMPETENT CEMENT CONCRETE FINISHERS.
9. FINISHING SHALL BE BROOM FINISH.
10. SAW CUT CONTROL JOINTS.
11. WHEN COMPLETED, CONCRETE SHALL BE KEPT MOIST AND PROTECTED FROM TRAFFIC AND WEATHER FOR AT LEAST 3 DAYS.
12. WELDED WIRE MESH SHALL BE 6"x6" No. 10 GAUGE AND SHALL BE SHEET MESH ONLY NOT ROLLED. MESH SHALL REST ON CONCRETE BLOCKS AND BE INSTALLED AT MID DEPTH IN CONCRETE.

1 CEMENT CONCRETE PAVEMENT AT TRAILHEADS

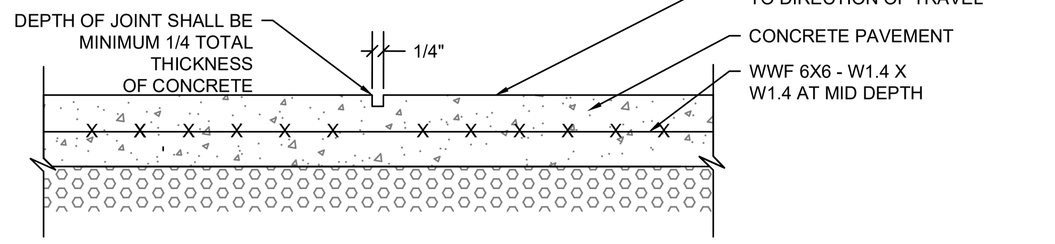
SCALE: N.T.S.



EXPANSION JOINT REQUIRED FOR EVERY +/- 225 SF OF PAVING OR EVERY 30FT ALONG WALKWAYS

EXPANSION JOINT NOTES:

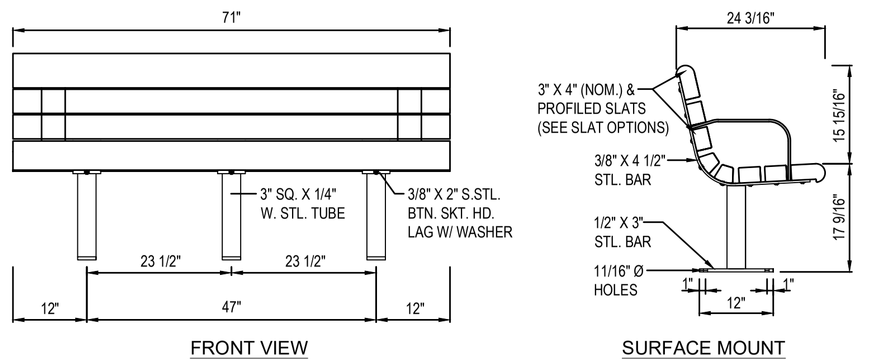
1. DOWEL IS TYPICAL AT ALL EXPANSION JOINTS EXCEPT AGAINST VERTICAL JOINTS WITH WALLS, CURBS OR SITE IMPROVEMENTS.



SAWCUT CONTROL JOINT REQUIRED FOR EVERY 36 SF OF PAVING.

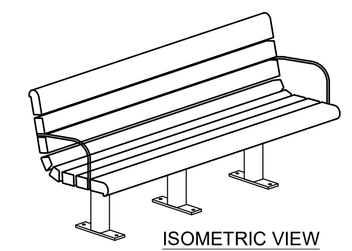
2 CONCRETE PAVEMENT JOINTS AT TRAILHEADS

SCALE: N.T.S.



FRONT VIEW

SURFACE MOUNT



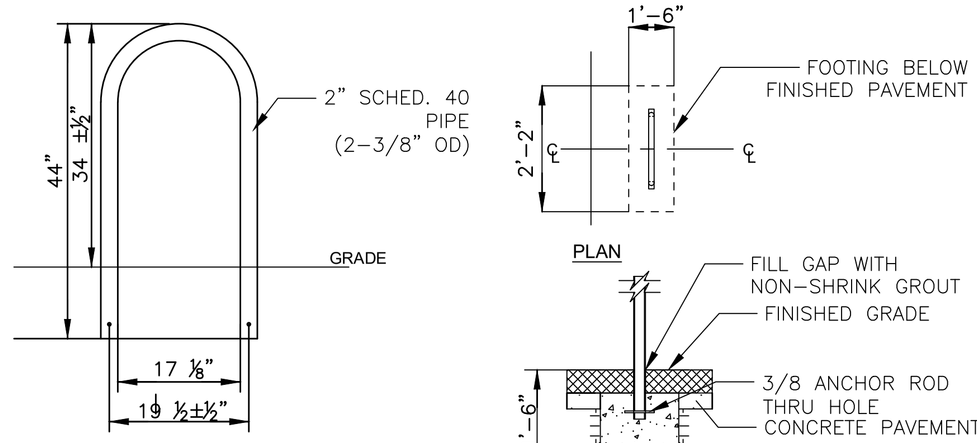
ISOMETRIC VIEW

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DRAWING NOT TO SCALE.
3. ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/POLYESTER POWDER COATING.
4. ½" x 3 ¾" EXPANSION ANCHOR BOLT 6 PER BENCH.
5. SUBMIT SHOP DRAWING FOR APPROVAL.
6. BENCH SHALL HAVE ARMREST ON BOTH ENDS.

3 BENCH

SCALE: N.T.S.



BIKE RACK SECTION

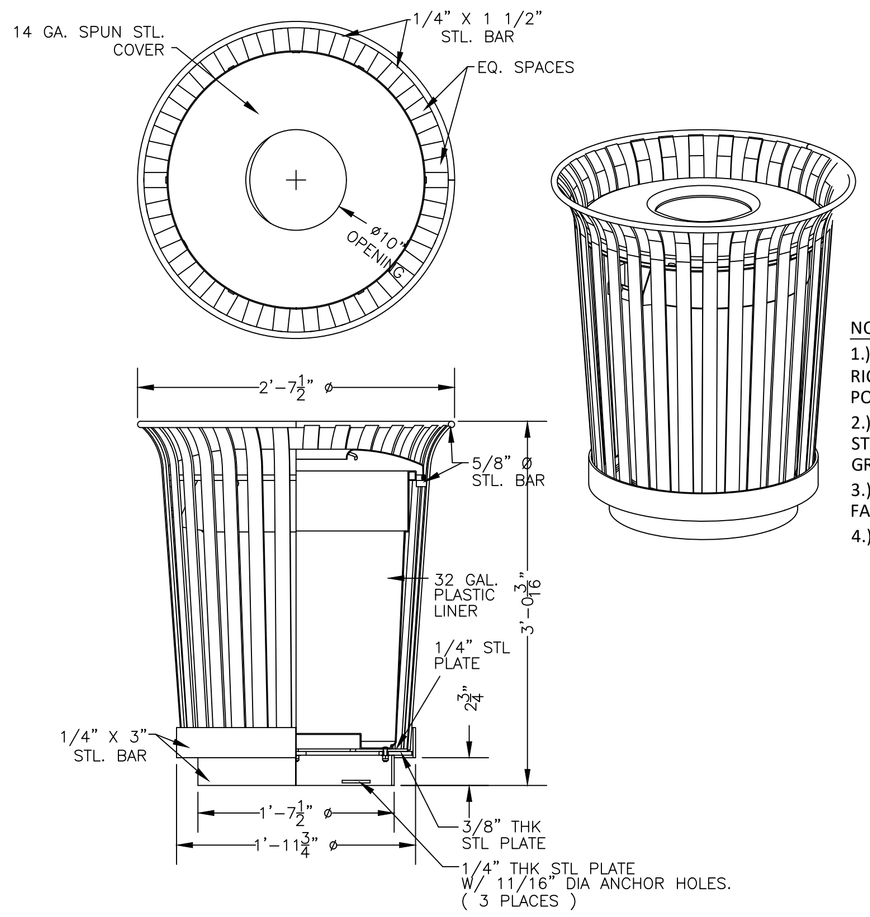
SECTION

NOTES:

1. INSTALL BIKE RACKS ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
2. SUBMIT SHOP DRAWING FOR APPROVAL.

4 BIKE RACK

SCALE: N.T.S.



NOTES:

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.

2.) ANCHOR BOLTS SHALL BE STAINLESS STEEL AND EXTENDED 3" BELOW FINISH GRADE.

3.) RECEPTACLE FULLY ASSEMBLED AT FACTORY.

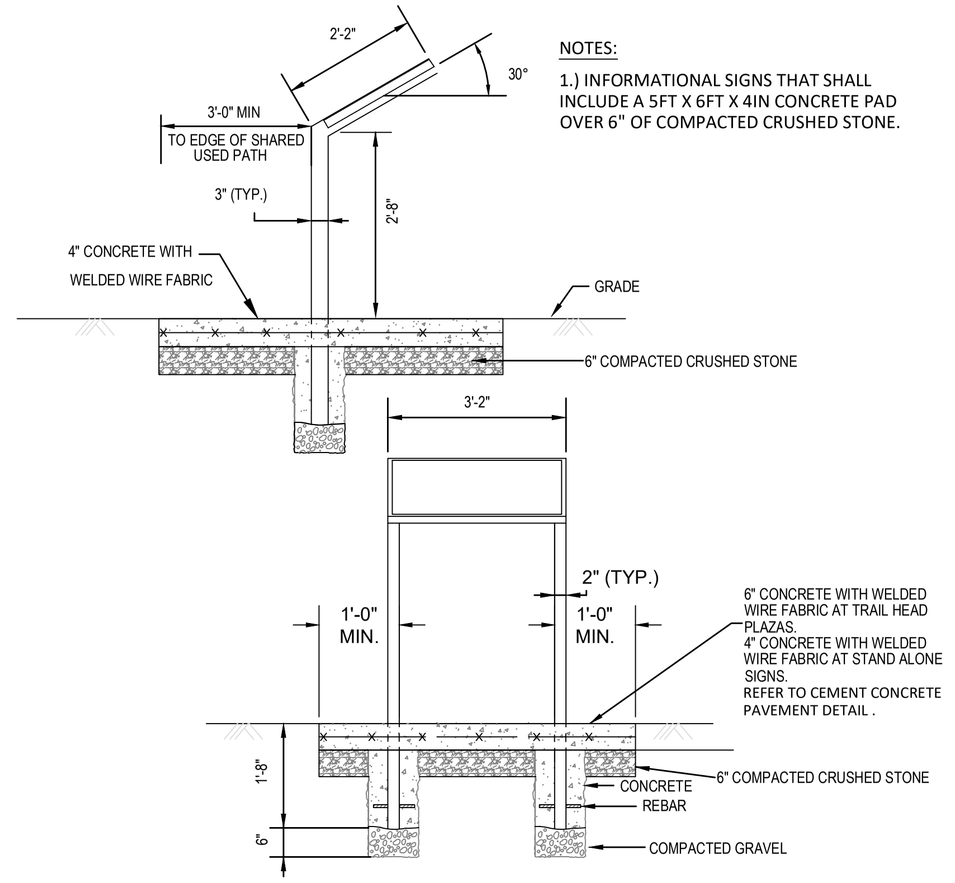
4.) PROVIDE CABLE ATTACHMENT FOR LID

5 TRASH RECEPTACLE

SCALE: N.T.S.

NOTES:

1.) INFORMATIONAL SIGNS THAT SHALL INCLUDE A 5FT X 6FT X 4IN CONCRETE PAD OVER 6" OF COMPACTED CRUSHED STONE.



6 INFORMATIONAL SIGN

SCALE: N.T.S.

SIGN GRAPHIC CONTENT TO BE PROVIDED AND INSTALLED BY OTHERS

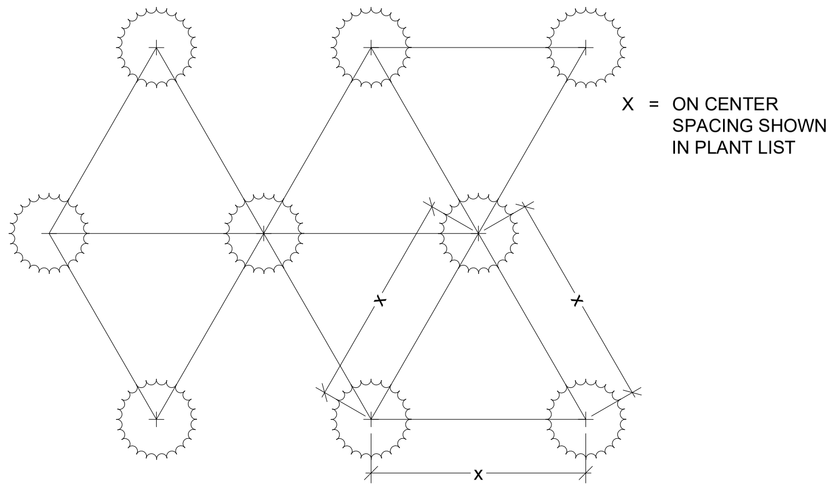
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	50	140
PROJECT FILE NO.	609211		

LANDSCAPE DETAILS - 2

Plotted on 5-Apr-2024 5:51 PM
SHT005_HD(LANDSCAPE DETAILS).DWG

Proposal No. 609211-132091

A00860 - 462

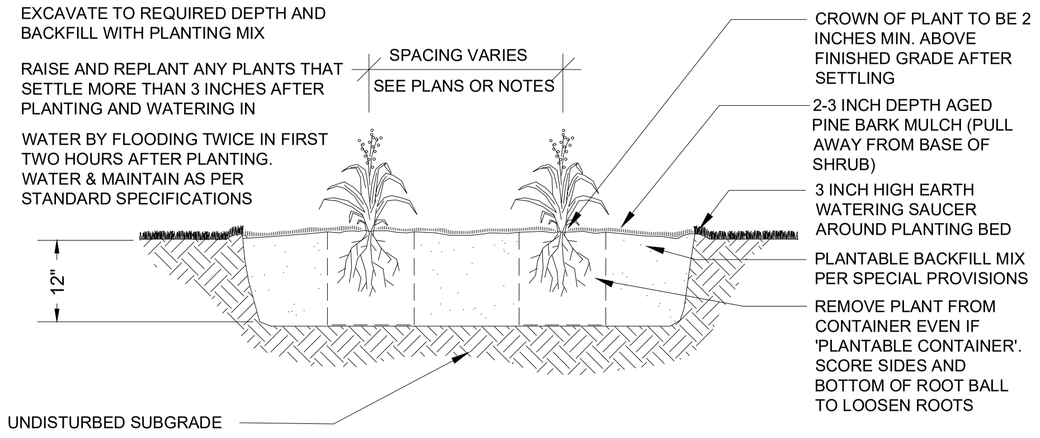


1 SHRUB, PERENNIAL AND ORNAMENTAL GRASS SPACING PLAN DETAIL

SCALE: N.T.S.

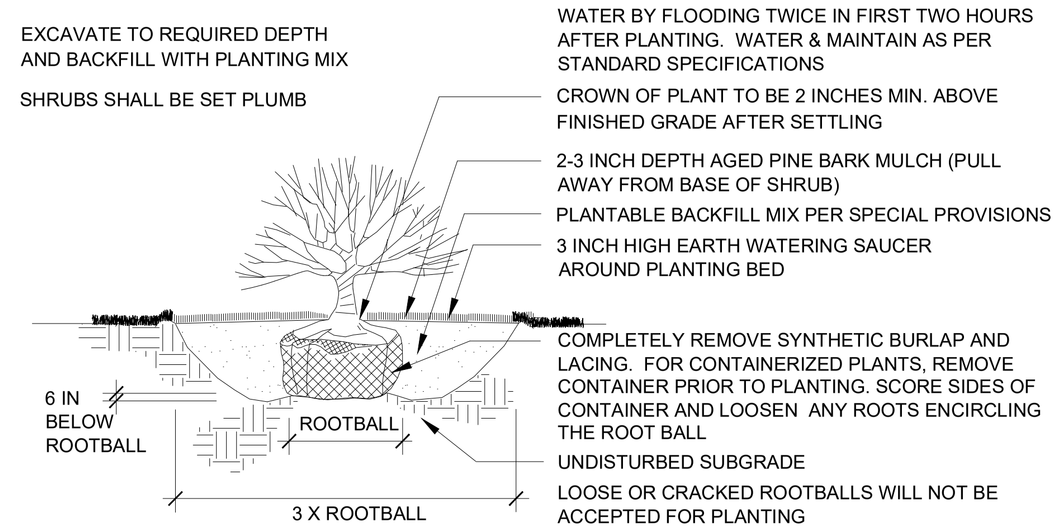
NOTE:

PINE BARK MULCH IN PERENNIAL AND SHRUB PLANTING BEDS SHALL BE PAID FOR IN PINE BARK MULCH ITEM. PINE BARK MULCH IN TREE PLANTING PITS AND SHRUBS NOT IN BEDS SHALL BE INCIDENTAL TO THOSE ITEMS.



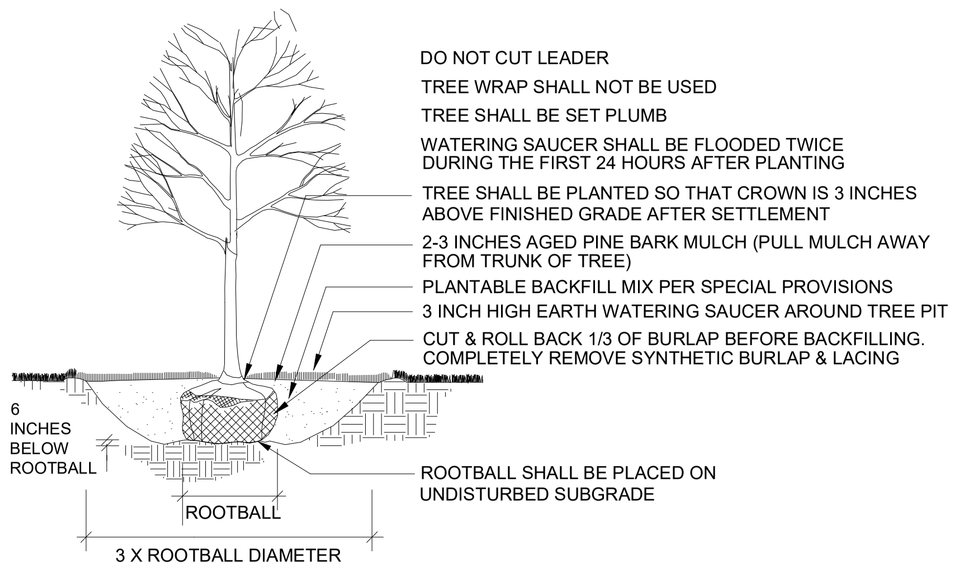
2 PERENNIAL AND ORNAMENTAL GRASS PLANTING

SCALE: N.T.S.



3 SHRUB PLANTING

SCALE: N.T.S.

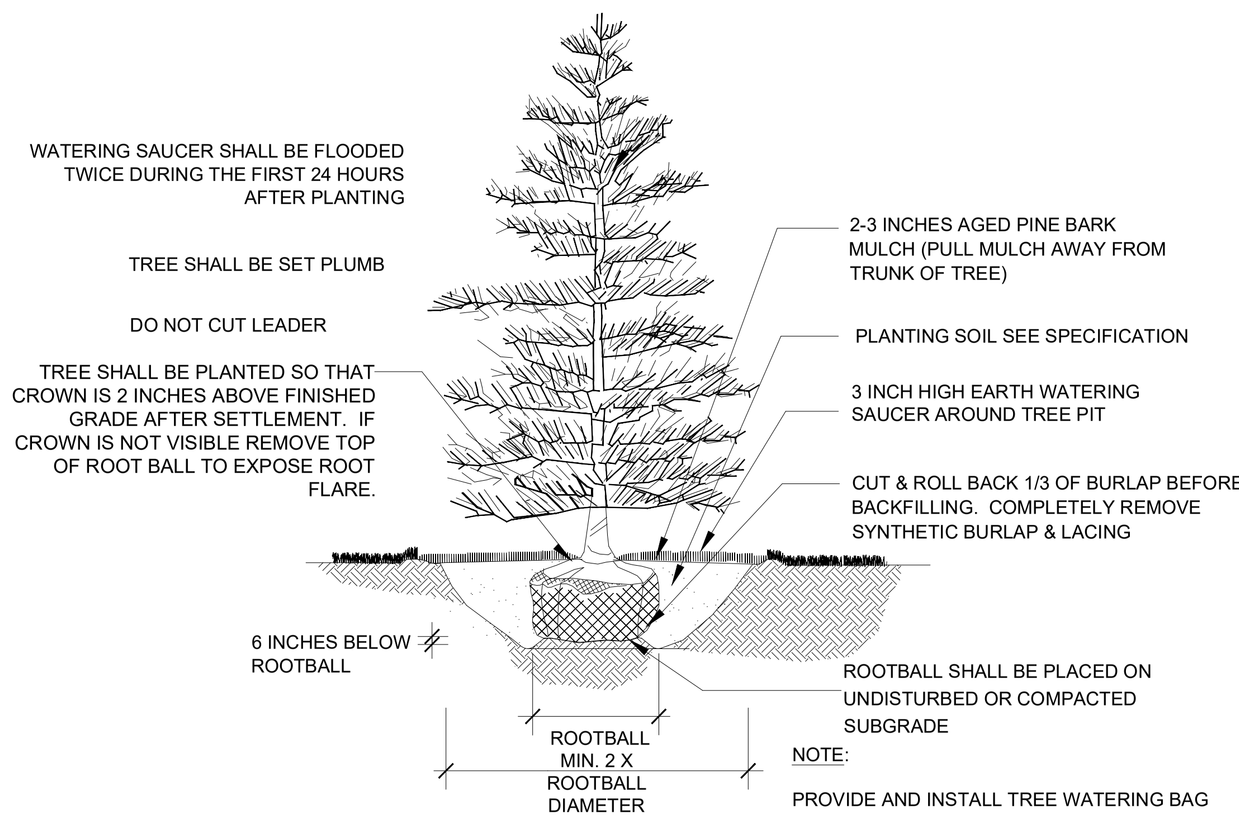


NOTE:

TREE TRUNK GUARDS SHALL BE INSTALLED AT ALL TREES. SEE SPECIAL PROVISION.

4 TREE PLANTING

SCALE: N.T.S.



NOTE:

PROVIDE AND INSTALL TREE WATERING BAG

5 EVERGREEN TREE PLANTING

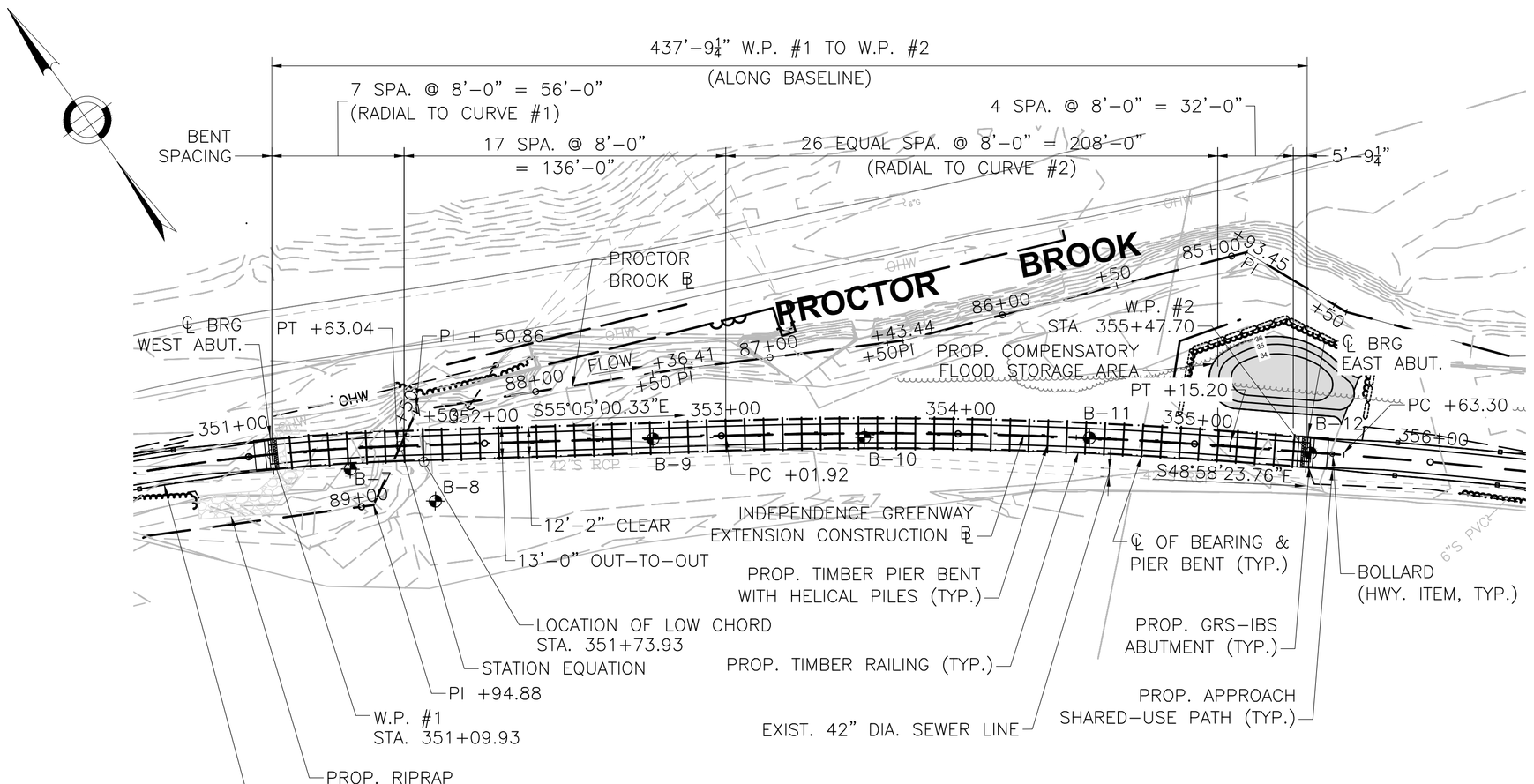
SCALE: N.T.S.

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway

609211_BR01(P03020).DWG Plotted on 5-Apr-2024 9:17 AM

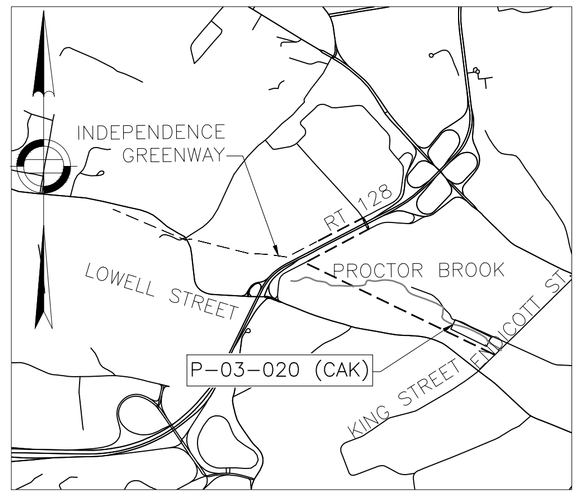
A00860 - 463



KEY PLAN

SCALE: 1" = 40'

STATION EQUATION: INDEPENDENCE GREENWAY EXTENSION CONSTRUCTION ℄ STA. 351+64.36 = PROCTOR BROOK ℄ STA. 88+67.46



LOCUS

1" = 2000'

HORIZONTAL CURVE #1 DATA
PC = 349+89.58
PT = 351+63.04
Δ = 12°-25'-23"
R = 800.00'
L = 173.46'
T = 87.07'

HORIZONTAL CURVE #2 DATA
PC = 353+01.92
PT = 355+15.20
Δ = 6°-06'-37"
R = 2000.00'
L = 213.28'
T = 106.74'

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	#	59	141
PROJECT FILE NO.	609211		

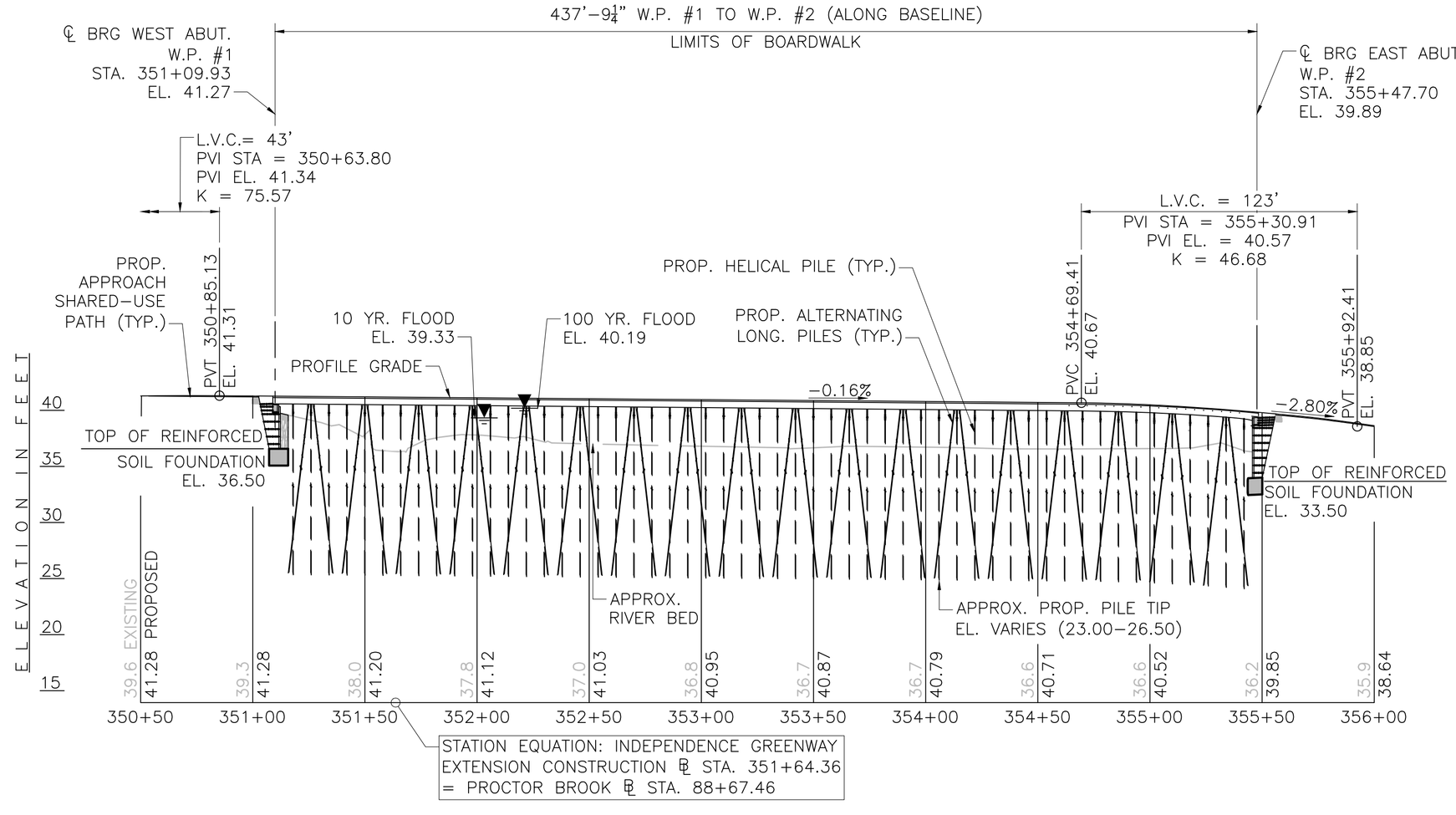
KEY PLAN PROFILE AND LOCUS

ESTIMATED QUANTITIES
(NOT GUARANTEED)

BRIDGE EXCAVATION	40 CY
TEST PIT FOR EXPLORATION	19 CY
CLASS B ROCK EXCAVATION	5 CY
CRUSHED STONE FOR BRIDGE FOUNDATIONS	15 TON
GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL	55 SY
HELICAL PILE AND BRACKET ASSEMBLY	3700 FT
PRE-DRILLING FOR PILE OBSTRUCTIONS	80 FT
HELICAL PILE VERIFICATION LOAD TEST	3 EA
RIPRAP	145 TON
NATURAL STREAMBED MATERIAL	75 SY
CONTROL OF WATER – STRUCTURE NO. P-03-020	1 LS
BRIDGE STRUCTURE, BRIDGE NO. P-03-020 (CAK)	1 LS

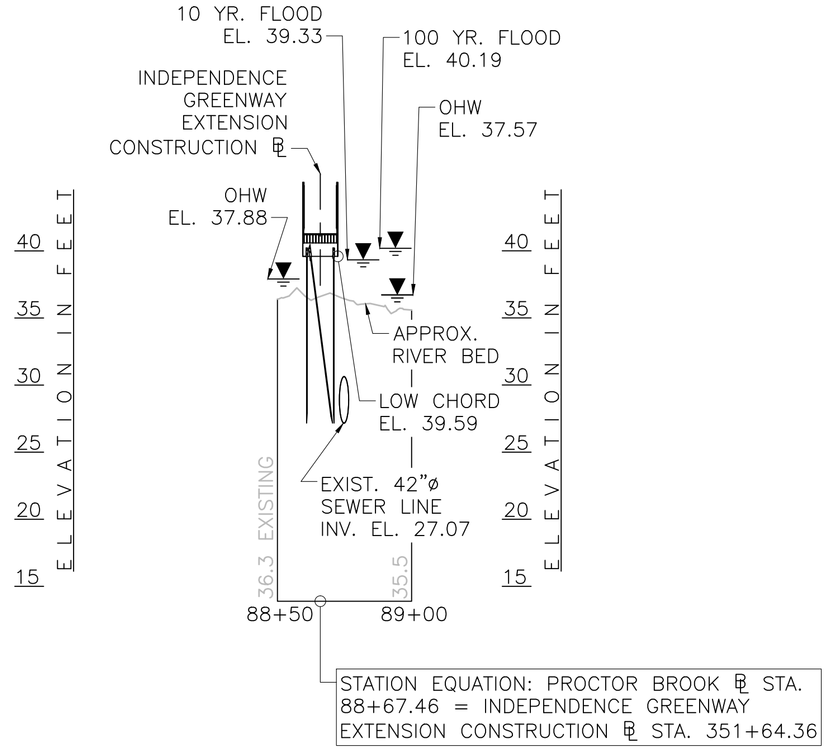
INDEX OF DRAWINGS

TITLE	SHEET NO.
KEY PLAN PROFILE AND LOCUS	1
GENERAL NOTES	2
BORING LOGS 1 OF 3	3
BORING LOGS 2 OF 3	4
BORING LOGS 3 OF 3	5
GENERAL PLAN AND ELEVATION 1 OF 2	6
GENERAL PLAN AND ELEVATION 2 OF 2	7
HELICAL PILE LAYOUT PLAN 1 OF 2	8
HELICAL PILE LAYOUT PLAN 2 OF 2	9
HELICAL PILE LAYOUT TABLE	10
HELICAL PILE DETAILS	11
WEST ABUTMENT PLAN AND ELEVATION	12
EAST ABUTMENT PLAN AND ELEVATION	13
FRAMING PLAN 1 OF 2	14
FRAMING PLAN 2 OF 2	15
TYPICAL SECTION AND TIMBER CONNECTION DETAILS	16
CONNECTION DETAILS	17



PROFILE-INDEPENDENCE GREENWAY EXTENSION

HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 8'



PROFILE-PROCTOR BROOK

HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 8'

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

MassDOT Massachusetts Department of Transportation Highway Division

PROPOSED BRIDGE

PEABODY

INDEPENDENCE GREENWAY EXTENSION OVER PROCTOR BROOK

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
10 PARK PLAZA BOSTON, MASS

GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL & STRUCTURAL ENGINEERS
TEWKSBURY, MASSACHUSETTS

STATE BRIDGE ENGINEER

CHIEF ENGINEER

05-April-2024

THIRD STRUCTURAL SUBMISSION (S3)

Proposal No. 609211-132091

GENERAL NOTES

DESIGN:
IN ACCORDANCE WITH THE 2009 AASHTO LRFD GUIDE SPECIFICATION FOR DESIGN OF PEDESTRIAN BRIDGES WITH 2015 INTERIM REVISIONS, FOR 90 PSF DESIGN PEDESTRIAN LOADING.

MASSDOT BENCH MARK:
ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

BENCHMARK: 9 – MAG NAIL SET UP #28 ON WARREN ROAD
STATION: 347+49.19 – 8.971 LT
NORTHING: 3019612.4266
EASTING: 807741.8898
ELEVATION: 41.17'

BENCHMARK: 11 – MAG NAIL SET ABOUT 1' ABOVE GROUND AT LP#6 ON ENDICOTT STREET
STATION: 359+34.38 – 79.411 LT
NORTHING: 3018945.6274
EASTING: 808725.6506
ELEVATION: 37.33'

MASSDOT SURVEY:
THE EXISTING CONDITIONS SHOWN ON THIS BASEMAP ARE THE RESULTS OF AN AERIAL SURVEY PERFORMED BY SANBORN COMPANY IN JUNE, 2004 SUPPLEMENTED BY AN ON GROUND INSTRUMENT SURVEY PERFORMED IN SEPTEMBER, 2004 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN). ADDITIONAL GROUND SURVEY WAS PERFORMED BETWEEN 2017 AND 2022 BY GREEN TO SUPPLEMENT EXISTING GROUND SURVEY.

SCALES:
SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR HALF-SIZE PRINTS.

FOUNDATIONS:
FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIAL:
ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

GEOTECHNICAL REPORT:
REFER TO GEOTECHNICAL REPORT, DATED MAY 2023, PREPARED BY GZA GEO ENVIRONMENTAL.

EXISTING CONDITIONS:
CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENTS AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUACY THEREOF, AND SHALL NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

STRUCTURAL WOOD NOTES:
ALL DIMENSIONAL LUMBER SHALL BE SOUTHERN PINE STAMPED BY A MEMBER OF THE WWPA AND KILN DRIED TO 19% MAXIMUM MOISTURE CONTENT. ALL STRUCTURAL LUMBER SHALL BE SELECT STRUCTURAL GRADE. IN ACCORDANCE WITH AASHTO TABLE 8.4.1.1.4–1 AND THE 2018 NATIONAL DESIGN SPECIFICATIONS (NDS) FOR WOOD CONSTRUCTION ALL PROPOSED TIMBER ELEMENTS SHALL HAVE A MINIMUM MODULUS OF ELASTICITY OF 1800 KSI.

STRINGERS AND PIER BENTS SHALL NOT BE NOTCHED EXCEPT WHERE SHOWN IN DETAILS. OBTAIN STRUCTURAL ENGINEER'S APPROVAL FOR ANY HOLES THROUGH OR NOTCHES IN THE TOP OF HORIZONTAL MEMBERS.

FOR BLACK LOCUST DECKING MATERIAL REQUIREMENTS PLEASE REFER TO THE SPECIAL PROVISIONS.

PROPOSED WOOD SCREWS FOR TIMBER FRAMING ELEMENTS SHALL COMPLY WITH ASME B18.6 REQUIREMENTS AND SHALL BE GALVANIZED UNLESS OTHERWISE NOTED. WOOD SCREW SIZES AND LENGTHS SHALL BE AS SHOWN ON THE PLANS.

SEE SHEET 17 FOR CONNECTION HARDWARE NOTES.

GRS–IBS MATERIALS
SEE SPECIAL PROVISIONS FOR DETAILED REQUIREMENTS.

CONCRETE MASONRY UNIT (CMU) FACING ELEMENTS
FACING ELEMENTS CONSISTING OF SPLIT–FACE CMU BLOCK UNITS SHALL MEET ASTM C90–11B AND THE REQUIREMENTS OF THE SPECIAL PROVISIONS, WITH A MINIMUM REQUIRED COMPREHENSIVE STRENGTH OF 4000 PSI AND A MAXIMUM WATER ABSORPTION RATE OF 5 PERCENT AFTER 24 HOURS.

CONSTRUCTION JOINTS
CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

BACKFILL MATERIALS
A. GEOSYNTHETIC REINFORCED SOIL (GRS) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 30 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
B. REINFORCED SOIL FOUNDATION (RSF) BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.4 AND HAVE A MINIMUM ANGLE OF INTERNAL FRICTION OF 38 DEGREES AS CONFIRMED BY A DIRECT SHEAR TEST.
C. INTEGRATED APPROACH BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.1.
D. LEVELING COURSE BACKFILL SHALL CONSIST OF CRUSHED STONE MEETING THE REQUIREMENTS OF M2.01.6.

GEOSYNTHETICS
FURNISH GEOSYNTHETICS CONSISTING OF GEOTEXTILE FOR THE GRS ABUTMENT, RSF AND INTEGRATED APPROACH. THE GEOSYNTHETIC MATERIAL SHALL BE MANUFACTURED FROM POLYPROPYLENE, HIGH–DENSITY POLYETHYLENE, OR POLYESTER AND MEET THE REQUIREMENTS OF THE SPECIAL PROVISIONS.

A. GEOSYNTHETIC REINFORCED SOIL SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
B. REINFORCED SOIL FOUNDATION SHALL INCLUDE A CLASS 1 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11 AND A REINFORCEMENT STRENGTH OF 1370 LB/FT AT 2 PERCENT STRAIN IN THE CROSS DIRECTION.
C. INTEGRATED APPROACH SOIL SHALL INCLUDE A CLASS 2 GEOTEXTILE WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 4800 LB/FT ACCORDING TO ASTM D 4595–11.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	60	141
PROJECT FILE NO.	609211		

GENERAL NOTES

TRAFFIC DATA	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	N/A	
AVERAGE DAILY TRAFFIC – PRESENT	N/A	
AVERAGE DAILY TRAFFIC – DESIGN YEAR	N/A	
DESIGN HOURLY VOLUME	N/A	
DIRECTIONAL DISTRIBUTION	N/A	
TRUCK PERCENTAGE – AVERAGE DAY	N/A	
TRUCK PERCENTAGE – PEAK HOUR	N/A	
DESIGN SPEED	N/A	
DIRECTIONAL DESIGN HOURLY VOLUME	N/A	

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000
DESIGN SPECTRA	
As	0.133
SDs	0.263
SD1	0.096
SITE CLASS	D
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA	
DRAINAGE AREA (SQ. MILES)	3.52
DESIGN FLOOD DISCHARGE (C.F.S.)	240
DESIGN FLOOD FREQUENCY (YEARS)	10
DESIGN FLOOD VELOCITY (F.P.S.)	5.97
DESIGN FLOOD ELEVATION (FEET, NAVD)	39.33
BASE (100–YEAR) FLOOD DATA	
BASE FLOOD DISCHARGE (C.F.S.)	420
BASE FLOOD ELEVATION (FEET, NAVD)	40.19
DESIGN AND CHECK SCOUR DATA	
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	25
DESIGN FLOOD ABUTMENT SCOUR DEPTH (FEET)	1.95
DESIGN FLOOD PIER SCOUR DEPTH (FEET)	1.17
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY (YEARS)	50
CHECK FLOOD ABUTMENT SCOUR DEPTH (FEET)	2.28
CHECK FLOOD PIER SCOUR DEPTH (FEET)	1.22
FLOOD OF RECORD	
DISCHARGE (C.F.S.)	N/A
FREQUENCY (IF KNOWN, YEARS)	N/A
MAXIMUM ELEVATION (FEET, NAVD)	N/A
DATE (MM/YYYY)	N/A
HISTORY OF ICE FLOES	N/A
EVIDENCE OF SCOUR AND EROSION	N/A

TEMPORARY WATER CONTROL DESIGN DATA	
DESIGN FLOOD DISCHARGE (C.F.S.)	240
DESIGN FLOOD FREQUENCY (YEARS)	10
DESIGN FLOOD VELOCITY (F.P.S.)	5.97
DESIGN FLOOD ELEVATION (FEET, NAVD)	39.33, 88

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway
609211_BR02(P03020).DWG Plotted on 5-Apr-2024 9:17 AM
A00860 - 464
THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway

PROP. TOP OF REINFORCED SOIL FOUNDATION
WEST ABUTMENT
EL. 36.50

ELEVATION IN FEET

40 30 20 10 0 −10

35.70 ▼ (1/04/19)

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-7
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method:Drive & Wash

Boring Location: N: 3019395.2599, E: 808062.9728
Ground Surface Elev. (ft.): 38.5
Final Boring Depth (ft.): 36
Date Start - Finish: 1/4/2019 - 1/4/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/4/19	1300	2.8	24	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	2 5 7 4	12	S-1: Medium dense, dark brown, fine to coarse SAND, little Gravel, little Silt, trace Wood, trace Roots.	1				
		S-2	2-4	24	9	2 2 3 1	5	S-2: Loose, gray-brown to dark brown, fine to medium SAND, little Silt, little Gravel, trace Roots.	2				
5		S-3	4-6	24	9	3 2 4 4	6	S-3: Loose, gray-brown, fine to medium SAND, little Gravel, little Silt, 3/4" seam of Clayey Silt 4" from bottom.	3		4	FILL/TOPSOIL	34.5'
		S-4	6-8	24	12	2 3 3 3	6	S-4: (Top 5") Brown, fine to coarse SAND, some Silt, little Gravel. (Bottom 7") Gray, fine to medium SAND, little Gravel, little Silt.					
		S-5	8-10	24	12	5 5 6 6	11	S-5: Medium dense, brown to gray with orange, fine to medium SAND, some Gravel, little Silt. Silt observed 5-6" from bottom.				SAND AND GRAVEL	
10													
15		S-6	14-16	24	9	6 9 11 11	20	S-6: Medium dense, light brown, fine to medium SAND, some Gravel, little (-) Silt.	4 5				
									6		17.5		21.0'
20		S-7	19-21	24	14	21 23 21 22	44	S-7: (Top 3") Light brown, SILT & CLAY, trace fine Sand, trace Gravel. (Bottom 11") Light brown, fine to medium SAND, some Gravel, some Silt.			19.3	SILT & CLAY	19.2'
											23.8	GLACIAL DEPOSIT	14.7'
25		S-8	24-24.2	2	2	100/2"	R	S-8: Very dense, gray, GRAVEL, little fine Sand, little Clayey Silt.	7		25	WEATHERED BEDROCK	13.5'
	min/ft 2:00 1:30 2:30 2:30 2:45	C-1	26-31	60	56			C-1: Hard to medium hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, subhorizontal to subvertical joints/fractures. RQD=20%	8			BEDROCK	
30													
	2:30 2:45 2:30 2:45 3:00 3:00 2:45	C-2	31-36	60	60			C-2: Hard, slightly weathered, medium to coarse grained, gray with pink, GRANITE, rough to smooth, planar to irregular, very close, moderately dipping to subvertical joints/fractures. RQD=35%				BEDROCK	
35											36		2.5'
								Bottom of boring at 36 feet.	9				
40													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 5.5 feet south of staked location due to restricted access and overhead wires.
3. Continuous sampling performed from sampling depths 0 to 10 feet below ground surface (bgs). Driller advanced 4-inch casing down as sampling advanced. The casing was advanced to 14 feet bgs following sampling of S-5.
4. Standard sampling performed from sample depths 14 to 24.2 feet bgs.
5. Driller advanced 4-inch casing from 14 to 24 feet bgs.
6. Clayey Silt observed in drill cuttings from 17.5 to 19 feet bgs.
7. Weathered Bedrock fragments and increased drill effort observed at 23.8 feet bgs.
8. Cored bedrock with a downward pressure of 500 psi at 1,350 rpm in 3rd gear using an NX core barrel.
9. Borehole backfilled to approximate ground surface with drill cuttings and surficial soils.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-7

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

B−7

SCALE: 1/4" = 1'−0"

APPROX. PROP. PILE TIP VARIES
EL. 23.00−25.50

32.00 ▼ (1/15/19)

TEST BORING LOG

GZA GeoEnvironmental, Inc. Engineers and Scientists

Peabody Bikeway - Phase II
Peabody, Massachusetts

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: MPS

Drilling Co.: New England Boring Contractors
Foreman: Matt Soucy
Logged By: Doug Maguire

Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method:Drive & Wash

Boring Location: N: 3019362.9337, E: 808083.6438
Ground Surface Elev. (ft.): 37.8
Final Boring Depth (ft.): 41
Date Start - Finish: 1/15/2019 - 1/15/2019

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300
Hammer Fall (in.): 24
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2
Sampler Hmr Wt (lb): 140
Sampler Hmr Fall (in): 30
Other: Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/15/19	1520	5.8	29.5	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	11	6 4 4 6	8	S-1: (Top 6") Brown to light brown, fine to medium SAND, some Gravel, trace Silt, trace Roots. (Bottom 5") Dark brown, Organic CLAY & SILT, some fine to medium Sand, little Brick, trace Roots, trace Glass.	1				
		S-2	2-4	24	5	21 18 14 28	32	S-2: Hard, dark brown, CLAY & SILT, some fine to medium Sand, little Gravel, trace Roots.	2				
5		S-3	4-6	24	7	18 15 18 12	33	S-3: Dense, gray-brown, fine to coarse SAND, some Gravel, some Clayey Silt.	3		4	FILL	33.8'
		S-4	6-8	24	15	17 16 13 14	29	S-4: Medium dense, light brown to gray, fine to coarse SAND, some Clayey Silt, some Gravel.					
		S-5	8-10	24	8	16 11 13 13	24	S-5: Dense, light brown, fine to medium SAND, some Gravel, little Silt.				SAND AND GRAVEL	
10													
15		S-6	14-16	24	7	6 10 9 10	19	S-6: Medium dense, light brown, fine to medium SAND, little Silt, trace (+) Gravel.					
20		S-7	19-21	24	12	6 6 6 7	12	S-7: (Top 2") Light brown, fine to medium SAND, little Silt. (Bottom 10") Brown-gray, SILT & CLAY, trace fine Sand.			19.2	SILT & CLAY	18.6'
											22.5	GLACIAL DEPOSIT	15.3'
25		S-8	24-26	24	6	26 22 18 23	40	S-8: Dense, gray-brown, fine to coarse SAND, some Silt, some Gravel.					
30		S-9	29-29.4	5	5	100/5"	R	S-9: Very dense, gray, GRAVEL, some fine to coarse Sand, little (-) Silt.	4		30		7.8'
	min/ft 3:00 3:45 4:30 5:15	C-1	31-36	60	42			C-1: Hard, slightly to moderately weathered, coarse to medium grained, gray with purple, GRANITE, rough, irregular to planar, very close, subvertical to subhorizontal joints/fractures. RQD=0%	5			BEDROCK	
35													
	4:15 4:45 5:15 4:30 4:30 3:30	C-2	36-41	60	60			C-2: Hard, slightly weathered, coarse to medium grained, gray with pink and purple, GRANITE, rough, irregular to planar, very close, subhorizontal to subvertical joints/fractures. RQD=0%	6				
40											41		-3.2'
								Bottom of boring at 41 feet.	7				
45													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitled "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc. on 1/16/2019.
2. Boring relocated 3.5 feet south due to restricted access.
3. Advanced boring using 4-inch casing from sample depths 0 to 29 feet below ground surface (bgs).
4. Consistent coarse sand-sized rock fragments observed in drill cuttings from sample depths 30 to 31 feet bgs.
5. Drill rig did not have a downward pressure or RPM gauge. Cored bedrock in 3rd gear using an NX core barrel.
6. Core barrel jammed with no loss of water at sample depths 35.1 and 38.3 feet bgs.
7. Borehole backfilled to approximate ground surface with drill cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

174019 PROPOSED PEABODY BIKEWAY.GPJ; STRATUM ONLY; 3/18/2019

B−8

SCALE: 1/4" = 1'−0"

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	61	141
PROJECT FILE NO.	609211		

BORING LOGS 1 OF 3

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: B−#
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.
6. B−7 AND B−8 WERE MADE IN JANUARY 2019 AND B−9 THROUGH B−12 WERE MADE IN FEBRUARY 2022.
7. BORINGS WERE MADE BY NEW ENGLAND BORING CONTRACTORS, 40 FORDWAY STREET, DERRY, NH, 03038.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

609211_BR03(P03020).DWG Plotted on 5-Apr-2024 9:17 AM

A00860 - 465

05-April-2024

THIRD STRUCTURAL SUBMISSION (S3)

ELEVATION IN FEET

50 40 30 20 10 0

34.90 ▼ (2/21/22)

APPROX. PROP. PILE TIP VARIES EL. 23.00–26.50

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*

Peabody Bikeway – Phase II
Peabody, Massachusetts

BORING NO.: B-9
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: LWP

Drilling Co.:	New England Boring Contractors	Type of Rig:	ATV Rig
Foreman:	Walter Hoeckele	Rig Model:	B-53 Mobile
Logged By:	Ryan Baronowski	Drilling Method:	Drive & Wash

Boring Location: N 3,019,329 / E 808,173
Ground Surface Elev. (ft.): 37.5
Final Boring Depth (ft.): 22.6
Date Start – Finish: 2/21/2022 – 2/21/2022

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type:	HW	Sampler Type:	Split Spoon
I.D./O.D.(in):	4/4-1/2"	I.D./O.D. (in.):	1.375/2.0
Hammer Weight (lb.):	300 lbs.	Sampler Hmr Wt (lb):	140 lbs
Hammer Fall (in.):	24"	Sampler Hmr Fall (in):	30"
Other:	Safety Hammer	Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
2/21/22	1100	2.65	20'	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0–2	24	12	2 4 10 12	14	S-1: Medium dense, dark brown to brown, fine to coarse SAND, little fine to coarse Gravel, little Silt, trace Wood, trace Leaves.	1 2		3'	FILL	34.5'
5		S-2	4–6	24	2	3 4 4 2	8	S-2: Loose, brown, fine to coarse SAND, little fine Gravel, trace Silt.					
10		S-3	9–11	24	6	12 7 4 6	11	S-3: Medium dense, fine to coarse SAND, some fine to coarse Gravel, little Silt (–).					
		S-4	11–13	24	5	4 3 5 5	8	S-4: Loose, brown, fine to coarse SAND, little Gravel, little Silt.	3			SAND AND GRAVEL	
		S-5	13–15	24	2	6 6 3 2	9	S-5, Loose, brown, fine to coarse SAND, little fine Gravel, trace Silt.	4				
15		S-6	15–17	24	7	5 7 7 12	14	S-6: Medium dense, brown, fine to medium SAND, trace fine Gravel, trace Silt.					
		S-7	17–19	24	11	7 8 10 13	18	S-7: Medium dense, brown, fine to medium SAND, little Silt.					
20		S-8	19–21	24	17	8 9 6 5	15	S-8: Top 11": Medium dense, brown, fine to medium SAND, little Silt. Bottom 6": Brown/gray, CLAY & SILT, trace (–) fine Sand.			20.5'		17.2'
		S-9	21–22.6	20	16	7 4 7 50/2"	11	S-9: Stiff, Silty CLAY, trace fine to coarse Gravel.	5		22.6'	CLAY & SILT	14.9'
25								Bottom of boring at 22.6 feet.					
30													

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitles "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc on 1/16/2019.
2. Driller advanced 4" diameter casing to approximately 20 feet below ground surface.
3. Driller noted difficult keeping casing straight from 10 to 15 feet below ground surface.
4. Sample S-6 appeared to consist of wash material.
5. Boring was terminated at approximately 22.6 feet below ground surface upon SPT refusal. Borehole was backfilled with natural soil cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-9

17A019.00 PEABODY BIKE PHII-GPJ; STRATUM ONLY NORWOOD; 1/20/2023

B–9
SCALE: 1/4" = 1'–0"

33.80 ▼ (2/21/22)

APPROX. PROP. PILE TIP VARIES EL. 23.00–26.50

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*

Peabody Bikeway – Phase II
Peabody, Massachusetts

BORING NO.: B-10
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: LWP

Drilling Co.:	New England Boring Contractors	Type of Rig:	ATV Rig
Foreman:	Walter Hoeckele	Rig Model:	B-53 Mobile
Logged By:	Ryan Baronowski	Drilling Method:	Drive & Wash

Boring Location: N 3,019,276 / E 808,248
Ground Surface Elev. (ft.): 36
Final Boring Depth (ft.): 23.1
Date Start – Finish: 2/21/2022 – 2/21/2022

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type:	HW	Sampler Type:	Split Spoon
I.D./O.D.(in):	4/4-1/2"	I.D./O.D. (in.):	1.375/2.0
Hammer Weight (lb.):	300 lbs.	Sampler Hmr Wt (lb):	140 lbs
Hammer Fall (in.):	24"	Sampler Hmr Fall (in):	30"
Other:	Safety Hammer	Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
2/21/22	1500	2.25	15'	20 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0–2	24	6	3 8 9 6	17	S-1: Medium dense, dark brown, fine to coarse SAND, little Silt, little fine Gravel, trace Leaves, trace Roots.	1 2				
5		S-2	4–6	24	1	5 1 WOH WOH	1	S-2: Very loose, brown, fine to coarse SAND, little Silt, trace fine Gravel.				FILL	
10		S-3	9–11	24	0	3 WOH WOH WOH	0	S-3: No Recovery.					
		S-4	11–13	24	11	3 6 5 8	11	S-4: Medium dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt.			11'		25.0'
		S-5	13–15	24	8	5 7 8 7	15	S-5: Medium dense, brown, fine to medium SAND, little fine Gravel, trace Silt.					
15		S-6	15–17	24	19	9 8 8 9	16	S-6: Medium dense, brown, fine to medium SAND, little (–) fine Gravel, trace Silt.	3			SAND AND GRAVEL	
		S-7	17–19	24	1	6 7 8 6	15	S-7: Medium dense, brown, fine to medium SAND, little Silt, trace fine Gravel.	4				
20		S-8	19–21	24	15	2 4 3 5	7	S-8: Top 8": Loose, brown, fine to medium SAND, trace Silt, trace fine Gravel. Bottom 7": Gray, Silty CLAY, trace fine Sand.			20.2'		15.8'
		S-9	21–22.8	22	12	6 5 22 75/4"	27	S-9: Top 6": Gray, Silty CLAY, trace fine Sand, trace fine Gravel.			22'	SILTY CLAY	14.0'
25		S-10	23–23.1	1"	0	75/1"	R	Bottom 6": Medium dense, gray, fine to coarse SAND and fine to coarse GRAVEL, little Clayey Silt. S-10: No Recovery.	5		23.1'	GLACIAL DEPOSIT	12.9'
30								Bottom of boring at 23.1 feet.					

REMARKS

1. Ground surface elevation estimated from electronic AutoCAD file entitles "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc on 1/16/2019.
2. Driller advanced 4" diameter casing to approximately 20 feet below ground surface.
3. Drill chatter observed while advancing rollerbit from 15–17 feet below ground surface.
4. Sample S-7, consisted predominantly of wash material.
5. Boring was terminated at approximately 23.1 feet below ground surface upon refusal in Glacial Till. Borehole was backfilled with natural soil cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-10

17A019.00 PEABODY BIKE PHII-GPJ; STRATUM ONLY NORWOOD; 1/20/2023

B–10
SCALE: 1/4" = 1'–0"

BORING NOTE:

SEE SHEET 3 FOR BORING NOTES.

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091
Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway
609211_BR04(P03020).DWG Plotted on 5-Apr-2024 9:17 AM
A00860 - 466
THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

609211_BR05(P03020).DWG Plotted on 5-Apr-2024 9:17 AM

Proposal No. 609211-132091

A00860 - 467

ELEVATION IN FEET

50
40
30
20
10
0

34.30 ▼ (2/22/22)

APPROX. PROP. PILE TIP VARIES EL. 23.00–26.50

33.90 ▼ (2/22/22)

PROPOSED TOP OF REINFORCED SOIL FOUNDATION EAST ABUTMENT EL. 33.50

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*

Peabody Bikeway – Phase II
Peabody, Massachusetts

BORING NO.: B-11
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: LWP

Drilling Co.: New England Boring Contractors
Foreman: Walter Hoeckele
Logged By: Ryan Baronowski

Type of Rig: ATV Rig
Rig Model: B-53 Mobile
Drilling Method: Drive & Wash

Boring Location: N 3,019,219 / E 808,321
Ground Surface Elev. (ft.): 36
Final Boring Depth (ft.): 27
Date Start – Finish: 2/22/2022 – 2/22/2022

H. Datum: NAD83
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4-1/2"
Hammer Weight (lb.): 300 lbs.
Hammer Fall (in.): 24"
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2.0
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
2/22/22	1150	1.7	Removed	25 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft.)
		S-1	0–2	24	9	2 4 5 2	9	S-1: Loose, dark brown to brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Wood, trace Leaves, trace Roots.	1 2 3			FILL	
											3'		33.0'
5		S-2	4–6	24	11	9 6 6 7	12	S-2: Medium dense, brown to red, fine to medium SAND, little (–) fine Gravel, little Silt.					
10		S-3	9–11	24	8	9 6 5 5	11	S-3: Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.	4 5			SAND AND GRAVEL	
		S-4	11–13	24	16	9 7 7 8	14	S-4: Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.					
		S-5	13–15	24	7	6 6 5 4	11	S-5: Medium dense, brown, fine to coarse SAND and fine to coarse GRAVEL, trace (+) Silt.					
15		S-6	15–17	24	19	6 6 8 7	14	S-6: Top 9": Brown, fine to coarse SAND, some (–) fine to coarse Gravel, trace Silt. Bottom 10": Medium dense, brown, fine to medium SAND, little Silt, trace (–) fine Gravel.	6				
		S-7	17–19	24	12	5 4 3 8	7	S-7: Top 7": Loose, brown, fine to medium SAND, trace Silt. Bottom 5": Brown, CLAY & SILT.	7		18.2' 19'	CLAY & SILT	17.8' 17.0'
20		S-8	19–21	24	18	6 8 11 13	19	S-8: Top 11": Brown, fine to medium SAND, trace Silt, trace (–) fine Gravel. Bottom 7": Gray, fine SAND, some Silt.				SAND AND GRAVEL	
		S-9	21–23	24	24	10 11 6 10	17	S-9: Top 13": Medium dense, brown, fine to medium SAND, little Silt, trace fine Gravel. Bottom 11": Gray, SILT & CLAY.			22'		14.0'
		S-10	23–25	24	18	WOH 1 15 9	16	S-10: Top 8": Gray, SILT & CLAY. Bottom 10": Very stiff, gray, SILT & CLAY, little fine Gravel, fine to medium Sand.			25'	SILT AND CLAY	11.0'
25		S-11	25–27	24	14	13 20 29 25	49	S-11: Dense, brown to gray, fine to coarse SAND, some fine to coarse Gravel, little Clayey Silt.	8		27'	GLACIAL DEPOSIT	9.0'
								Bottom of boring at 27 feet.					
30													

174019.00 PEABODY BIKE PHILGP2; STRATUM ONLY NORWOOD; 1/20/2023

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitles "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc on 1/16/2019.
2. Driller advanced 4" diameter casing to approximately 25 feet below ground surface.
3. Standard sampling performed from sample depths 0 to 9 feet below ground surface.
4. Continuous sampling performed from sample depths 9 to 27 feet below ground surface.
5. Significant difficulty advancing casing from 0–5 feet below ground surface. Wash appeared to be fine to coarse Sand.
6. Red/black mottling in sample S-7, S-8, and S-9.
7. Alternating layers of Sand, Clay and Silt in sample S-8 and S-9.
8. Borehole was backfilled with natural soil cuttings and sand.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-11

B–11
SCALE: $\frac{1}{4}$" = 1'–0"

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*

Peabody Bikeway – Phase II
Peabody, Massachusetts

BORING NO.: B-12
SHEET: 1 of 1
PROJECT NO: 01.0174019.00
REVIEWED BY: LWP

Drilling Co.: New England Boring Contractors
Foreman: Walter Hoeckele
Logged By: Ryan Baronowski

Type of Rig: ATV Rig
Rig Model: B-53 Mobile
Drilling Method: Drive & Wash

Boring Location: N 3,019,158 / E 808,392
Ground Surface Elev. (ft.): 36
Final Boring Depth (ft.): 27
Date Start – Finish: 2/22/2022 – 2/22/2022

Auger/Casing Type: HW
I.D/O.D.(in): 4/4-1/2"
Hammer Weight (lb.): 300 lbs.
Hammer Fall (in.): 24"
Other: Safety Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375/2.0
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth
2/22/22	1500	2.1

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft.)
		S-1	0–2	24	18	3 5 5 3	10	S-1: Medium dense, dark brown to brown, fine to medium SAND, little fine to coarse Gravel, little Silt, trace Wood, trace Roots.	1 2			FILL	
5		S-2	4–6	24	4	7 1 5 6	6	S-2: Loose, brown, fine to coarse SAND, little fine to coarse Gravel, little Wood/Decomposed Wood, trace Plastic.			8'		28.0'
10		S-3	9–11	24	6	5 5 5 5	10	S-3: Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.				SAND AND GRAVEL	
		S-4	11–13	24	15	10 9 12 9	21	S-4: Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.					
		S-5	13–15	24	10	5 6 6 8	12	S-5: Medium dense, brown, fine to medium SAND, some fine to coarse Gravel, little Silt.					
15		S-6	15–17	24	23	10 13 13 12	26	S-6: Medium dense, brown, fine to medium SAND, little Silt, trace fine Gravel.					
		S-7	17–19	24	15	5 7 9 12	16	S-7: Medium dense, brown to gray, fine SAND, some Silt.	3				
20		S-8	19–21	24	19	6 7 5 5	12	S-8: Top 11": Medium dense, gray, fine SAND & SILT. Bottom 8": Gray, CLAY & SILT, trace fine Sand.			20'	CLAY & SILT	16.0'
		S-9	21–23	24	24	3 3 5 5	8	S-9: Medium stiff, gray, CLAY & SILT, trace fine Sand.					
		S-10	23–25	24	24	5 6 6 9	12	S-10: Stiff, gray, CLAY & SILT, trace fine Sand.	4				
25		S-11	25–27	24	24	9 12 12 19	24	S-11: Medium dense, gray to brown, fine to coarse SAND and fine to coarse GRAVEL, little Clayey Silt.	5		25'		11.0'
								Bottom of boring at 27 feet.	6				
30													

174019.00 PEABODY BIKE PHILGP2; STRATUM ONLY NORWOOD; 1/20/2023

REMARKS
1. Ground surface elevation estimated from electronic AutoCAD file entitles "Peabody Bike Path 2018 Merge Basemap-Final.DWG", provided by Green International, Inc on 1/16/2019.
2. Driller advanced 4" diameter casing to approximately 25 feet below ground surface.
3. Red mottling observed in samples S-5 through S-7.
4. Significant drill chatter observed beginning at approximately 24.7 feet below ground surface.
5. Gravel in tip of sample S-10.
6. Borehole was backfilled with natural soil cuttings.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were mode.

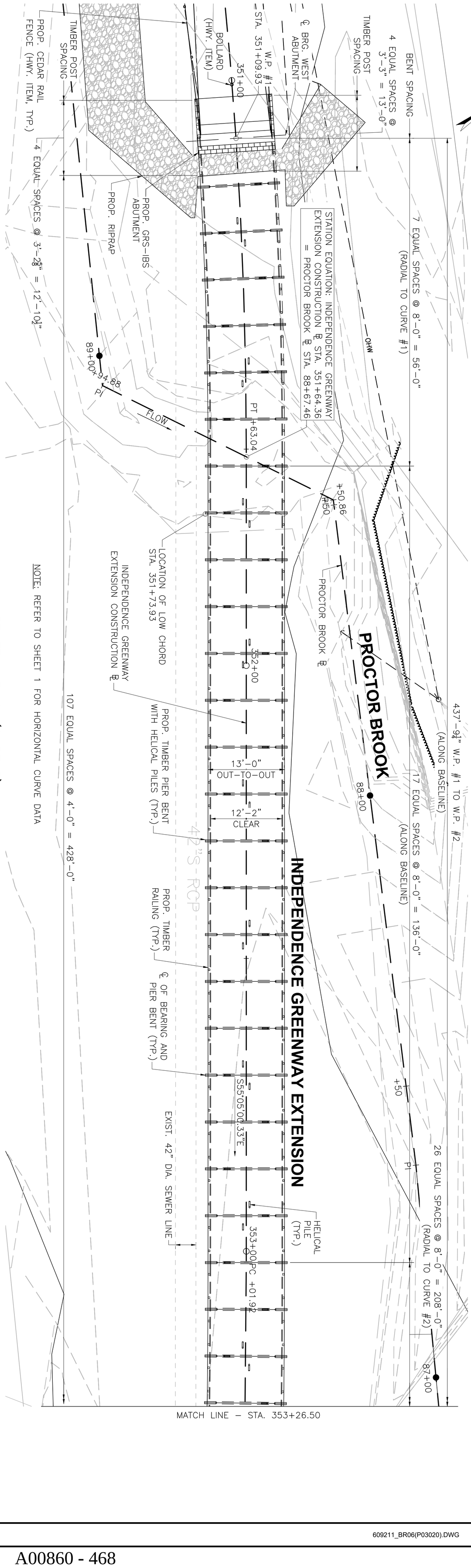
B–12
SCALE: $\frac{1}{4}$" = 1'–0"

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

05-April-2024
THIRD STRUCTURAL SUBMISSION (S3)

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway



GENERAL PLAN (1 OF 2)

SCALE: 1" = 1'-0"

NOTE: REFER TO SHEET 1 FOR HORIZONTAL CURVE DATA

TYPICAL ELEVATION (1 OF 2)

SCALE: 1" = 1'-0"

PEABODY
INDEPENDENCE GREENWAY EXTENSION
GENERAL PLAN AND ELEVATION 1 OF 2

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	64	141
PROJECT FILE NO.	609211		

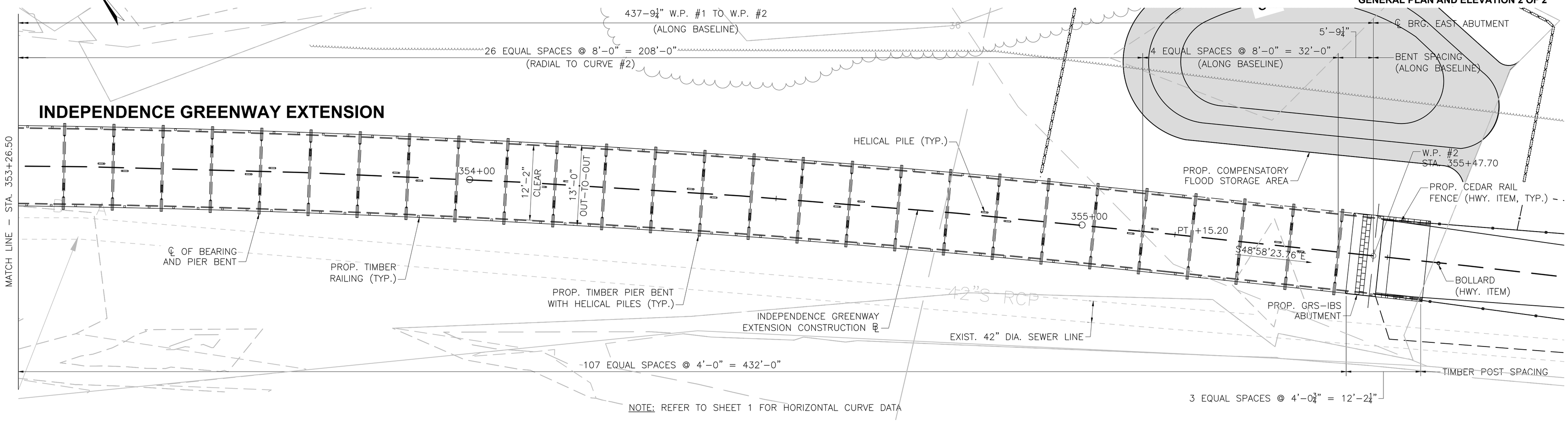
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

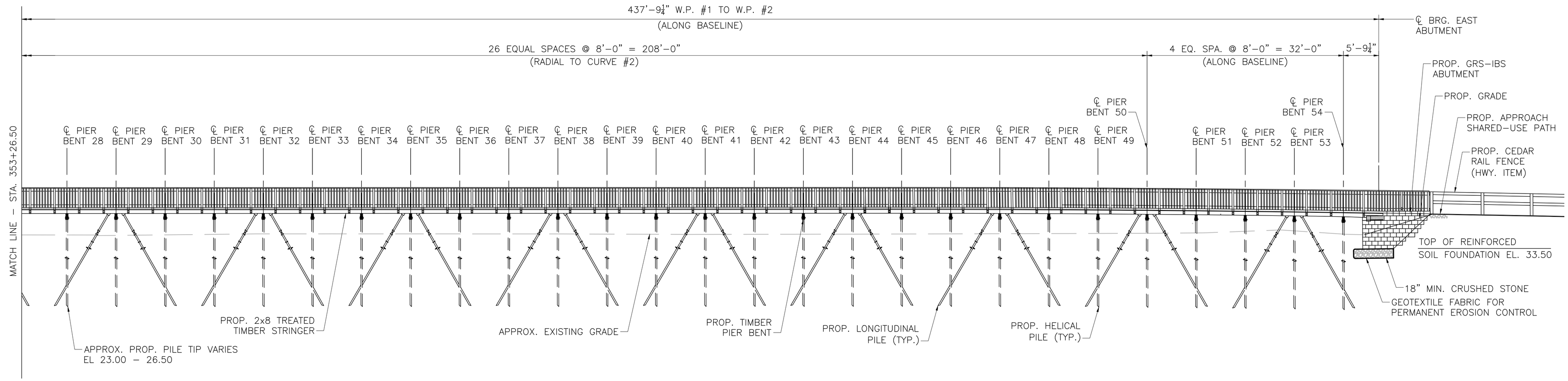
SHEET 6 OF 17 SHEETS BRIDGE NO. P-03-020 (CAK)

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	65	141
PROJECT FILE NO.	609211		

GENERAL PLAN AND ELEVATION 2 OF 2



GENERAL PLAN (2 OF 2)
SCALE: ⅛" = 1'–0"



TYPICAL ELEVATION (2 OF 2)
SCALE: ⅛" = 1'–0"

MMMM DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: _____ STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

Proposal No. 609211-132091
A00860 - 469
609211_BR07(P03020).DWG Plotted on 5-Apr-2024 9:17 AM
05-April-2024
THIRD STRUCTURAL SUBMISSION (S3)
Y:\Shared\Engineering\Projects\2017\171185\Dwg\Bridge\Pedestrian Walkway

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

HELICAL PILE LAYOUT PLAN 1

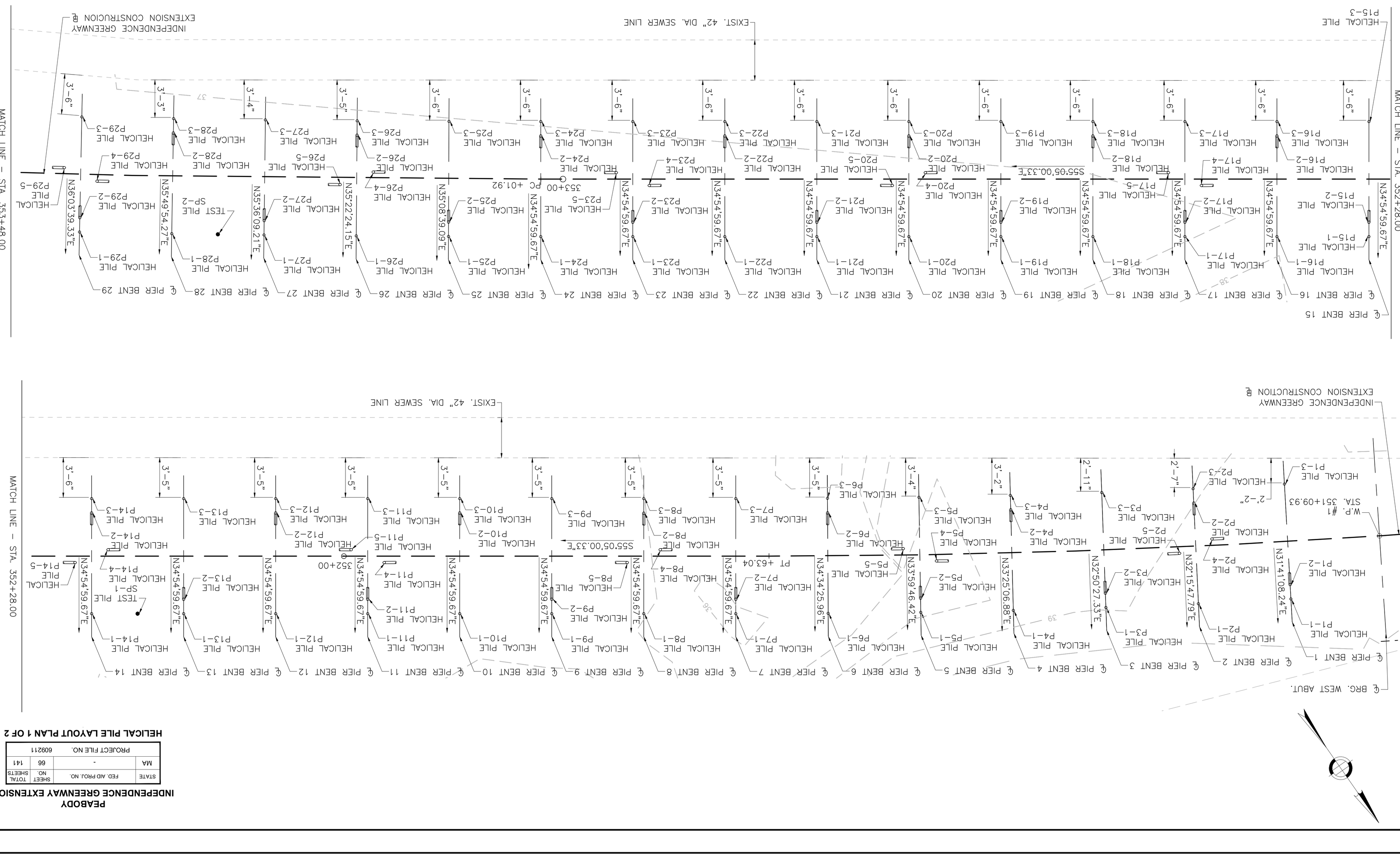
SCALE: 1" = 1'-0"

NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'-6" TO THE TOP HELICE FOR ALL P#-3 LOCATIONS WITH AN OFFSET LESS THAN 3'-6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
6. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
7. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

LEGEND:

- ○ HELICAL PILE P#-#
- ● TEST PILE SP-#



HELICAL PILE LAYOUT PLAN 1 OF 2

PEABODY INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	66	141
PROJECT FILE NO. 609211			

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

609211_BR08(R03020).DWG Plotted on 5-Apr-2024 9:18 AM

A00860 - 470

Y:\Shared\Engineering\Projects\20171718\Dwg\Bridge\Pedestrian Walkway

Proposal No. 609211-132091

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

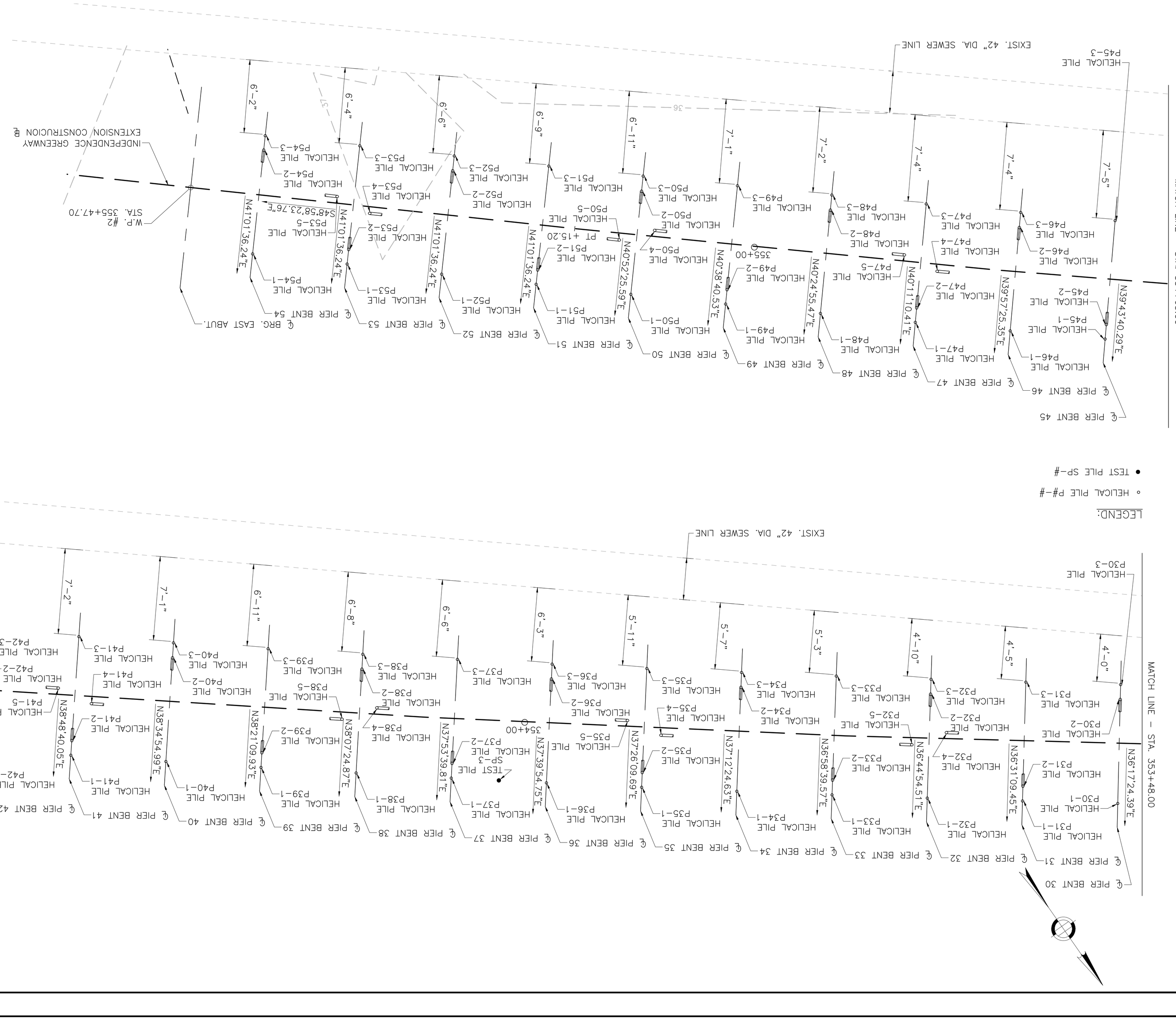
THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT

AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

HELICAL PILE LAYOUT PLAN 2

SCALE: $\frac{1}{4}$" = 1'-0"



NOTES:

1. SEE SHEET 10 FOR HELICAL PILE STATION AND OFFSET.
2. SEE SHEET 11 FOR HELICAL PILE NOTES.
3. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'-6" TO THE TOP HELICE FOR ALL P#-3 LOCATIONS WITH AN OFFSET LESS THAN 3'-6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE AS DIMENSIONED ON THIS SHEET.
4. ALL DIMENSIONS SHOWN FOR THE SOUTH HELICAL PILES TO THE EXISTING SEWER LINE ARE APPROXIMATE AND TAKEN PERPENDICULAR TO THE SEWER LINE.
5. THE VERIFICATION TEST HELICAL PILES SHALL BE A SACRIFICIAL HELICAL PILE. THE VERIFICATION TEST SHALL BE PERFORMED PRIOR TO CONSTRUCTION OF PRODUCTION HELICAL PILES. THE VERIFICATION TEST LOCATIONS ARE APPROXIMATE AS SHOWN. CONTRACTOR TO SELECT THE EXACT LOCATION OF THE VERIFICATION TEST HELICAL PILES WITH APPROVAL BY THE ENGINEER.
6. PRIOR TO LAYOUT AND INSTALLATION OF THE HELICAL PILES, THE CONTRACTOR SHALL LOCATE THE EXISTING SEWER MANHOLES AND STAKE OUT THE 42" RCP PIPE ALIGNMENT BETWEEN MANHOLES WITHIN THE LIMITS OF THE PROPOSED BOARDWALK. THE CONTRACTOR SHALL PERFORM A MINIMUM OF TWO (2) TEST PITS ALONG THE STAKED OUT ALIGNMENT OF THE SEWER WITHIN THE PROXIMITY OF THE HELICAL PILES.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	67	141
PROJECT FILE NO. 609211			

HELICAL PILE LAYOUT PLAN 2 OF 2

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

609211_BR09(P03020).DWG Plotted on 5-Apr-2024 9:18 AM

A00860 - 471

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway

HELICAL PILE	STATION	OFFSET
P1-1	351+17.93	5.00 LT
P1-2	351+17.93	3.75 LT
P1-3	351+17.93	5.00 RT
P2-1	351+25.93	5.00 LT
P2-2	351+25.93	3.75 RT
P2-3	351+25.93	5.00 RT
P3-1	351+33.93	5.00 LT
P3-2	351+33.93	3.75 LT
P3-3	351+33.93	5.00 RT
P4-1	351+41.93	5.00 LT
P4-2	351+41.93	3.75 RT
P4-3	351+41.93	5.00 RT
P5-1	351+49.93	4.99 LT
P5-2	351+49.93	3.76 LT
P5-3	351+49.93	5.01 RT
P6-1	351+57.93	4.99 LT
P6-2	351+57.93	3.74 RT
P6-3	351+57.93	5.01 RT
P7-1	351+65.93	5.00 LT
P7-2	351+65.93	3.75 LT
P7-3	351+65.93	5.00 RT
P8-1	351+73.93	5.00 LT
P8-2	351+73.93	3.73 RT
P8-3	351+73.93	5.00 RT
P9-1	351+81.93	5.00 LT
P9-2	351+81.93	3.75 LT
P9-3	351+81.93	5.00 RT
P10-1	351+89.93	5.00 LT
P10-2	351+89.93	3.75 RT
P10-3	351+89.93	5.00 RT
P11-1	351+97.93	5.00 LT
P11-2	351+97.93	3.75 LT
P11-3	351+97.93	5.00 RT
P12-1	352+05.93	5.00 LT
P12-2	352+05.93	3.75 RT
P12-3	352+05.93	5.00 RT
P13-1	352+13.93	5.00 LT
P13-2	352+13.93	3.75 LT
P13-3	352+13.93	5.00 RT
P14-1	352+21.93	5.00 LT
P14-2	352+21.93	3.75 RT
P14-3	352+21.93	5.00 RT
P15-1	352+29.93	5.00 LT
P15-2	352+29.93	3.75 LT
P15-3	352+29.93	5.00 RT
P16-1	352+37.93	5.00 LT
P16-2	352+37.93	3.75 RT
P16-3	352+37.93	5.00 RT
P17-1	352+45.93	5.00 LT
P17-2	352+45.93	3.75 LT
P17-3	352+45.93	5.00 RT
P18-1	352+53.93	5.00 LT
P18-2	352+53.93	3.75 RT
P18-3	352+53.93	5.00 RT
P19-1	352+61.93	5.00 LT
P19-2	352+61.93	3.75 LT
P19-3	352+61.93	5.00 RT
P20-1	352+69.93	5.00 LT
P20-2	352+69.93	3.75 RT
P20-3	352+69.93	5.00 RT

HELICAL PILE	STATION	OFFSET
P21-1	352+77.93	5.00 LT
P21-2	352+77.93	3.50 LT
P21-3	352+77.93	5.00 RT
P22-1	352+85.93	5.00 LT
P22-2	352+85.93	3.75 RT
P22-3	352+85.93	5.00 RT
P23-1	352+93.93	5.00 LT
P23-2	352+93.93	3.75 LT
P23-3	352+93.93	5.00 RT
P24-1	353+01.93	5.00 LT
P24-2	353+01.93	3.75 RT
P24-3	353+01.93	5.00 RT
P25-1	353+09.93	5.00 LT
P25-2	353+09.93	3.75 LT
P25-3	353+09.93	5.00 RT
P26-1	353+17.93	5.00 LT
P26-2	353+17.93	3.75 RT
P26-3	353+17.93	5.00 RT
P27-1	353+25.93	5.00 LT
P27-2	353+25.93	3.75 LT
P27-3	353+25.93	5.00 RT
P28-1	353+33.93	5.00 LT
P28-2	353+33.93	3.75 RT
P28-3	353+33.93	5.00 RT
P29-1	353+41.93	5.00 LT
P29-2	353+41.93	3.75 LT
P29-3	353+41.93	5.00 RT
P30-1	353+49.93	5.00 LT
P30-2	353+49.93	3.75 RT
P30-3	353+49.93	5.00 RT
P31-1	353+57.93	5.00 LT
P31-2	353+57.93	3.75 LT
P31-3	353+57.93	5.00 RT
P32-1	353+65.93	5.00 LT
P32-2	353+65.93	3.75 RT
P32-3	353+65.93	5.00 RT
P33-1	353+73.93	5.00 LT
P33-2	353+73.93	3.75 LT
P33-3	353+73.93	5.00 RT
P34-1	353+81.93	5.00 LT
P34-2	353+81.93	3.74 RT
P34-3	353+81.93	5.00 RT
P35-1	353+89.93	5.00 LT
P35-2	353+89.93	3.76 LT
P35-3	353+89.93	5.00 RT
P36-1	353+97.93	5.00 LT
P36-2	353+97.93	3.74 RT
P36-3	353+97.93	5.00 RT
P37-1	354+05.93	5.00 LT
P37-2	354+05.93	3.76 LT
P37-3	354+05.93	5.00 RT
P38-1	354+13.93	5.00 LT
P38-2	354+13.93	3.74 RT
P38-3	354+13.93	5.00 RT
P39-1	354+21.93	5.00 LT
P39-2	354+21.93	3.76 LT
P39-3	354+21.93	5.00 RT
P40-1	354+29.93	5.00 LT
P40-2	354+29.93	3.74 RT
P40-3	354+29.93	5.00 RT

HELICAL PILE	STATION	OFFSET
P41-1	354+37.93	5.00 LT
P41-2	354+37.93	3.76 LT
P41-3	354+37.93	5.00 RT
P42-1	354+45.93	5.00 LT
P42-2	354+45.93	3.73 RT
P42-3	354+45.93	5.00 RT
P43-1	354+53.93	5.00 LT
P43-2	354+53.93	3.77 LT
P43-3	354+53.93	5.00 RT
P44-1	354+61.93	5.00 LT
P44-2	354+61.93	3.73 RT
P44-3	354+61.93	5.00 RT
P45-1	354+69.93	5.00 LT
P45-2	354+69.93	3.77 LT
P45-3	354+69.93	5.00 RT
P46-1	354+77.93	5.00 LT
P46-2	354+77.93	3.73 RT
P46-3	354+77.93	5.00 RT
P47-1	354+85.93	5.00 LT
P47-2	354+85.93	3.78 LT
P47-3	354+85.93	5.00 RT
P48-1	354+93.93	5.00 LT
P48-2	354+93.93	3.72 RT
P48-3	354+93.93	5.00 RT
P49-1	355+01.93	5.00 LT
P49-2	355+01.93	3.78 LT
P49-3	355+01.93	5.00 RT
P50-1	355+09.93	5.00 LT
P50-2	355+09.93	3.72 RT
P50-3	355+09.93	5.00 RT
P51-1	355+17.93	5.00 LT
P51-2	355+17.93	3.78 LT
P51-3	355+17.93	5.00 RT
P52-1	355+25.93	5.00 LT
P52-2	355+25.93	3.74 RT
P52-3	355+25.93	5.00 RT
P53-1	355+33.93	5.00 LT
P53-2	355+33.93	3.77 LT
P53-3	355+33.93	5.00 RT
P54-1	355+41.93	5.00 LT
P54-2	355+41.93	3.78 RT
P54-3	355+41.93	5.00 RT

SACRIFICIAL HELICAL TEST PILE	STATION	OFFSET
SP-1	352+17.93	5.00 LT
SP-2	353+29.93	5.00 LT
SP-3	354+01.93	5.00 LT

HELICAL PILE	STATION	OFFSET
P53-5	355+35.37	0.56 RT
P53-4	355+32.50	0.56 LT
P50-5	355+11.37	0.56 LT
P50-4	355+8.49	0.56 RT
P47-5	354+87.38	0.56 RT
P47-4	354+84.51	0.56 LT
P44-5	354+63.38	0.56 LT
P44-4	354+60.51	0.56 RT
P41-5	354+39.38	0.56 RT
P41-4	354+36.50	0.56 LT
P38-5	354+15.38	0.56 LT
P38-4	354+12.50	0.56 RT
P35-5	353+91.38	0.56 RT
P35-4	353+88.50	0.56 LT
P32-5	353+67.37	0.56 LT
P32-4	353+64.49	0.56 RT
P29-5	353+43.37	0.56 RT
P29-4	353+40.50	0.56 LT
P26-5	353+19.37	0.56 LT
P26-4	353+16.50	0.56 RT
P23-5	352+95.37	0.56 RT
P23-4	352+92.49	0.56 LT
P20-5	352+71.37	0.56 LT
P20-4	352+68.50	0.56 RT
P17-5	352+47.37	0.56 RT
P17-4	352+44.50	0.56 LT
P14-5	352+23.37	0.56 LT
P14-4	352+20.49	0.56 RT
P11-5	351+99.37	0.56 RT
P11-4	351+96.49	0.56 LT
P8-5	351+75.37	0.56 LT
P8-4	351+72.49	0.56 RT
P5-5	351+51.37	0.56 RT
P5-4	351+48.48	0.56 LT
P2-5	351+27.37	0.56 LT
P2-4	351+24.49	0.56 RT

NOTE:
SEE SHEETS 8 AND 9 FOR PILE LAYOUT AND ADDITIONAL NOTES.

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	68	141
PROJECT FILE NO. 609211			

HELICAL PILE LAYOUT TABLE

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER
USE ONLY PRINTS OF LATEST DATE

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

609211_BR10P03020.DWG Plotted on 5-Apr-2024 9:18 AM

A00860 - 472

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT

AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

A00860 - 473

609211_BR11(P03020).DWG Plotted on 5-Apr-2024 9:18 AM

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	69	141
PROJECT FILE NO. 609211			

HELICAL PILE DETAILS

NOTES:

1. THE TABLE BELOW SUMMARIZES THE FACTORED AXIAL DESIGN LOADS PER PILE FOR AASHTO LRFD BRIDGE SPECIFICATIONS STRENGTH I LOAD COMBINATIONS. THE NOMINAL GEOTECHNICAL RESISTANCE, AND THE FACTORED GEOTECHNICAL RESISTANCE PER PILE:

	FACTORED DESIGN LOADS	NOMINAL GEOTECHNICAL RESISTANCE	FACTORED GEOTECHNICAL RESISTANCE**
HELICAL PILE (COMPRESSION)	10.00 KIPS	17.00 KIPS	11.90 KIPS
HELICAL PILE (TENSION)	5.00 KIPS	14.80 KIPS	10.35 KIPS

**FACTORED GEOTECHNICAL RESISTANCE IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE AND A RESISTANCE FACTOR OF 0.70.

2. THE TOP HELIX OF ALL PROPOSED HELICAL PILES SHALL BE TORQUED TO A MINIMUM EMBEDMENT OF 9 FEET BELOW EXISTING GRADE, EXCEPT AS NOTED ON SHEET 8 ADJACENT TO THE SEWER LINE.

3. THREE PRE-PRODUCTION VERIFICATION LOAD TESTS FOR THREE SACRIFICIAL PILES ARE REQUIRED TO CONFIRM THE HELICAL PILE NOMINAL RESISTANCE. LOAD TESTING SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIAL PROVISION REQUIREMENTS, THE GEOTECHNICAL REPORT RECOMMENDATIONS, AND THE SACRIFICIAL PILE LOCATIONS SHALL BE AGREED UPON BY THE CONTRACTOR AND ENGINEER. A RESISTANCE FACTOR OF 0.70 MAY BE UTILIZED UPON SUCCESSFUL COMPLETION OF STATIC LOAD TESTING.

4. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS FOR THE PROPOSED HELICAL PILES SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER LICENSED IN THE COMMONWEALTH OF MASSACHUSETTS.

5. ALTERNATIVE ATTACHMENT AND ASSEMBLIES CAN BE SUBMITTED THROUGH THE SHOP DRAWING PROCESS FOR REVIEW AND APPROVAL.

6. LATERAL PILES ALTERNATE DIRECTION EVERY BENT.

7. LATERAL AND LONGITUDINAL PILE ANGLE CAN RANGE BETWEEN 25° AND 35°.

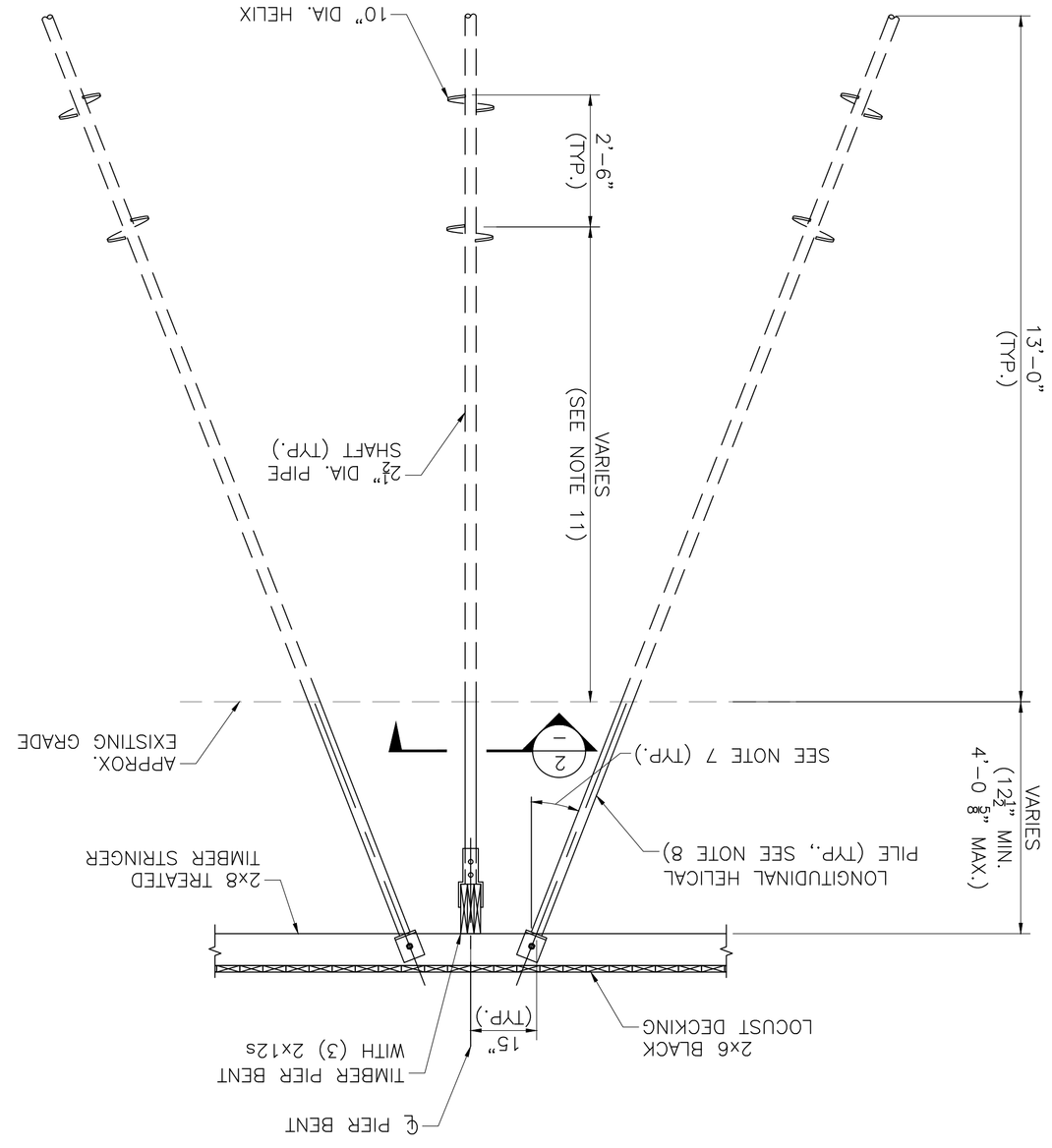
8. LONGITUDINAL BATTERED PILES SHALL BE AT EVERY THIRD PIER BENT TO RESIST LONGITUDINAL LOADING.

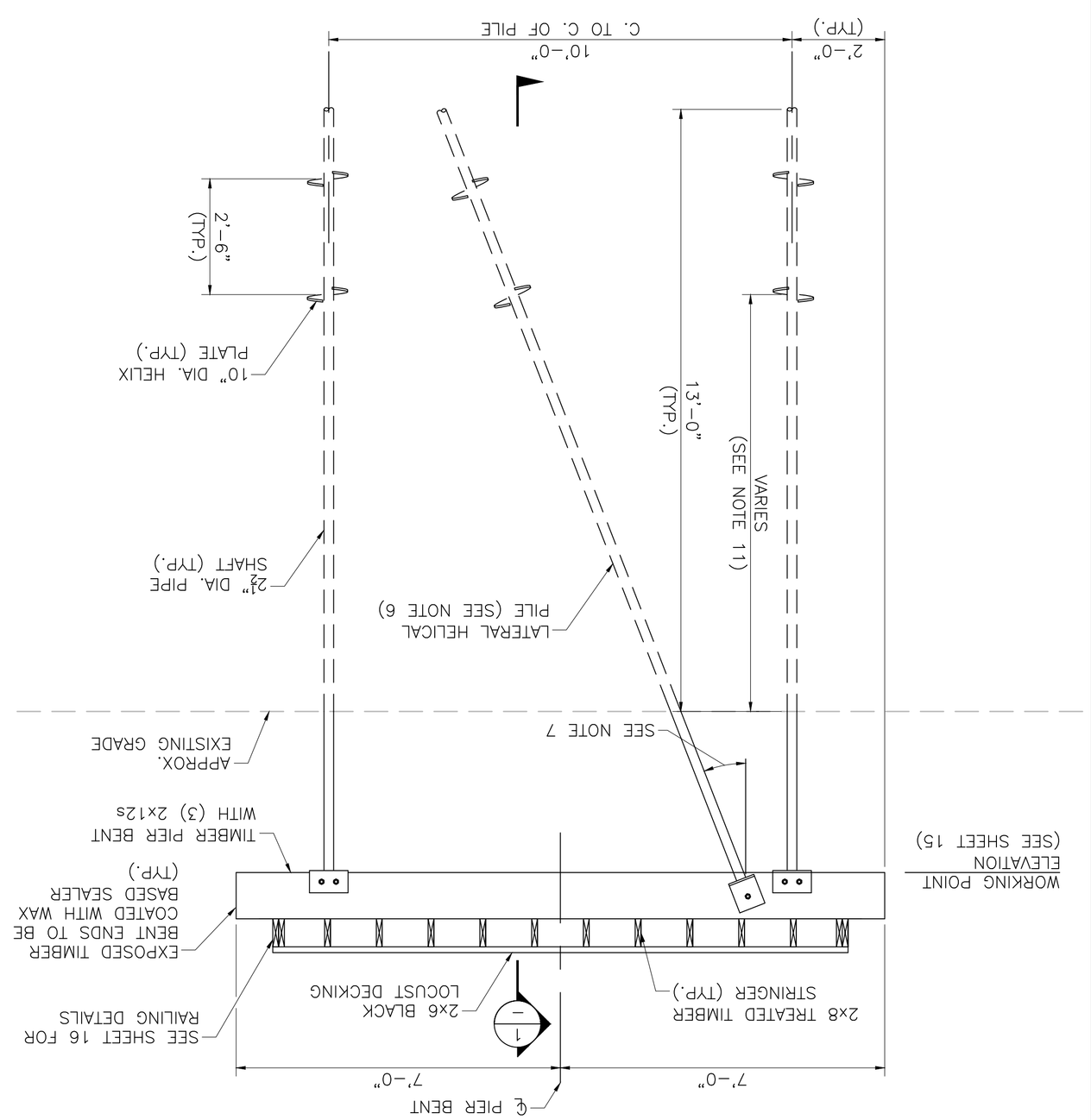
9. HELICAL PILES AND CONNECTIONS SHALL BE HOT-DIPPED GALVANIZED.

10. REMOVAL OF SURFICIAL COBBLES/BOULDERS WILL BE REQUIRED PRIOR TO HELICAL PILE INSTALLATION. PRE-DRILLING MAY BE REQUIRED TO PENETRATE THE COBBLES AND BOULDERS.

11. HELICAL PILE MINIMUM EMBEDMENT SHALL BE 11'-6" TO THE TOP HELICE FOR ALL P#-3 LOCATIONS WITH AN OFFSET LESS THAN 3'-6" BETWEEN THE CENTER OF PILE AND THE EDGE OF THE SEWER LINE. MINIMUM EMBEDMENT FOR ALL REMAINING PILES SHALL BE 9'-0".

12. FOR ADDITIONAL HELICAL PILE REQUIREMENTS, SEE SPECIAL PROVISION ITEM NO. 943.20.





HELICAL PILE TYPICAL SECTION

SCALE: ½" = 1'-0"

SECTION

SCALE: 3" = 1'-0"

1

–

SECTION

SCALE: ½" = 1'-0"

2

–

LATERAL AND LONGITUDINAL HELICAL PILE ATTACHMENT ASSEMBLY

SCALE: 1½" = 1'-0"

HELICAL PILE ATTACHMENT ASSEMBLY

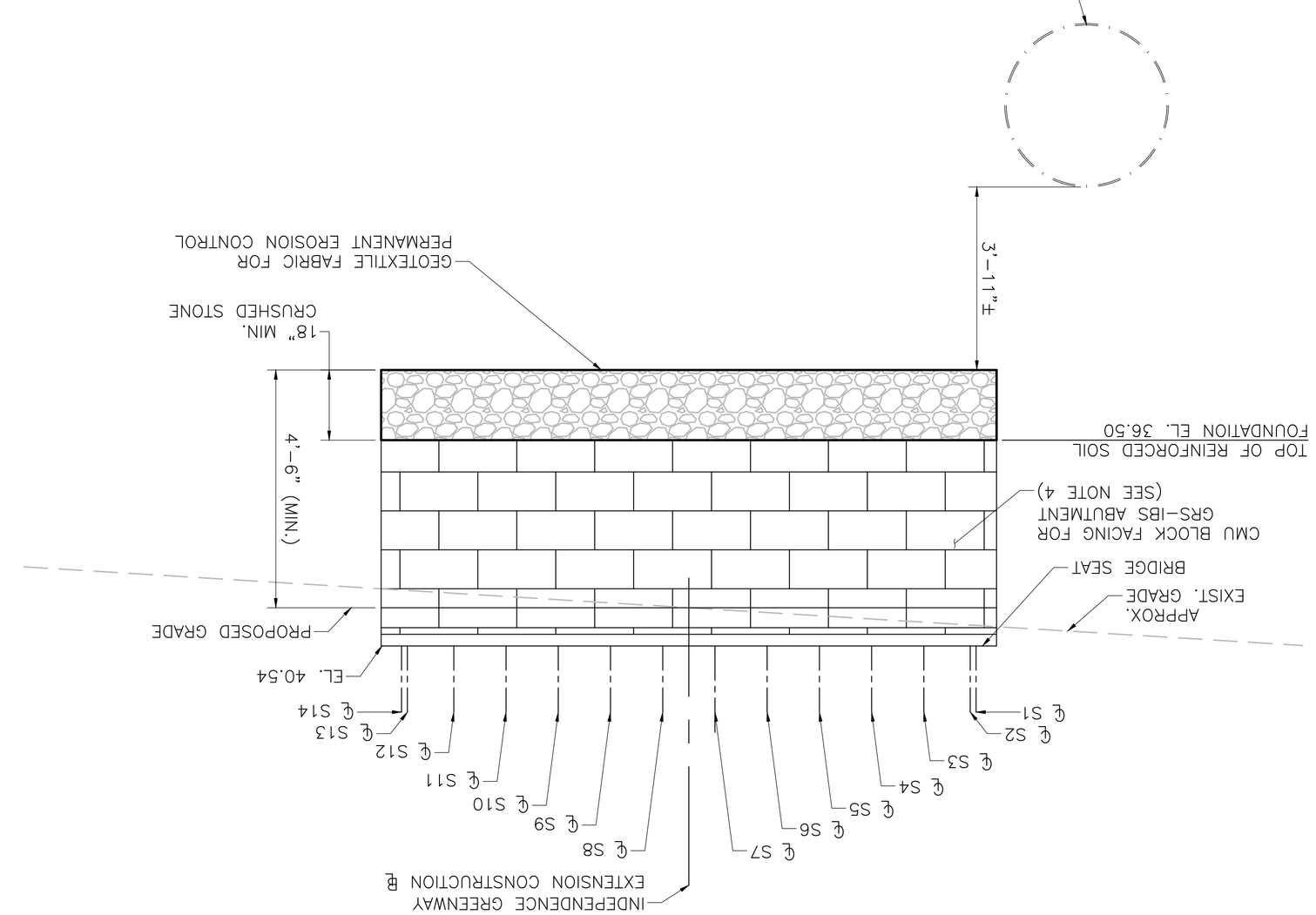
SCALE: 1½" = 1'-0"

Y:\Shared\Engineering\Projects\2017\17118\Dwg\Bridge\Pedestrian Walkway

Proposal No. 609211-132091

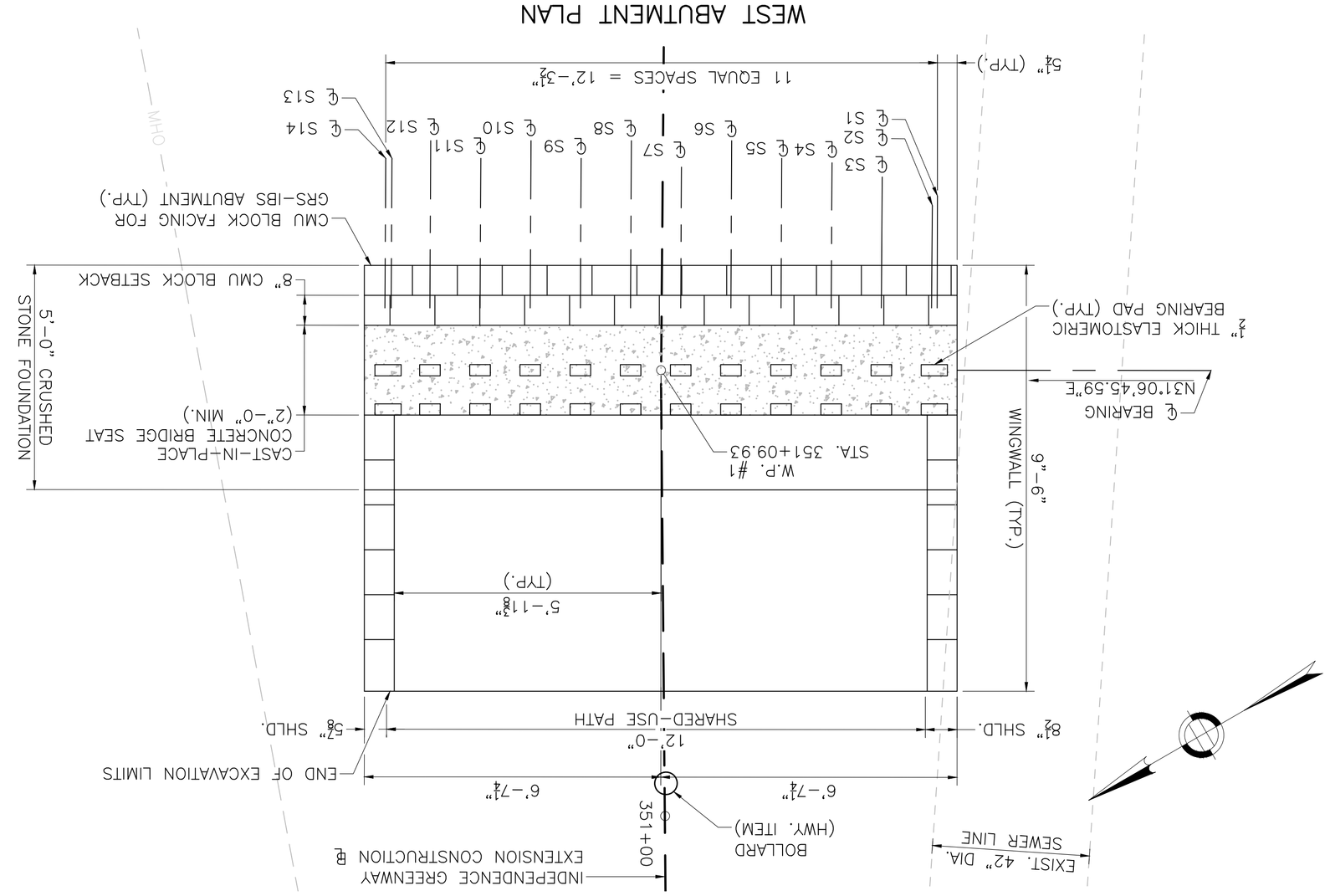
WEST ABUTMENT ELEVATION

SCALE: $\frac{1}{4}$" = 1'-0"



WEST ABUTMENT PLAN

SCALE: $\frac{1}{4}$" = 1'-0"

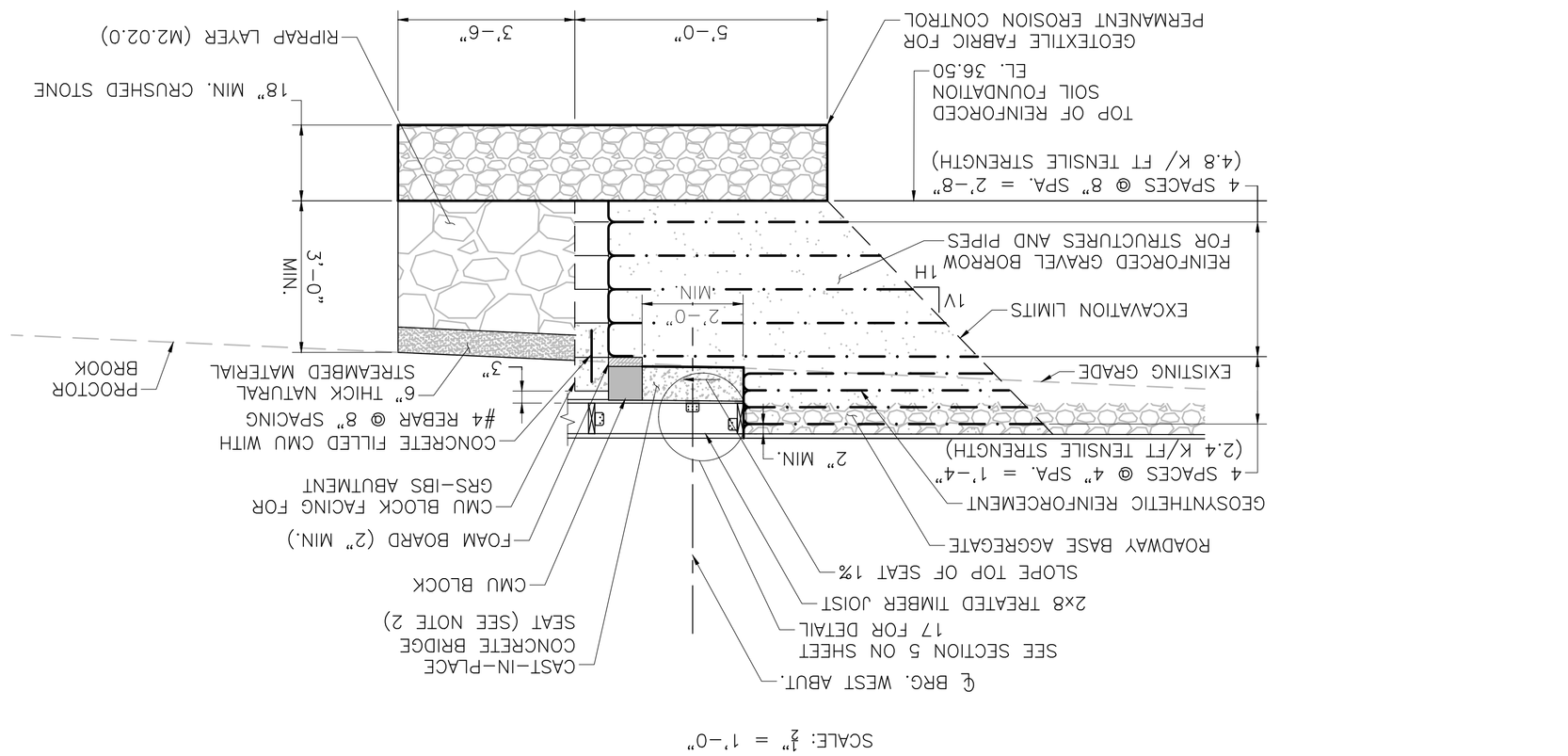


GRS-IBS ABUTMENT NOTES:

1. THE FACTORED BEARING PRESSURE = 0.897 KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.
   FACTORED BEARING RESISTANCE = 5.8 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.65.
2. CAST-IN-PLACE CONCRETE BEARING SEAT SHALL BE 5000 PSI HP CEMENT CONCRETE WITH ONE LAYER OF #4 WELDED WIRE FABRIC PLACED AT MID-HEIGHT.
3. THE GEOTEXTILE REINFORCEMENT SHALL EXTEND BETWEEN THE LAYERS OF CMU BLOCK.
4. ALL CMU BLOCKS ABOVE PROPOSED GRADE AND THE FIRST BLOCK BELOW GRADE SHALL BE HOLLOW AND FILLED WITH BLOCK WALL CONCRETE FILL. ALL CMU BLOCKS BELOW THAT POINT SHALL BE SOLID. SEE SECTION VIEW FOR LIMITS OF CONCRETE FILL CMU BLOCKS ABOVE GRADE.

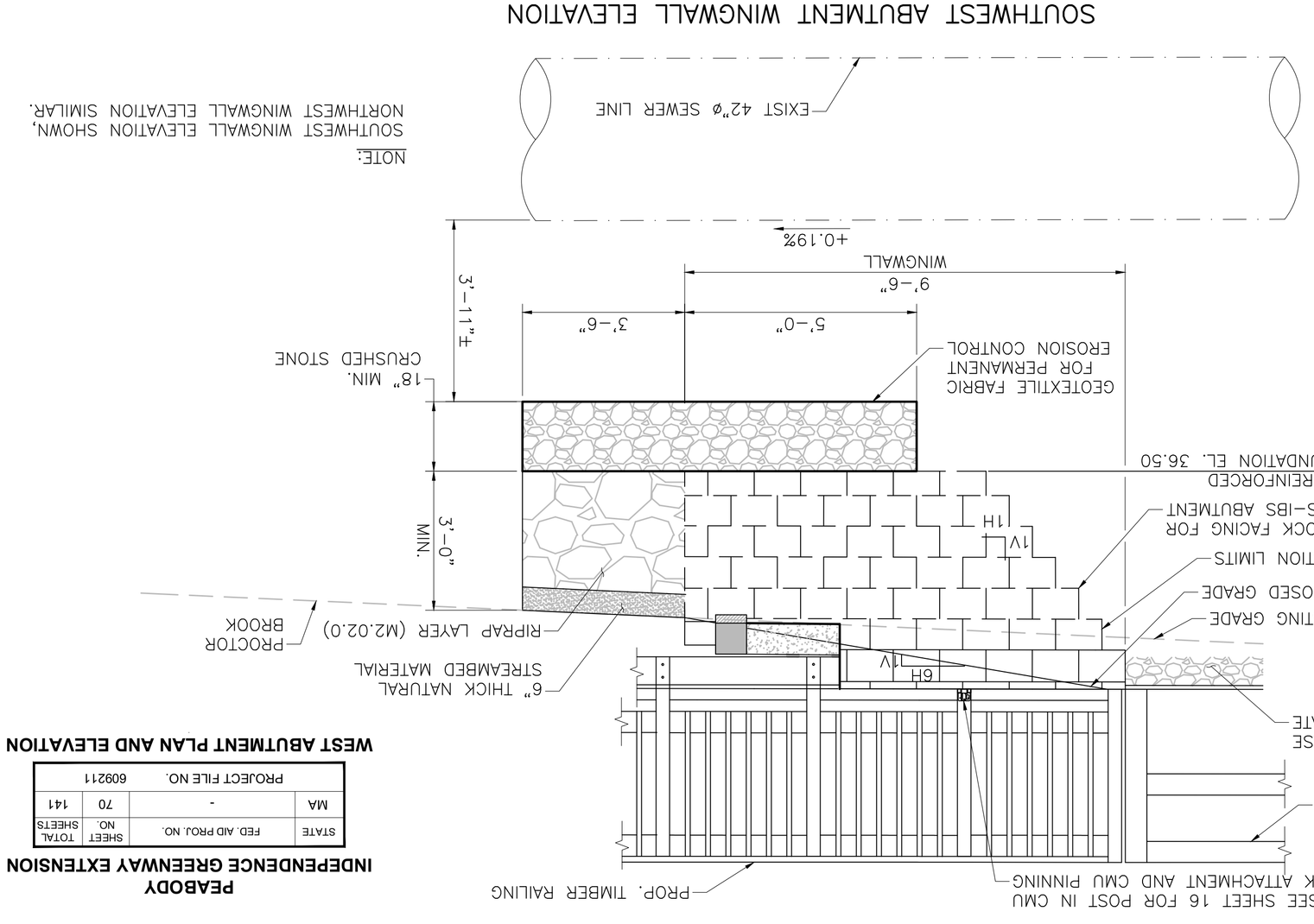
WEST ABUTMENT TYPICAL SECTION

SCALE: $\frac{1}{4}$" = 1'-0"



SOUTHWEST ABUTMENT WINGWALL ELEVATION

SCALE: $\frac{1}{4}$" = 1'-0"



NOTE:
SOUTHWEST WINGWALL ELEVATION SHOWN, NORTHWEST WINGWALL ELEVATION SIMILAR.

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

PEABODY
INDEPENDENCE GREENWAY EXTENSION
WEST ABUTMENT PLAN AND ELEVATION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	70	141

PROJECT FILE NO. 609211

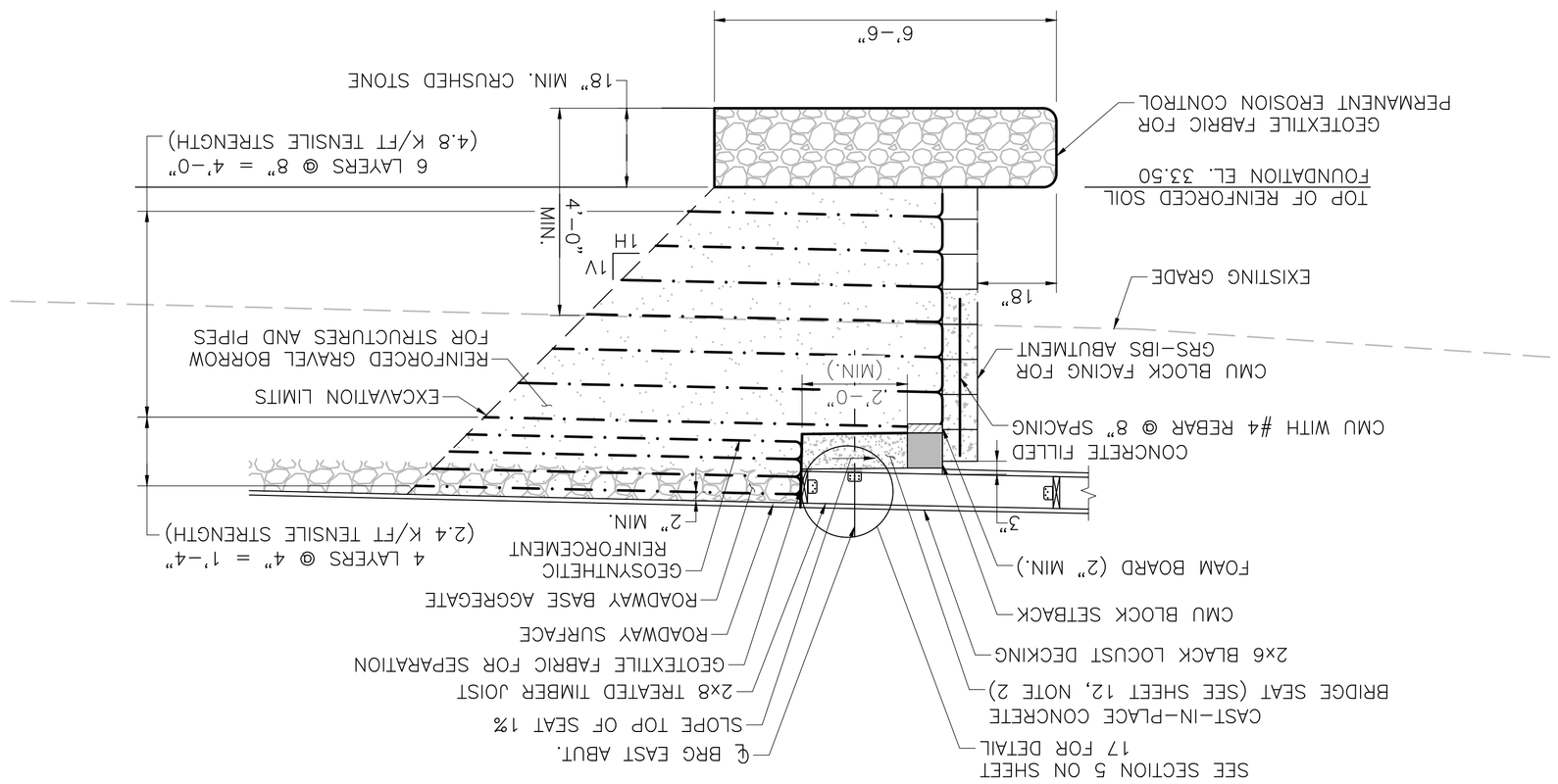
DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT
AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

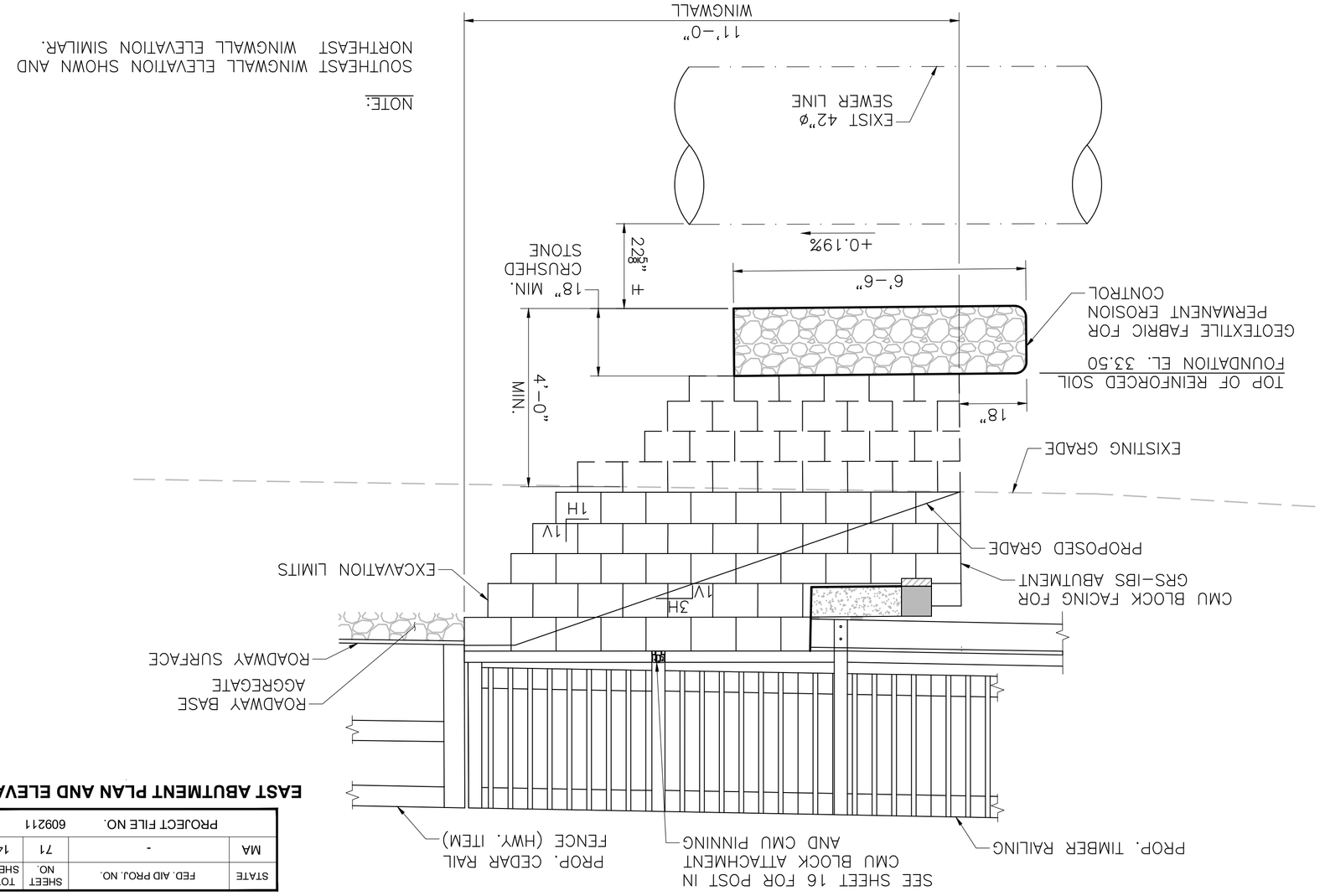
USE ONLY PRINTS OF LATEST DATE

NOTE:
SEE SHEET 12 FOR GRS-IBS ABUTMENT NOTES.

EAST ABUTMENT SECTION
SCALE: 1/2" = 1'-0"



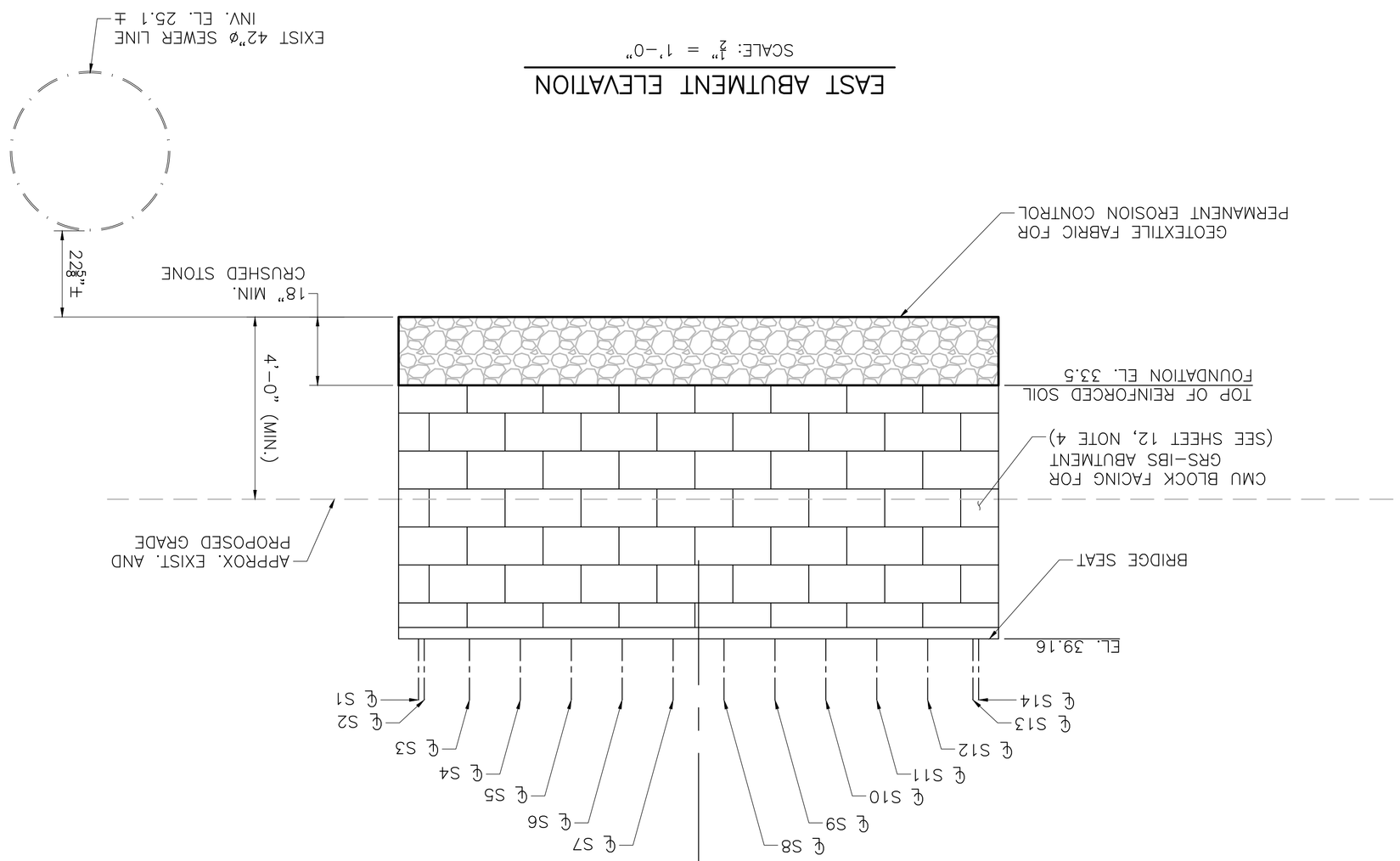
SOUTHEAST ABUTMENT WINGWALL ELEVATION
SCALE: 1/2" = 1'-0"



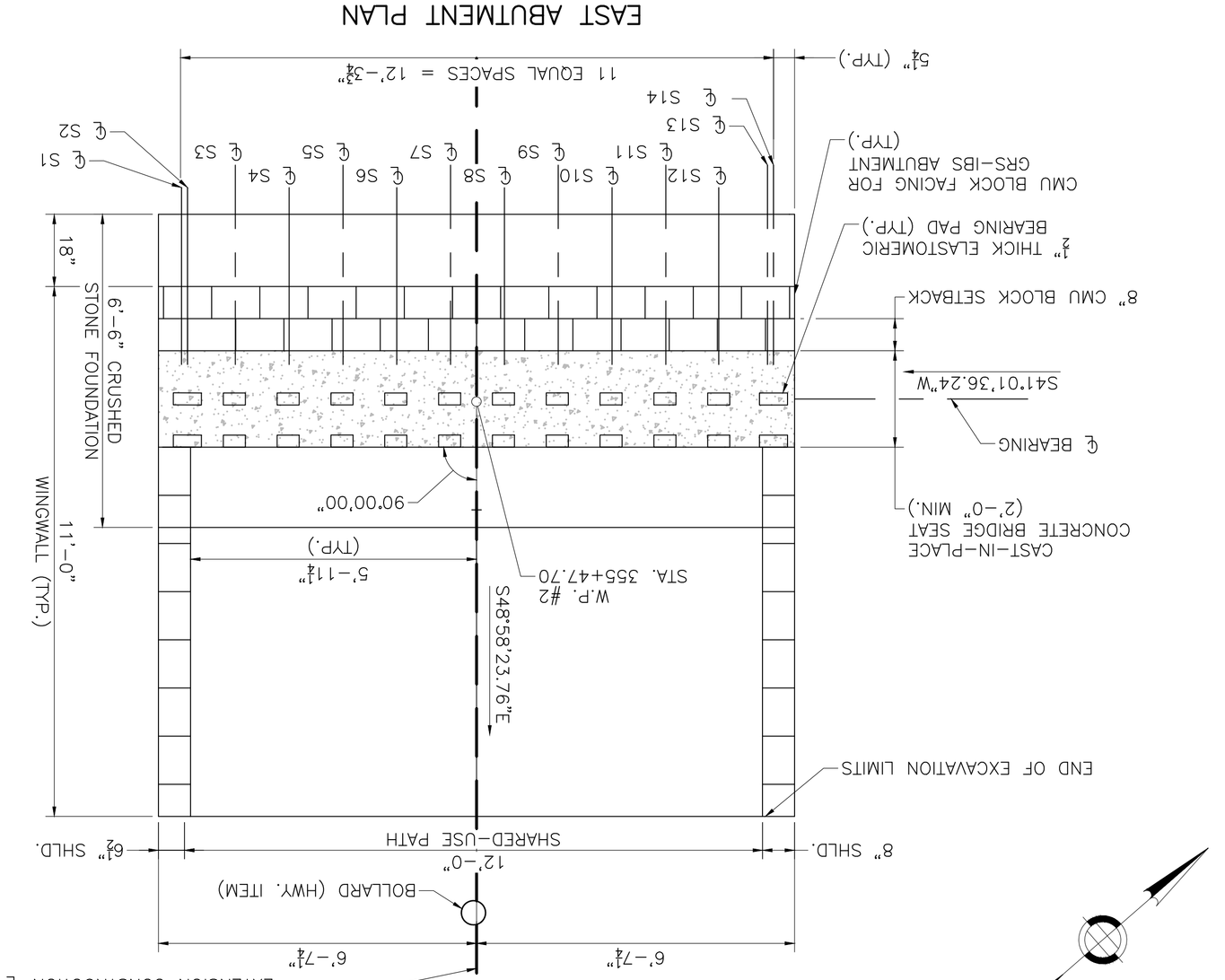
NOTE:
SOUTHEAST WINGWALL ELEVATION SHOWN AND NORTHEAST WINGWALL ELEVATION SIMILAR.

EXIST. 42" DIA. SEWER LINE

EAST ABUTMENT ELEVATION
SCALE: 1/2" = 1'-0"



EAST ABUTMENT PLAN
SCALE: 1/2" = 1'-0"



EAST ABUTMENT PLAN AND ELEVATION

PROJECT FILE NO. 609211		
STATE	FED. AID PROJ. NO.	SHEET NO. / TOTAL SHEETS
MA	-	71 / 141

PEABODY
INDEPENDENCE GREENWAY EXTENSION

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT

AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

A00860 - 476

609211_BR16(P03020).DWG Plotted on 5-Apr-2024 9:18 AM

Y:\Shared\Engineering\Projects\20171718\Dwg\Bridge\Pedestrian Walkway

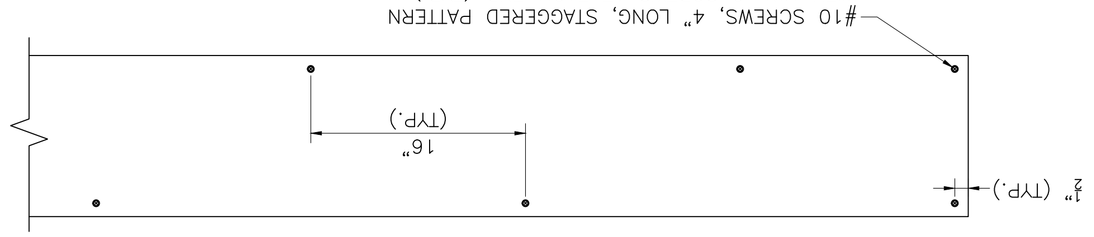
Proposal No. 609211-132091

PIER CAP ASSEMBLY DETAIL

SCALE: 1½" = 1'-0"

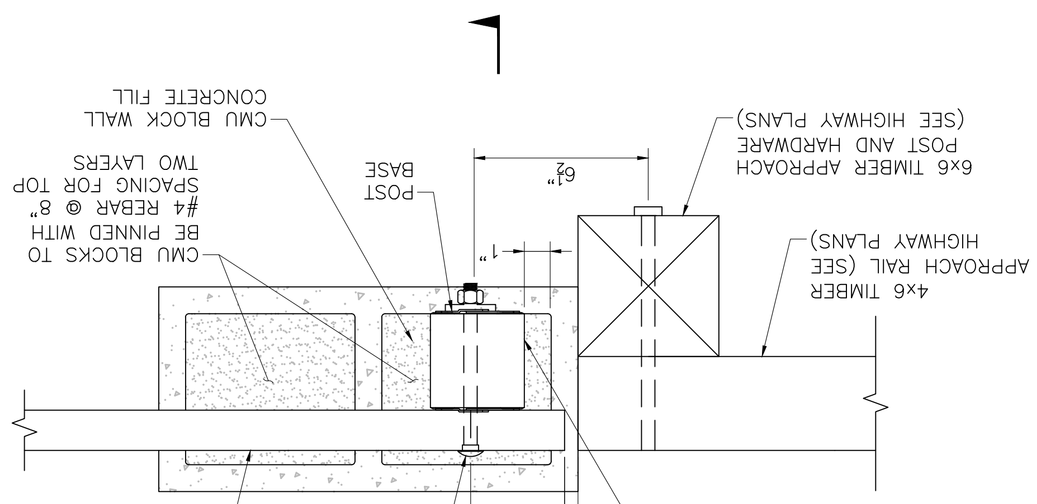
NOTES:

1. DETAIL SHOWN FOR PIER CAP ASSEMBLY, SISTERED EXTERIOR STRINGERS SIMILAR.
2. FOR CONNECTION OF 3 MEMBERS, SCREWS TO BE INSTALLED ON BOTH SIDES. FOR CONNECTIONS OF 2 MEMBERS SCREWS TO BE INSTALLED ON ONE SIDE



RAILING POST IN CMU BLOCK PLAN

SCALE: 3" = 1'-0"

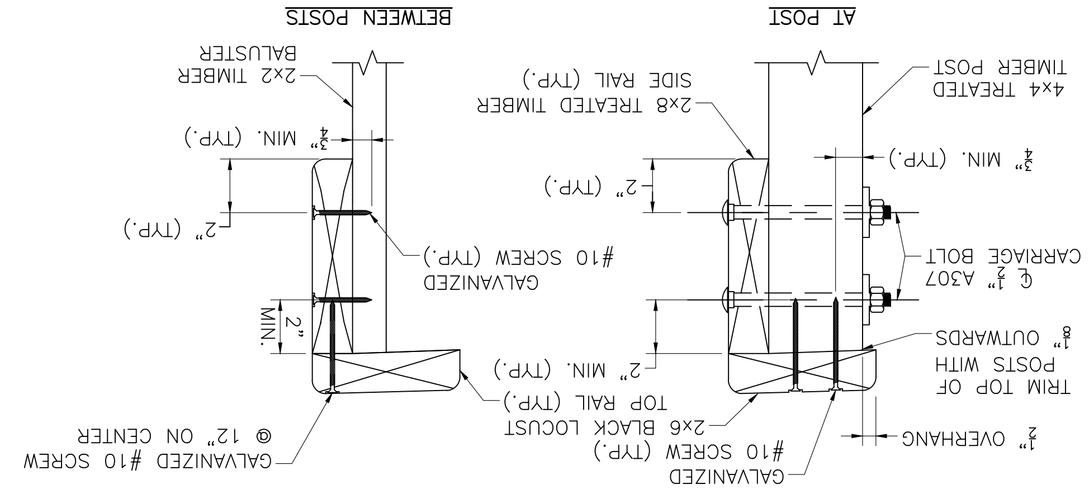


DETAIL

SCALE: 3" = 1'-0"

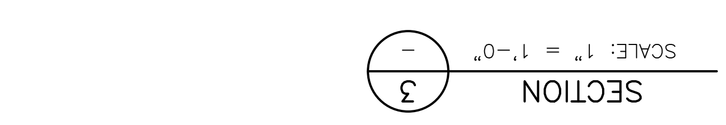
NOTE:

RUB RAIL CONNECTION NOT SHOWN BUT SIMILAR.



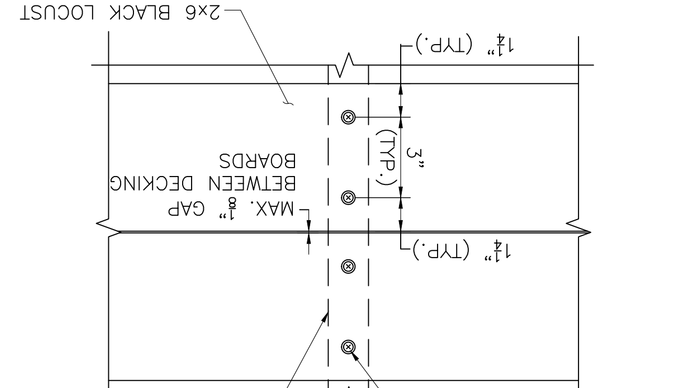
SECTION

SCALE: 1" = 1'-0"



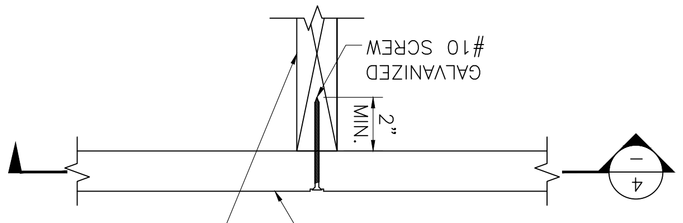
SECTION

SCALE: 3" = 1'-0"



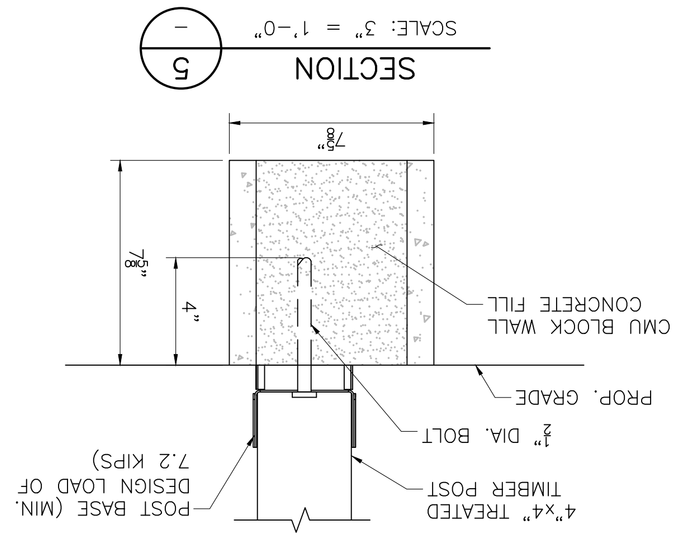
DETAIL

SCALE: 3" = 1'-0"



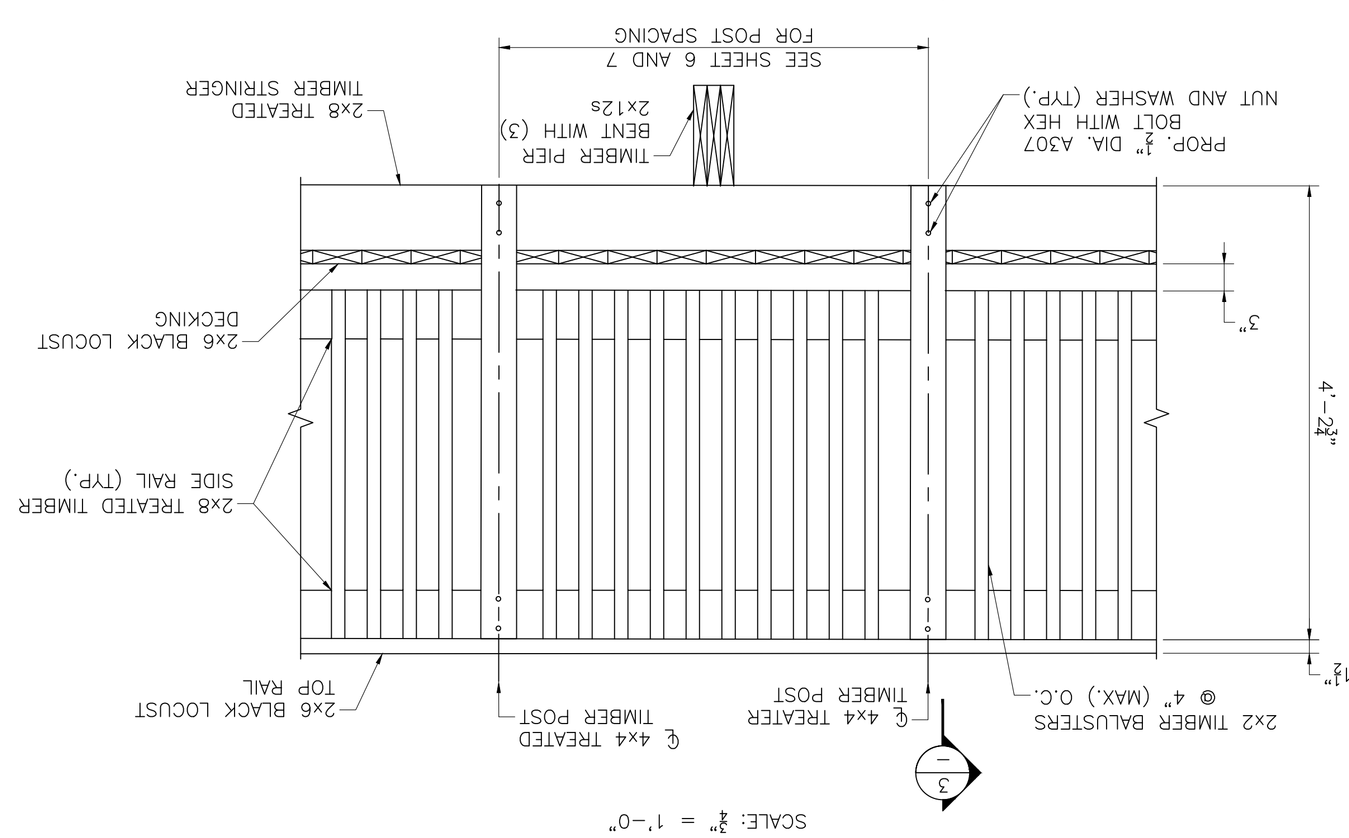
SECTION

SCALE: 3" = 1'-0"



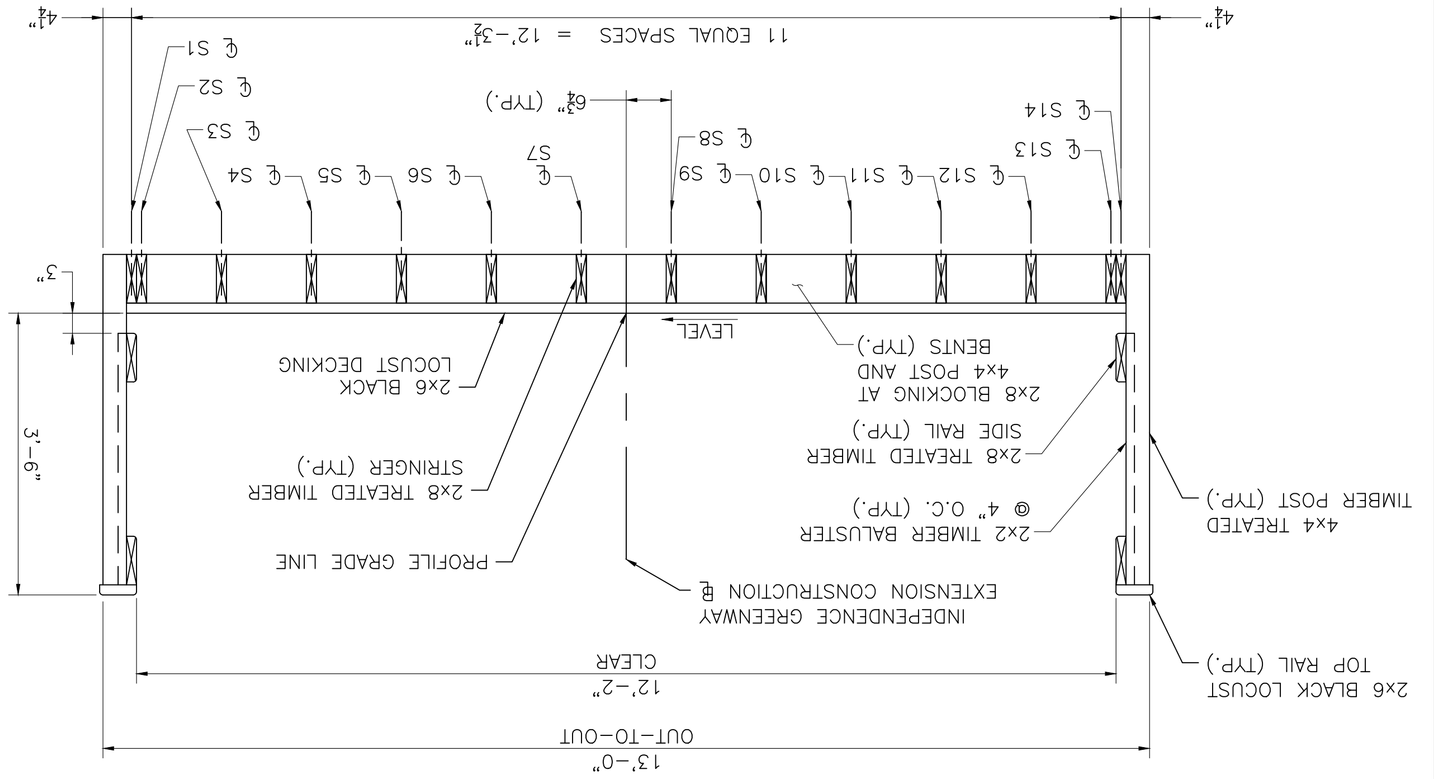
RAILING ELEVATION

SCALE: 1" = 1'-0"



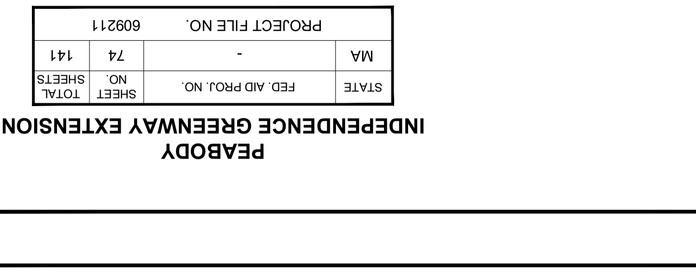
TYPICAL SECTION

SCALE: ¾" = 1'-0"



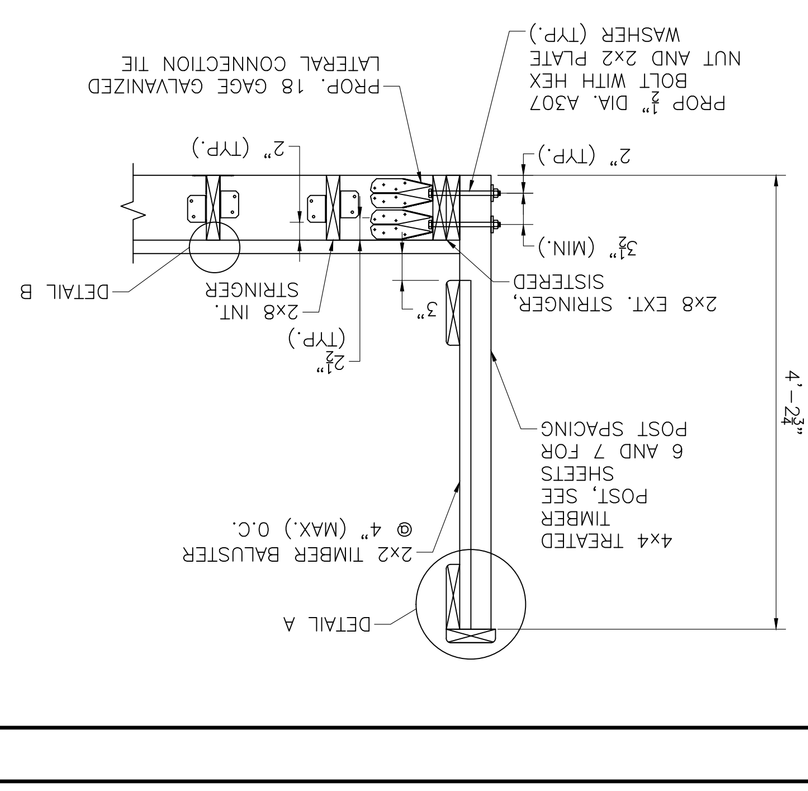
DETAIL

SCALE: 3" = 1'-0"



SECTION

SCALE: 1" = 1'-0"



PEABODY INDEPENDENCE GREENWAY EXTENSION

TYPICAL SECTION AND TIMBER CONNECTION DETAILS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	74	141
PROJECT FILE NO. 609211			

Y:\Shared\Engineering\Projects\207\71\18\Dwg\Bridge\Pedestrian Walkway

CONNECTION HARDWARE GENERAL NOTES:

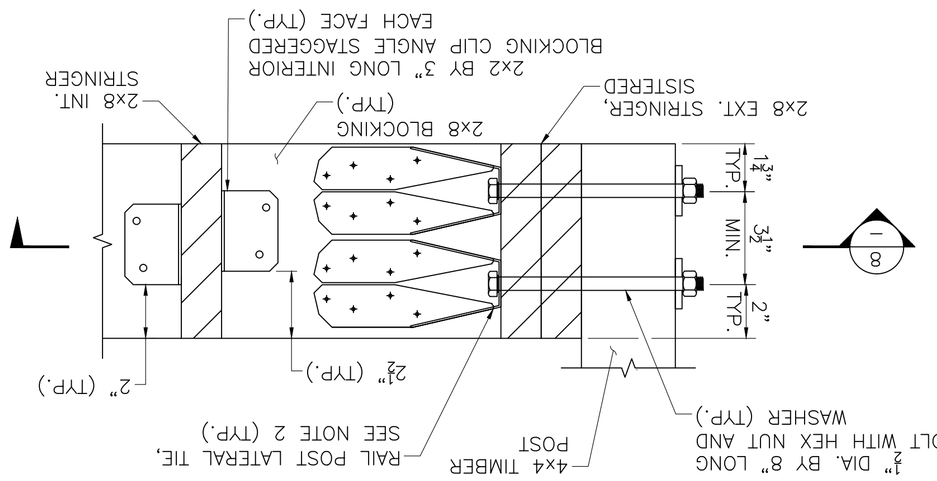
1. ALL CONNECTION COMPONENTS, OTHER THAN BOLTS, SHALL BE 33 KSI STAINLESS STEEL, GALVANIZED STEEL, OR ZINC COATED STEEL, UNLESS OTHERWISE SPECIFIED.
2. ALL CONNECTION COMPONENTS SHALL BE A MINIMUM OF 18 GAUGE STEEL.
3. ALL PROPOSED BOLTS SHALL BE EITHER ASTM A307 GALVANIZED BOLTS, OR ASTM SS316 STAINLESS STEEL BOLTS.
4. ALL WOOD OR LAG SCREWS SHALL BE GALVANIZED OR STAINLESS STEEL #10 BY 1½" LONG, UNLESS OTHERWISE NOTED.

RAIL POST CONNECTION TO STRINGER ELEVATION

SCALE: 3" = 1'–0"

NOTES:

1. TIMBER DECKING NOT SHOWN FOR CLARITY.
2. LATERAL TIES SHALL BE STAINLESS STEEL, GALVANIZED, OR ZINC COATED. EACH TIE SHALL PROVIDE A MINIMUM LATERAL TENSILE CAPACITY OF 1,500 LBS.



SECTION

SCALE: 3" = 1'–0"

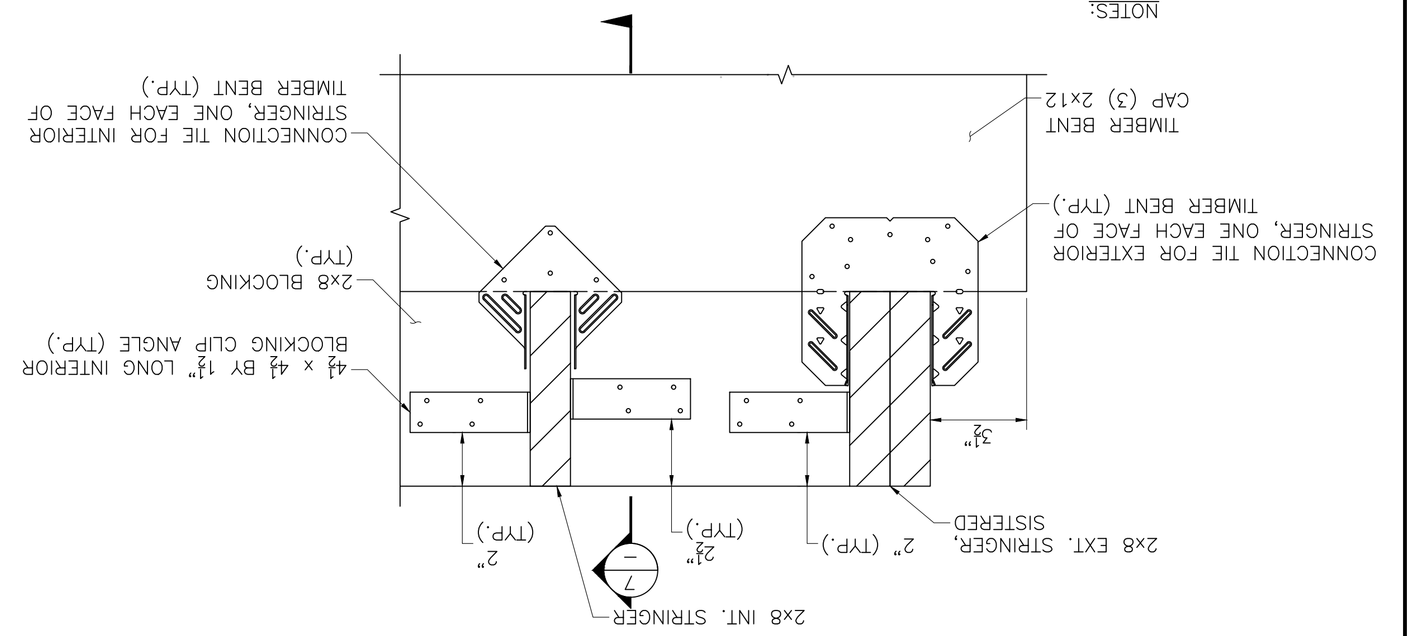
7

STRINGER AT PIER BENT SUPPORT ELEVATION

SCALE: 3" = 1'–0"

NOTES:

1. TIMBER DECKING NOT SHOWN FOR CLARITY.

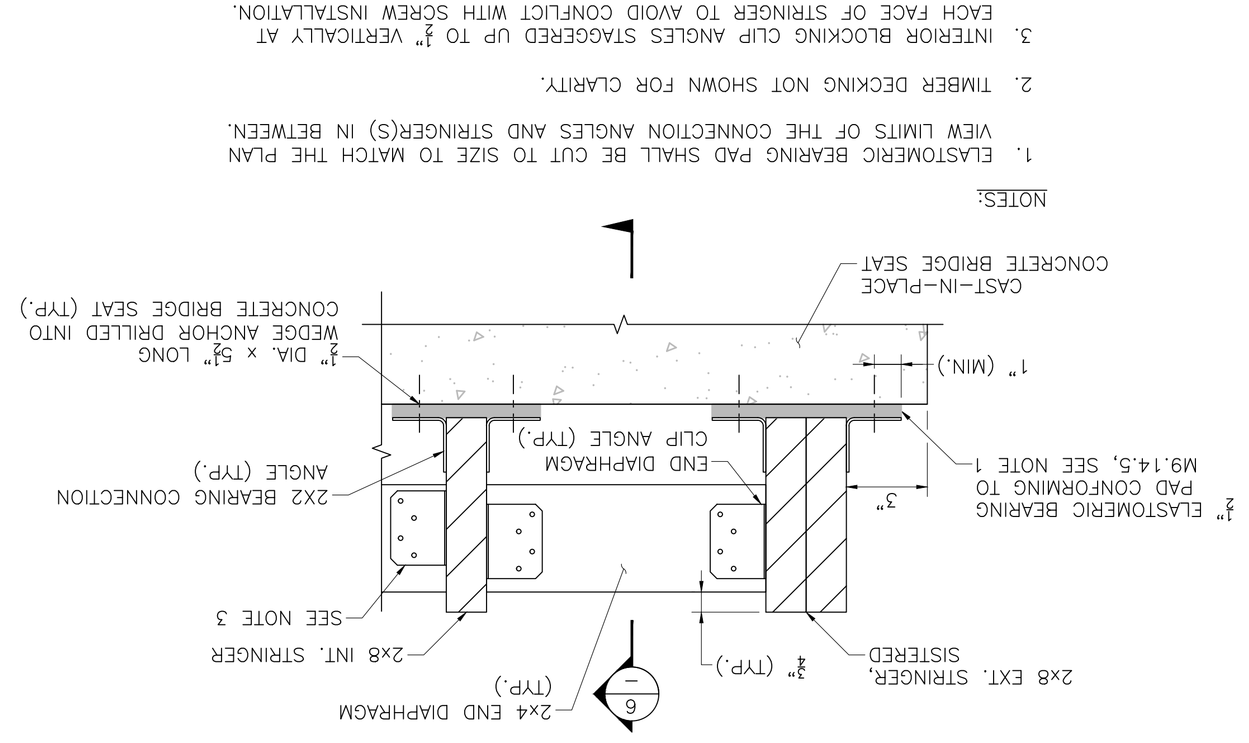


END DIAPHRAGM & BEARING ELEVATION

SCALE: 3" = 1'–0"

NOTES:

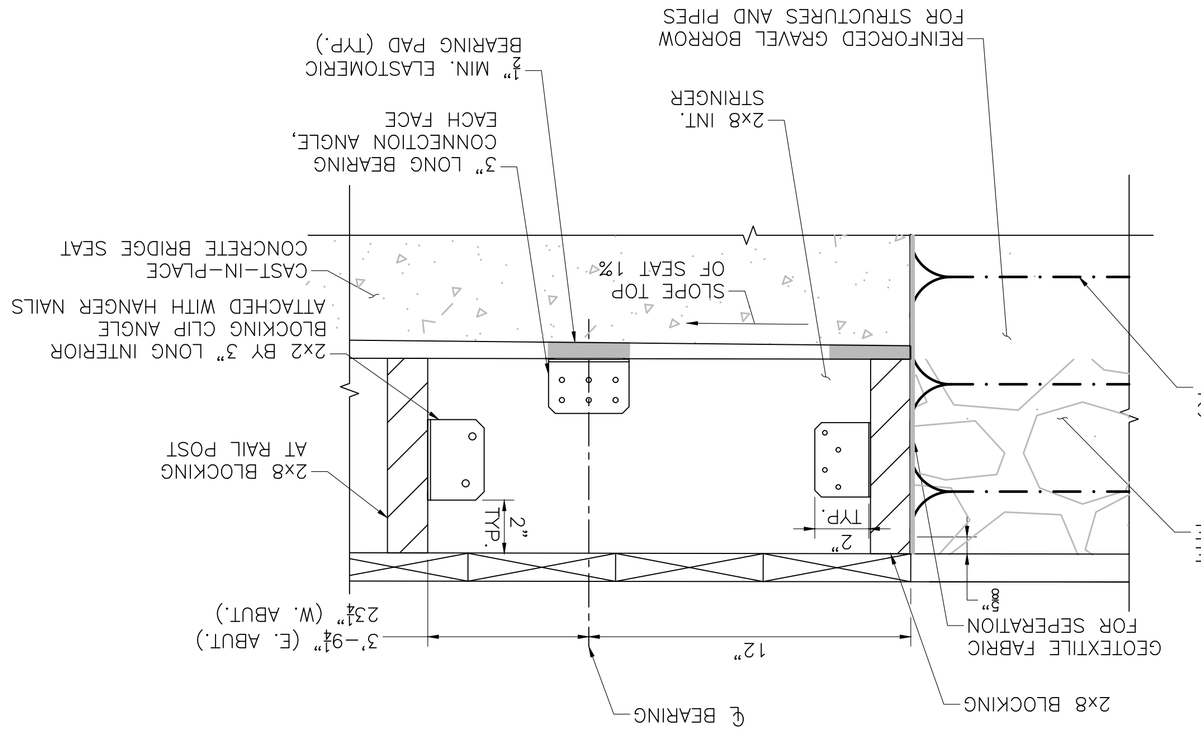
1. ELASTOMERIC BEARING PAD SHALL BE CUT TO SIZE TO MATCH THE PLAN VIEW LIMITS OF THE CONNECTION ANGLES AND STRINGER(S) IN BETWEEN.
2. TIMBER DECKING NOT SHOWN FOR CLARITY.
3. INTERIOR BLOCKING CLIP ANGLES STAGGERED UP TO ½" VERTICALLY AT EACH FACE OF STRINGER TO AVOID CONFLICT WITH SCREW INSTALLATION.

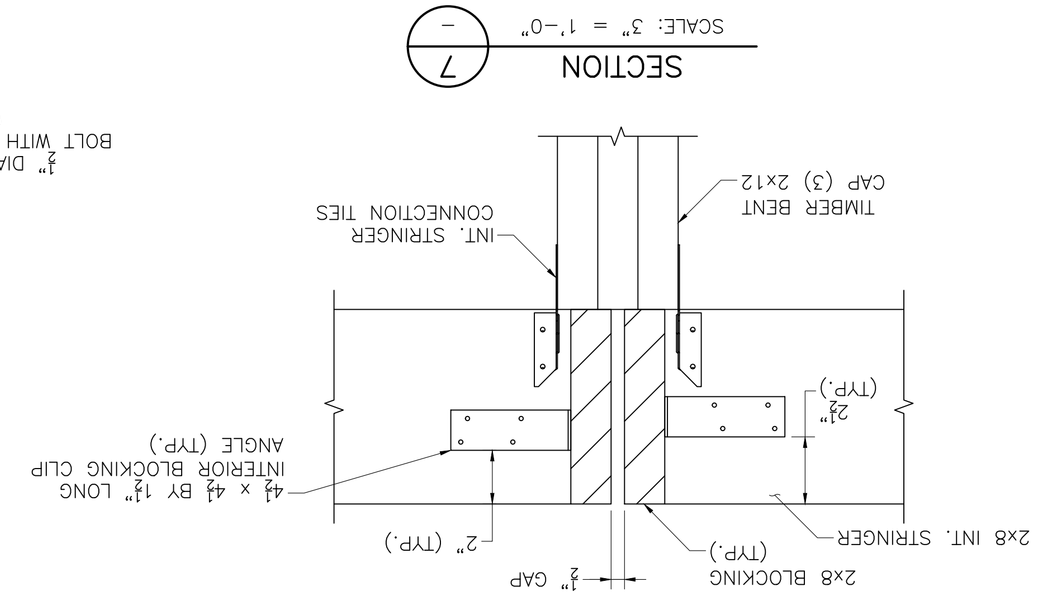


SECTION

SCALE: 3" = 1'–0"

6

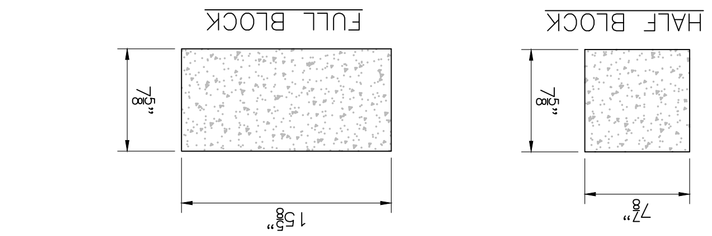


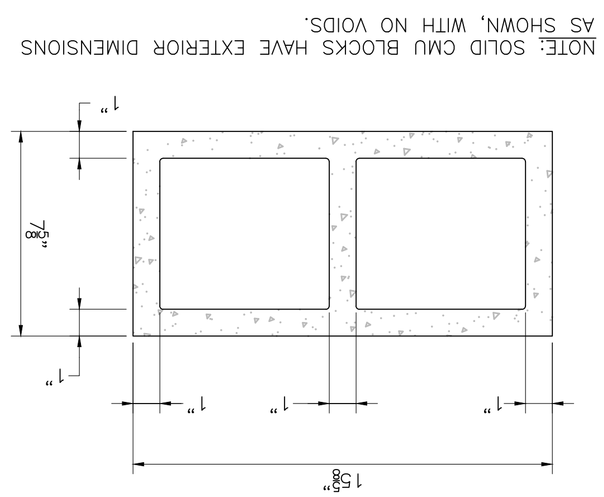


TYPICAL CMU BLOCK ELEVATION

SCALE: 1½" = 1'–0"

NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.





8" CMU PLAN VIEW

SCALE: 3" = 1'–0"

NOTE: SOLID CMU BLOCKS HAVE EXTERIOR DIMENSIONS AS SHOWN, WITH NO VOIDS.

SECTION

SCALE: 3" = 1'–0"

8

TYPICAL SECTION AND TIMBER CONNECTION DETAILS

PEABODY
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	75	141
	PROJECT FILE NO.	609211	

THIRD STRUCTURAL SUBMISSION (S3) 05-April-2024

609211_BR17P03020.DWG Plotted on 5-Apr-2024 9:18 AM

A00860 - 477

SHEET 17 OF 17 SHEETS BRIDGE NO. P–03–020 (CAK)

DATE	DESCRIPTION
MMMM DD, YYYY	ISSUED FOR CONSTRUCTION

THIS SHEET IS APPROVED FOR CONSTRUCTION BY MASSDOT AUTHORIZED SIGNATORY: STATE BRIDGE ENGINEER

USE ONLY PRINTS OF LATEST DATE

June 4, 2024

To:	Danielle Spicer, P.E. Oxana Fartushnaya
Cc:	
From:	Brandon Faneuf, PWS
Date:	June 5, 2024
Project Name:	609211 Peabody – Independence Greenway Extension Proposed Wetland Replication Area
Project Number:	Green No. 17118
Subject:	Wetland Description - Independence Greenway Extension Proposed Wetland Replication Area, Peabody, MA

Introduction

This memo is to describe the types and extents of wetlands and wetland jurisdictional areas at the proposed wetland replication area site located at 265 Lowell St (A), Peabody, MA (see attached Locus Map Figure). Investigations were conducted on May 23, 2024 to identify, and delineate if present, the extent and location of jurisdictional wetlands and "Waters of the U.S." within the Project Area pursuant to the Federal Clean Water Act (Sections 401 and 404), and in Massachusetts, activities regulated under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40) regulations. In conjunction with the U.S. Army Corps of Engineers (USACE), this program is administered by the Massachusetts Department of Environmental Protection (MassDEP). Jurisdictional wetlands were defined using the 1987 *U.S. Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and subsequent guidance documents including the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* (US Corps of Engineers, January 2012). Waters of the U.S., which include all streams, adjacent wetlands, and other waterbodies, are defined in 33 CFR 328.3(a). Peabody has promulgated a local Wetlands & Rivers Protection Ordinance (The Ordinance) and Wetlands and Rivers Protection Regulations (Chapter 32) that exceed jurisdictional areas and performance standards of the WPA and 310 CMR 10.00.

The above-referenced proposed wetland replication area site is located at 265 Lowell St (A), Peabody, MA with site access off Gilmore Terrace. Investigations were conducted in order to determine a suitable place for the construction of a wetland replication area in accordance with 310 CMR 10.55 (4)(b) provisions. This proposed work will be conducted on and adjacent to a Bordering Vegetated Wetland (BVW) associated with Proctor Brook, making portions of the project subject to the Wetlands Protection Act (WPA).

Area of Interest (AOI)

Investigations were conducted at the parcel located at 265 Lowell St (A), Peabody, MA. The area of the AOI contains medium density residential single-family homes and wooded areas and abutted by non-forested wetland area associated with Proctor Brook to the north.

The land along the southern bank of Proctor Brook was investigated for wetland resource areas. Dominant non-native vegetation present in the AOI includes Norway maple (*Acer platanoides*), black locust (*Robinia pseudoacacia*), common buckthorn (*Rhamnus cathartica*), Oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria petiolata*). Associated native vegetation includes box elder (Acer negundo), black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), common elderberry (*Sambucus canadensis*), silky dogwood (*Cornus amomum*), smooth sumac (*Rhus glabra*), Virginia creeper (*Parthenocissus quinquefolia*), skunk cabbage (*Symplocarpus foetidus*), jewelweed (*Impatiens capensis*), and sensitive fern (*Onoclea sensibilis*). Soil samples revealed that the extant topsoil is likely fill. There is trash scattered throughout the AOI.

Wetland Resource Areas

A Bordering Vegetated Wetland (BVW) exists in the northern half of 265 Lowell St (A) parcel, south of Proctor Brook. The BVW is hydrologically connected with Proctor Brook, and is the sole wetland resource area present on the project site. The BVW was delineated using alpha-numerical flags. Each delineated section of the BVW retains a one-hundred foot (100') buffer zone per 310 CMR 10.00.

The following Wetland Resource Areas are present on site:

- Bordering Vegetated Wetland ("BVW"), as delineated in the field with 'RA' - series flags. These flags represent the edge of the BVW where it changes from vegetated wetland to upland. Per 310 CMR 10.00 , these receive 100' Buffer Zones.

- Bordering Land Subject to Flooding ("BLSF") associated with Proctor Brook. This is the 100-year floodplain as delineated by FEMA (see attached FEMA FIRMETTE). This follows Proctor Brook and includes contiguous portions of the delineated BVW. However, BLSF is not present in the AOI.200' Riverfront Area ("RFA") associated with Proctor Brook. The RFA extends perpendicularly from the Bank of the brook without regard for topography. The entire proposed replication area is located within a Riverfront Area.

Table 1. Delineated Wetland Resource Areas

Flag Series	Wetland Type	Approx. Location
RA1 – RA12 (pink flags)	Bordering Vegetated Wetland w/ 100' Buffer Zone per 310 CMR 10.00 and the Ordinance.	200' from the end of Gilmore Terrace. Bisecting the 265 Lowell St (A) parcel from the parcel boundary with 4 Karelitz Road to the parcel boundary with 10 Castle Circle.

Other Resources

A desktop analysis of the Project Area was conducted prior to performing field surveys and included the entire defined area of investigation. A search of other critical resources within the project area was conducted using GIS software and data available through various governmental agencies (FEMA, DEP, and others). The results of our search are listed in the table below.

Table 2. Selected MASSGIS Environmental Data Layers

Mapped Resource On or Within Proximity to Site	Yes	No
Area of Critical Environmental Concern		✓
NHESP Certified Vernal Pool		✓
NHESP Potential Vernal Pool		✓
NHESP Estimated Habitat of Rare Wildlife		✓
NHESP Priority Habitat of Rare species		✓
Outstanding Resource Waters		✓
FEMA Flood Zones (BLSF)		✓[1]
Surface Water Protection Area		✓
Interim Wellhead Protection Area		✓
Zone I Wellhead Protection Area		✓
Zone II Wellhead Protection Area		✓
Mass DFW Designated Coldwater Fisheries		✓

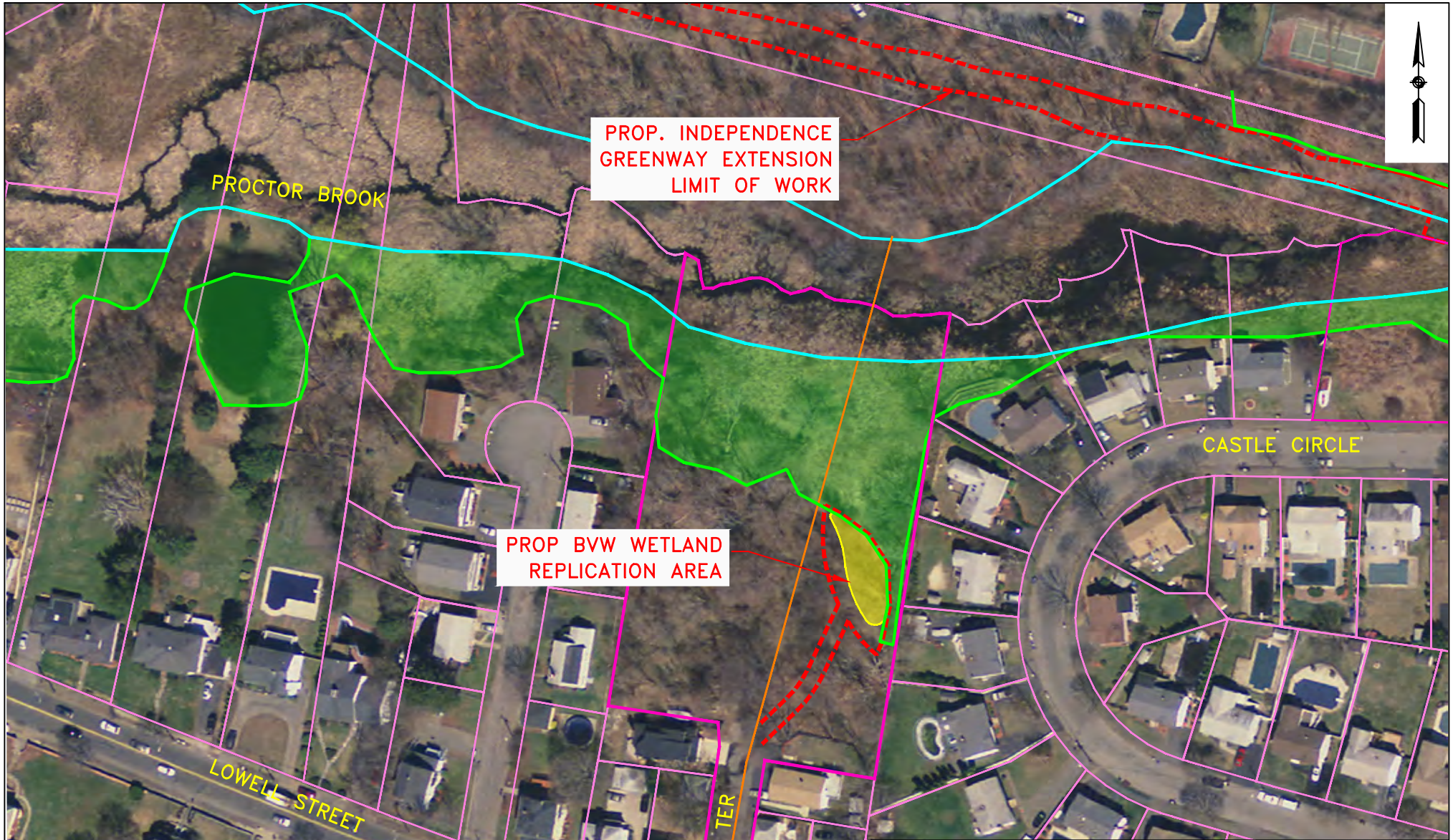
✓[1] BLSF follows Proctor Brook and includes contiguous portions of the delineated BVW. However, BLSF is not present in the AOI, which is limited to the outlined limit of work associated with the replication area.

Regulatory Jurisdiction

The wetland resource areas described above are regulated by the Massachusetts Wetlands Protection Act (WPA) and 310 CMR 10.00 which is administered by the City of Peabody Conservation Commission or (upon appeal) by Massachusetts Department of Environmental Protection (MassDEP).

WETLANDS MEMORANDUM ATTACHMENTS

- LOCUS FIGURE
- PHOTO LOG
- FEMA FIRMETTE
- BORDERING VEGETATED WETLAND DETERMINATION FORMS



LEGEND:

- LIMIT OF WORK
- DELINEATED/SURVEYED & DEP WETLANDS
- PROP. WETLAND REPLICATION AREA BOUNDARY
- BANK/MAHW/PERENNIAL STREAM
- 265 LOWELL ST (A) PARCEL BOUNDARIES
- OTHER PARCEL BOUNDARIES
- APPROXIMATE DRAIN LINE

SCALE IN FEET

60 0 60 120

1" = 120'

NOTE: DATA TAKEN FROM MASSGIS

PROPOSED WETLAND REPLICATION AREA

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT #609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR, SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118
DATE: 06/05/2024 REVISED:	DRAWN BY: JK/OF CHECKED BY: OF

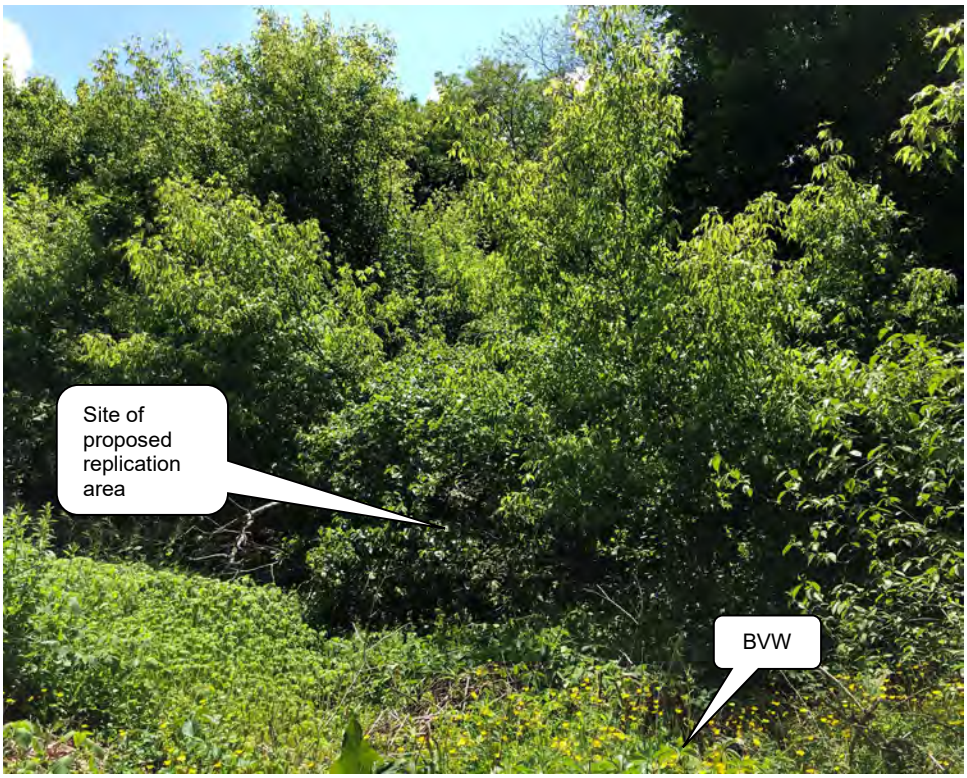
LOCUS FIGURE

Proposal No. 609211-132091

Y:\Shared\Engineering\Projects\2017\17118\Dwg\ENV\LOCUS FIGURE – Gilmore Replication Area.dwg

A00860 - 482

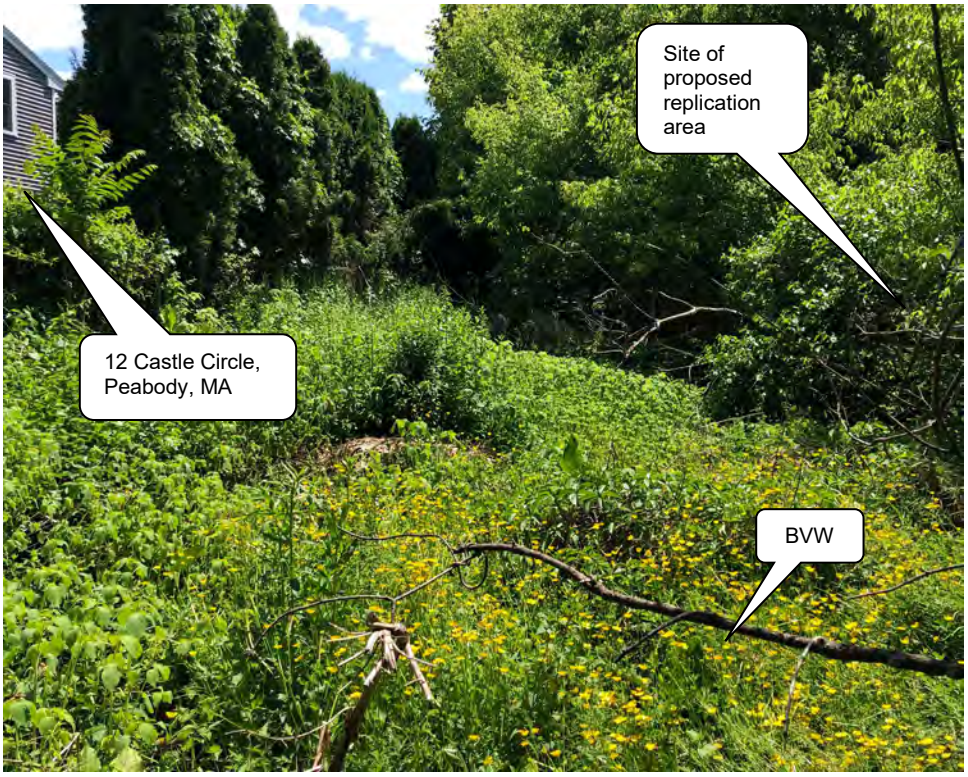
PHOTO LOG: Photos taken 05/31/2024



Picture #1 – View looking southwest at site of proposed replication area.

Picture #2 – View looking north from the center of the site of the proposed replication area.

Picture #3 – View looking northeast towards Proctor Brook inside of BVW.



Picture #4 – View looking south showing site of proposed replication area in relation to the eastern property boundary.

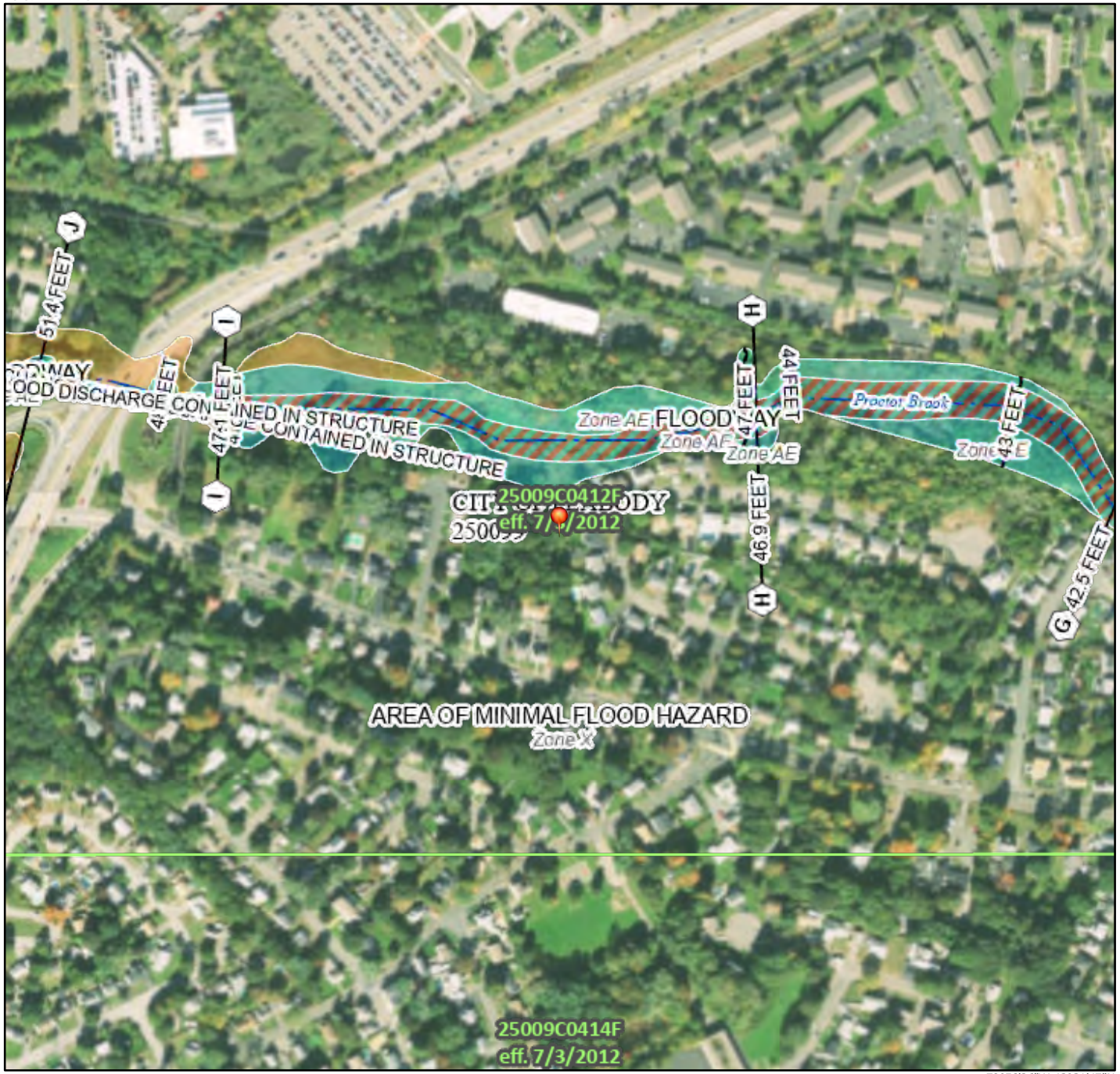
Picture #5 – View looking northeast at site of proposed access road.

Picture #6 – View looking northeast. Site access off Gilmore Terrace.

National Flood Hazard Layer FIRMette

FEMA

70°57'4"W 42°32'14"N



70°56'26"W 42°31'47"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/5/2024 at 9:22 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Proposal No. 609211-132091

A00860 - 486

BVW Determination Form

Bordering Vegetated Wetland Determination Form

Project Site: 265 Lowell St (A) City/Town: Peabody Sampling Date: 5/23/2024

Applicant/Owner: City of Peabody Sampling Point or Zone: UPLAND RA-5

Invesigators: Brandon Faneuf Lat/Long: 42°32'01.25"N, 70°56'46.

Soil Map Unit Name: 626B- Merrimac-Urban land complex NWI/DEP Classification: SM

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks)

Are vegetation [ ] Soil [X] or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS - Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met? **YES** ***Is the Sampled Area within a wetland?*** **NO**

Hydric Soils criterion met? **NO**

Wetlands hydrology present? **NO**

Remarks, Photo Details, Flagging, etc.:

Site is on historic fill

HYDROLOGY

Field Observation:

Surface Water Present? NO Depth (inches):

Water Table Present? NO Depth (inches):

Saturation Present (including capillary fringe)? NO Depth (inches):

Wetland Hydrology Indicators (Enter x for all that apply)

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained Leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[ ] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue(aerenchyma)	[ ] Woody plants w/ adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland)
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

VEGETATION - Use both common and scientific names of plants.

Tree Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Black Locust	Robinia pseudoacacia	FACU	63	YES	NO
Sugar Maple	Acer saccharum	FACU	10.5	NO	NO
Black Cherry	Prunus serotina	FACU	10.5	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

84 = *Total Cover*

Shrub/Sapling Stratum Plot size: 15' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Black Cherry	Prunus serotina	FACU	20.5	YES	NO
Red Chokeberry	Aronia arbutifolia	FACW	20.5	YES	YES
Japanese Honeysuckle	Lonicera japonica	FACU	20.5	YES	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

61.5 = *Total Cover*

Herb Stratum Plot size: 5' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Skunk-Cabbage	Symplocarpus foetidus	OBL	3	NO	YES
Spotted Touch-Me-Not	Impatiens capensis	FACW	10.5	NO	YES
Eastern Poison Ivy	Toxicodendron radicans	FAC	3	NO	YES
Virginia-Creeper	Parthenocissus quinquefolia	FACU	3	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

19.5 = *Total Cover*

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

Woody Vine Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
				NO	NO
				NO	NO
				NO	NO
				NO	NO
			0	*= Total Cover*	
Rapid Test: Do all dominant species have an indicator status of OBL or FACW?			**NO**		
Dominance Test: Number of dominant species	Number of dominant species that are wetland indicator plants	*Do wetland indicator plants make up ≥ 50% of dominant species?*			
		YES			
Prevalence Index:	Total % Cover (all strata)		Result		
OBL species	3	1	3		
FACW species	31	2	62		
FAC species	3	3	9		
FACU species	128	4	512		
UPL species	0	5	0		
Column Totals	165		586		
Prevalence Index:	3.3		*Is the Prevalence Index ≤ 3.0?*		
			NO		
Wetland vegetation criterion met?	**YES**				

Definitions of Vegetation Strata

Tree - Woody plants 3in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 fs (1 m) tall

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges

Range	Midpoint
1-5 %	3.0%
6-15 %	10.5%
15-25 %	20.5%
26-50%	38.0%
51-75 %	63.0%
76-95 %	85.5%
96-100 %	98.0%

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: UPLAND RA-5

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type1	Location2		
0-8	10YR 2/2	100					sl	
8-14	10YR 3/3	100					sl	
14-20	10YR 2/2	100					fsl	
20+	10YR 5/6	100					sl	

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains 2Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Enter **x** for all that apply)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratisfied Layers (A5)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8)
- [ ] Thin Dark Surface (S9)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F7)
- [ ] Depleted Dark Surface (F8)

Indicators for Problematic Hydric Soils

- [ ] 2 cm Muck (A10)
- [ ] 5 cm Mucky Peat or Peat (S3)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8)
- [ ] Thin Dark Surface (S9)
- [ ] Iron-Manganese Masses (F12)
- [ ] Mesic Spodic (A17)
- [ ] Red Parent Material (F21)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Include Explanation in Remarks)

Restrictive Layer if observed) Type: Depth (inches):

Remarks:

Hydric Soils criterion met? **NO**

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Bordering Vegetated Wetland Determination Form

Project Site: 265 Lowell St (A) City/Town: Peabody Sampling Date: 5/23/2024

Applicant/Owner: City of Peabody Sampling Point or Zone: WETLAND RA-5

Invesigators: Brandon Faneuf Lat/Long: 42°32'01.25"N, 70°56'46.

Soil Map Unit Name 626B- Merrimac-Urban land complex NWI/DEP Classification: SM

Are climatic/hydrologic conditions on the site typical for this time of year? YES (If no, explain in Remarks)

Are vegetation [ ] Soil [X] or Hydrology [ ] significantly disturbed? (If yes, explain in Remarks)

Are vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? (If yes, explain in Remarks)

SUMMARY OF FINDINGS - Attach site map and photograph log showing sampling locations, transects, etc.

Wetland vegetation criterion met? **YES** ***Is the Sampled Area within a wetland?*** **YES**

Hydric Soils criterion met? **NO**

Wetlands hydrology present? **YES**

Remarks, Photo Details, Flagging, etc.:
Site is on historic fill.

HYDROLOGY

Field Observation:

Surface Water Present? NO Depth (inches):

Water Table Present? YES Depth (inches): 10"

Saturation Present (including capillary fringe)? YES Depth (inches): 10"

Wetland Hydrology Indicators **(Enter x for all that apply)**

Reliable Indicators of Wetlands Hydrology	Indicators that can be Reliable with Proper Interpretation	Indicators of the Influence of Water
[ ] Water-stained Leaves	[ ] Hydrological records	[ ] Direct observation of inundation
[ ] Evidence of aquatic fauna	[X] Free water in a soil test hole	[ ] Drainage patterns
[ ] Iron deposits	[ ] Saturated soil	[ ] Drift lines
[ ] Algal mats or crusts	[ ] Water marks	[ ] Scoured areas
[ ] Oxidized rhizospheres/pore linings	[ ] Moss trim lines	[ ] Sediment deposits
[ ] Thin muck surfaces	[ ] Presence of reduced iron	[ ] Surface soil cracks
[ ] Plants with air-filled tissue(aerenchyma)	[ ] Woody plants w/ adventitious roots	[ ] Sparsely vegetated concave surface
[ ] Plants with polymorphic leaves	[ ] Trees with shallow root systems	[ ] Microtopographic relief
[ ] Plants with floating leaves	[ ] Woody plants with enlarged lenticels	[ ] Geographic position (depression, toe of slope, fringing lowland)
[ ] Hydrogen sulfide odor		

Remarks (describe recorded data from stream gauge, monitoring well, aerial photos, previous inspections, if available):

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

VEGETATION - Use both common and scientific names of plants.

Tree Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Box Elder	Acer negundo	FAC	63	YES	YES
Black Locust	Robinia pseudoacacia	FACU	10.5	NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

73.5 *= Total Cover*

Shrub/Sapling Stratum Plot size: 15' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Chinese Privet	Ligustrum sinense	FACU	10.5	NO	NO
Black Cherry	Prunus serotina	FACU	20.5	YES	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

31 *= Total Cover*

Herb Stratum Plot size: 5' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
Garlic-Mustard	Alliaria petiolata	FACU	10.5	NO	NO
Northern Lady Fern	Athyrium angustum	FAC	10.5	NO	YES
Skunk-Cabbage	Symplocarpus foetidus	OBL	20.5	YES	YES
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO
				NO	NO

41.5 *= Total Cover*

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

Woody Vine Stratum Plot size: 30' radius

Common Name	**Scientific Name**	***Indicator Status***	**Absolute % Cover**	***Dominant?***	***Wetland Indicator?***
				NO	NO
				NO	NO
				NO	NO
				NO	NO
			0	*= Total Cover*	
Rapid Test : Do all dominant species have an indicator status of OBL or FACW?			**NO**		
Dominance Test: Number of dominant species	Number of dominant species that are wetland indicator plants	*Do wetland indicator plants make up ≥ 50% of dominant species?*			
		YES			
Prevalence Index:	Total % Cover (all strata)		Result		
OBL species	20.5	1	20.5		
FACW species	0	2	0		
FAC species	73.5	3	220.5		
FACU species	52	4	208		
UPL species	0	5	0		
Column Totals	146		449		
Prevalence Index:	2.9		*Is the Prevalence Index ≤ 3.0?*		
			YES		
Wetland vegetation criterion met?	**YES**				

Definitions of Vegetation Strata

Tree - Woody plants 3in. (7.62 cm) or more in diameter at breast height (DBH), regardless of height

Shrub / Sapling - Woody plants less than 3 in. (7.62 cm) DBH and greater than or equal to 3.3 fs (1 m) tall

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.3 ft. (1 m) tall

Woody vines - All woody vines greater than 3.3 ft. (1 m) in height

Cover Ranges

Range	Midpoint
1-5 %	3.0%
6-15 %	10.5%
15-25 %	20.5%
26-50%	38.0%
51-75 %	63.0%
76-95 %	85.5%
96-100 %	98.0%

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.

BVW Determination Form

Sampling Point: WETLAND RA-5

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type1	Location2		
0-10	10YR 2/2	100					sl	S/I at 10"
18-20	10YR 5/6	100					gcos	

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains 2Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Enter **x** for all that apply)

Histosol (A1)		Polyvalue Below Surface (S8)		2 cm Muck (A10)
Histic Epipedon (A2)		Thin Dark Surface (S9)		5 cm Mucky Peat or Peat (S3)
Black Histic (A3)		Loamy Mucky Mineral (F1)		Dark Surface (S7)
Hydrogen Sulfide (A4)		Depleted Matrix (F3)		Polyvalue Below Surface (S8)
Stratisfied Layers (A5)		Redox Dark Surface (F7)		Thin Dark Surface (S9)
Depleted Below Dark Surface (A11)		Depleted Dark Surface (F8)		Iron-Manganese Masses (F12)
Thick Dark Surface (A12)				Mesic Spodic (A17)
Sandy Mucky Mineral (S1)				Red Parent Material (F21)
Sandy Gleyed Matrix (S4)				Very Shallow Dark Surface (TF12)
Sandy Redox (S5)				Other (Include Explanation in Remarks)
Stripped Matrix (S6)				
Dark Surface (S7)				

Indicators for Problematic Hydric Soils

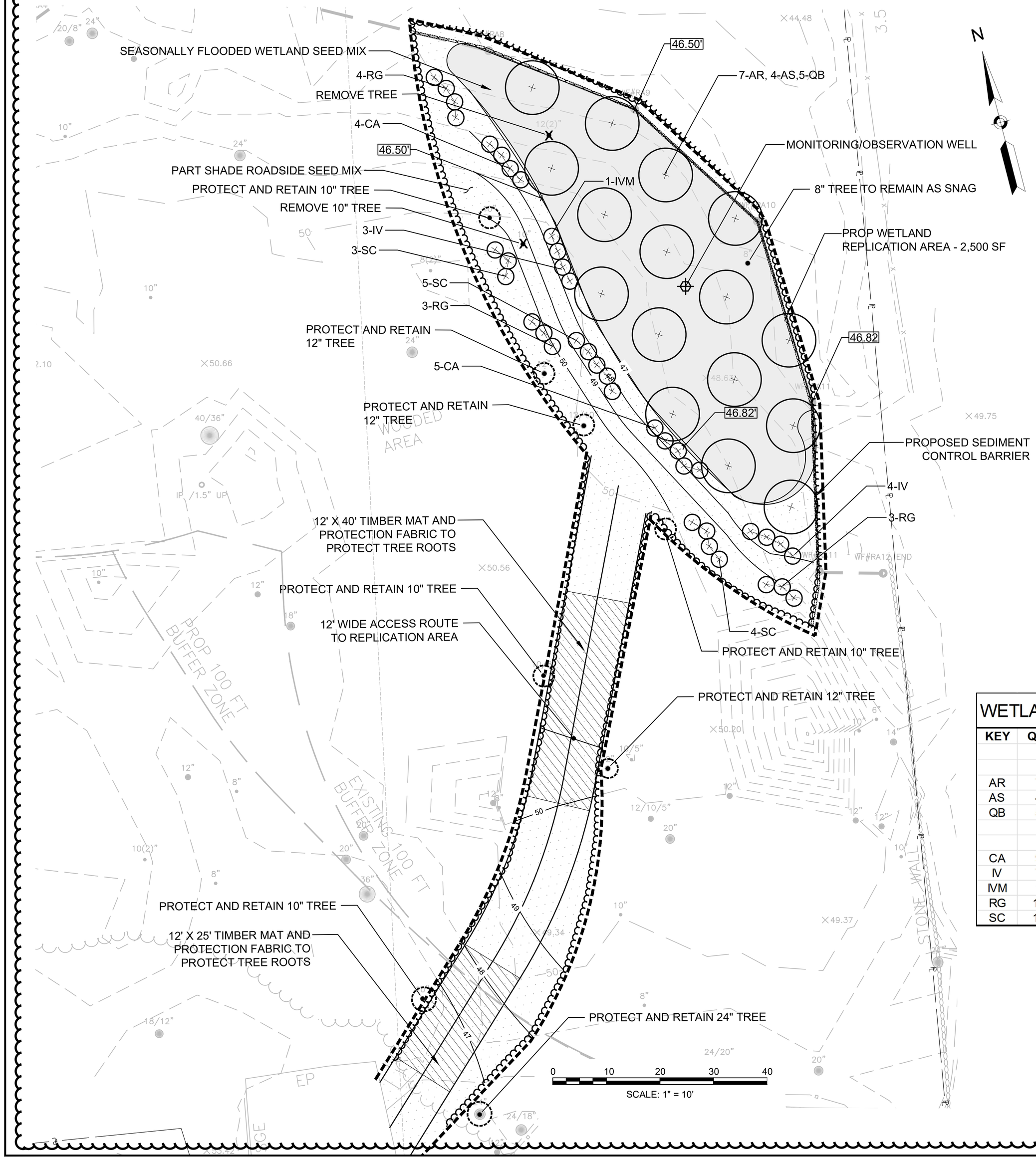
Restrictive Layer if observed) Type: Depth (inches):

Remarks:

Hydric Soils criterion met? **NO**

©2023 Ecosystem Solutions, Inc.

Italics denote auto caluclated field.



PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	142
PROJECT FILE NO.	609211		

WETLAND REPLICATION PLAN
NOI REVISIONS, 6/5/2024

NOTES:

1. IMPACTS TO EXISTING TREES AND SOILS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE.
2. CONTACT THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION PRIOR TO THE START OF CONSTRUCTION. THE REPRESENTATIVE FOR THIS PROJECT IS MAXWELL R. MCNULTY MAXWELL.R.MCNULTY@DOT.STATE.MA.US.
3. FINAL GRADES TO BE TO MATCH ADJACENT WETLAND. MINOR ADJUSTMENTS IN FINAL GRADES SHALL BE MADE IN THE FIELD BY THE WETLAND SPECIALIST.
4. REPLICATION AREA SHALL BE EXCAVATED BELOW PROPOSED GRADES TO ALLOW FOR THE PLACEMENT OF WETLAND SOILS. THE DEPTH OF WETLAND SOILS SHALL BE 18" MAXIMUM AND SHALL MATCH THE DEPTH OF WETLAND SOIL IN THE ADJACENT WETLAND. DEPTH OF WETLAND SOIL SHALL BE DETERMINED BY THE WETLAND SPECIALIST. THE SALVAGED TOPSOIL MATERIAL AND B-HORIZON SUBSOIL MATERIAL EXCAVATED FROM THE WETLAND IMPACT AREAS SHALL BE PLACED IN SEPARATE STOCKPILES TO BE REUSED IN THE PROPOSED REPLICATION AREA IF SUITABLE.
5. REPLICATION AREA GRADES SHALL MATCH THE ELEVATIONS OF THE ABUTTING WETLAND TO MAINTAIN A HYDROLOGIC CONNECTION. WETLAND SPECIALIST SHALL INSPECT THE SUB-GRADE OF THE REPLICATION AREA TO ENSURE THAT THE PROPER HYDROLOGY HAS BEEN ESTABLISHED. MINOR MODIFICATIONS TO THIS GRADING PLAN MAY BE MADE IN THE FIELD BY THE QUALIFIED WETLAND SPECIALIST IN RESPONSE TO SUBSURFACE HYDROLOGIC CONDITIONS.
6. TREES AND SHRUBS IN THE REPLICATION AREA AND ADJACENT UPLAND AREA SHALL BE FIELD LOCATED BY THE WETLAND SPECIALIST.

PLANTING & SEEDING NOTES:

1. SEED SHALL BE MANUALLY BROADCAST. LIMITS SHOWN ARE APPROXIMATE. ACTUAL LIMITS SHALL BE AS DIRECTED BY THE WETLAND SPECIALIST.

LEGEND

- LIMIT OF WORK
- SEDIMENT BARRIER
- 100 — EXISTING CONTOUR
- 44 — PROPOSED CONTOUR
- PROPERTY LINE (FROM MASSGIS)
- LIMIT OF CLEARING
- 124.694 — PROPOSED SPOT GRADE
- MONITORING/OBSERVATION WELL
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX
- PROPOSED SHRUB
- PROPOSED TREE
- EXISTING TREE ARMORING
- X — TREE REMOVAL
- TIMBER MAT AND PROTECTION FABRIC

153 FT LENGTH OF SEDIMENT CONTROL BARRIER

3,736 SQ FT OF PART SHADE ROADSIDE SEED MIX

2,500 SQ FT WETLAND SOIL AND SEASONALLY FLOODED WETLAND SEED MIX

WETLAND REPLICATION PLANT LIST

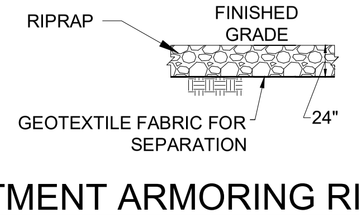
KEY	QTY	WETLAND STAUS	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
			DECIDUOUS TREES			
AR	7	FAC	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	4	FACW	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
QB	5	FACW	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
			DECIDUOUS SHRUBS			
CA	9	FACW	CORNUS AMOMUM	SILKY DOGWOOD	2-3 FEET	#2 CONT.
IV	7	FACW	ILEX VERTICILATA	WINTERBERRY	2-3 FEET	#2 CONT.
IVM	1	FACW	ILEX VERTICILATA - MALE	MALE WINTERBERRY	2-3 FEET	#2 CONT.
RG	10	UPLAND	RHUS GLABRA	SMOOTH SUMAC	2-3 FEET	#2 CONT.
SC	12	FACW	SAMBUCUS CANADENSIS	COMMON ELDERBERRY	2-3 FEET	#2 CONT.

Proposal No. 609211-132091

A00860 - 495

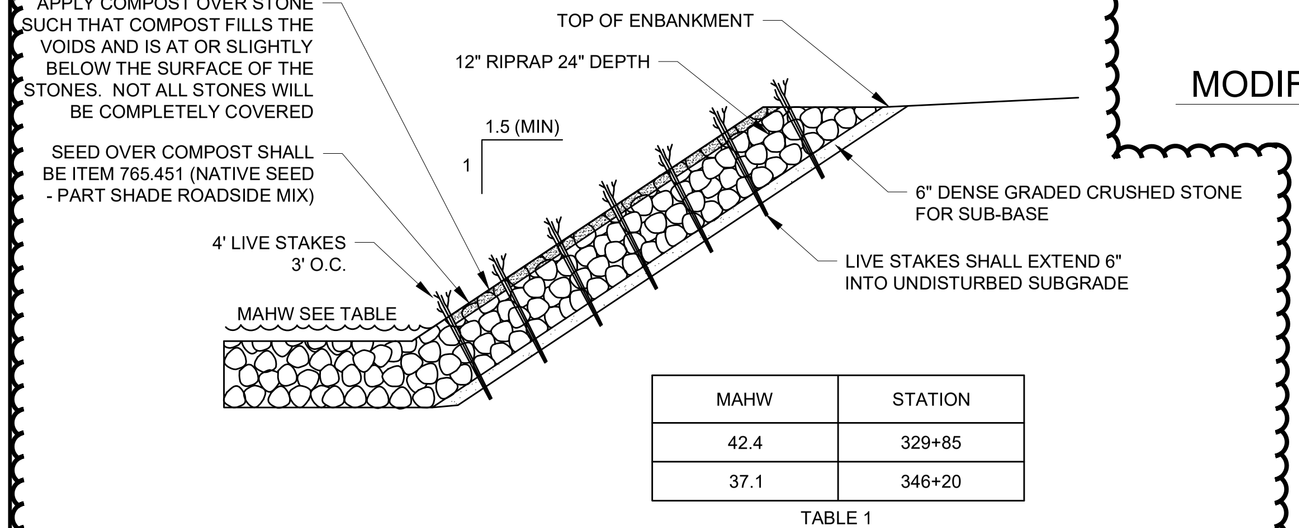
SHT0XX_EW(WETLAND REPLICATION PLAN).DWG Plotted on 5-Jun-2024 1:45 PM

Plotted on 5-Jun-2024 2:47 PM
SHT014_HDICONSTRUCTION & DRAINAGE DETAILS) - UPDATED.DWG
A00860 - 496
Proposal No. 609211-132091



ABUTMENT ARMORING RIPRAP DETAIL

NOT TO SCALE



MAHW	STATION
42.4	329+85
37.1	346+20

TABLE 1

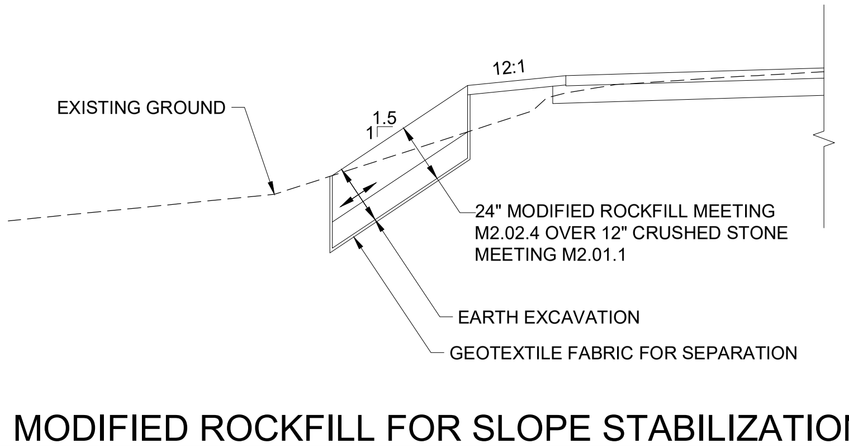
NOTES:

1. DRIVE REBAR INTO VOIDS BETWEEN RIP RAP.
2. HOLES SHALL EXTEND 12" BELOW RIP RAP INTO SUBGRADE OR GRANULAR FILL LAYER.
3. LIVE STAKES SHALL BE PLACED IN HOLES SO THAT THEY EXTEND 6" INTO SUBGRADE.
4. LIVE STAKES SHALL BE LOCATED APPROXIMATELY 3 FEET ON CENTER STARTING 6" ABOVE MEAN HIGH WATER.

LIVE STAKES PLANT LIST				
QTY	BOTANICAL NAME	COMMON NAME	PLANT SIZE	SPACING
100	CORNUS RACEMOSA	GREY DOGWOOD	4 FEET LENGTH	3' O.C
100	SALIX DISCOLOR	PUSSY WILLOW	4 FEET LENGTH	3' O.C
100	CORNUS SERICEA	REDOSIER DOGWOOD	4 FEET LENGTH	3' O.C

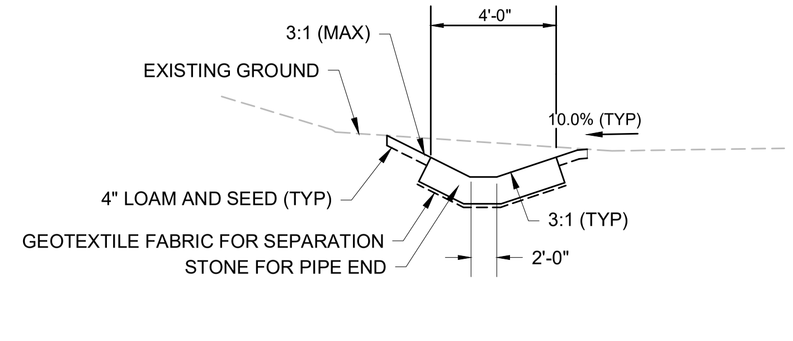
COMPOST AND SEED OVER VEGETATED RIPRAP

NOT TO SCALE



MODIFIED ROCKFILL FOR SLOPE STABILIZATION

NOT TO SCALE



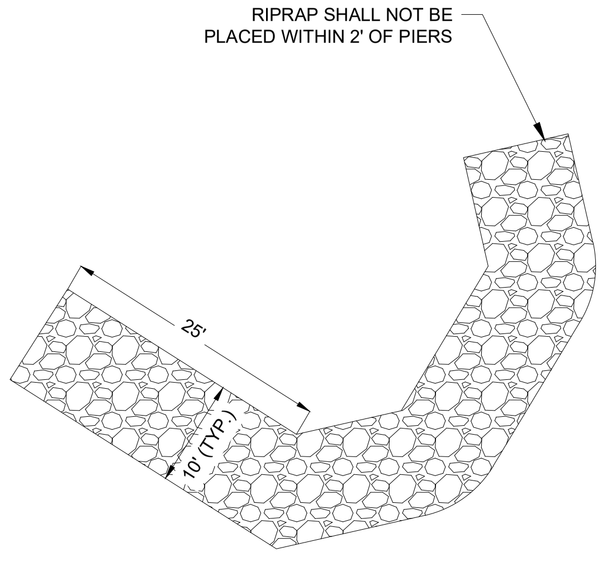
PAVED WATERWAY

NOT TO SCALE

FHWA CLASS	LENGTH OF APRON L (FEET)	DEPTH OF APRON H (FEET)	WIDTH OF APRON (FEET)	MASSDOT RIPRAP SIZE	CULVERTS AT STATION
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	329+85
II	10.0	2.0	13.5	M2.02.3	340+10
II	8.0	2.0	11.0	M2.02.3	342+25
III	AS SHOWN IN PLANS	3.0	AS SHOWN IN PLANS	M2.02.2	346+20
II	10.0	2.0	5.0	M2.02.3	358+51

SOURCE:
FHWA HYDRAULIC ENGINEERING CIRCULAR NO. 23
MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES

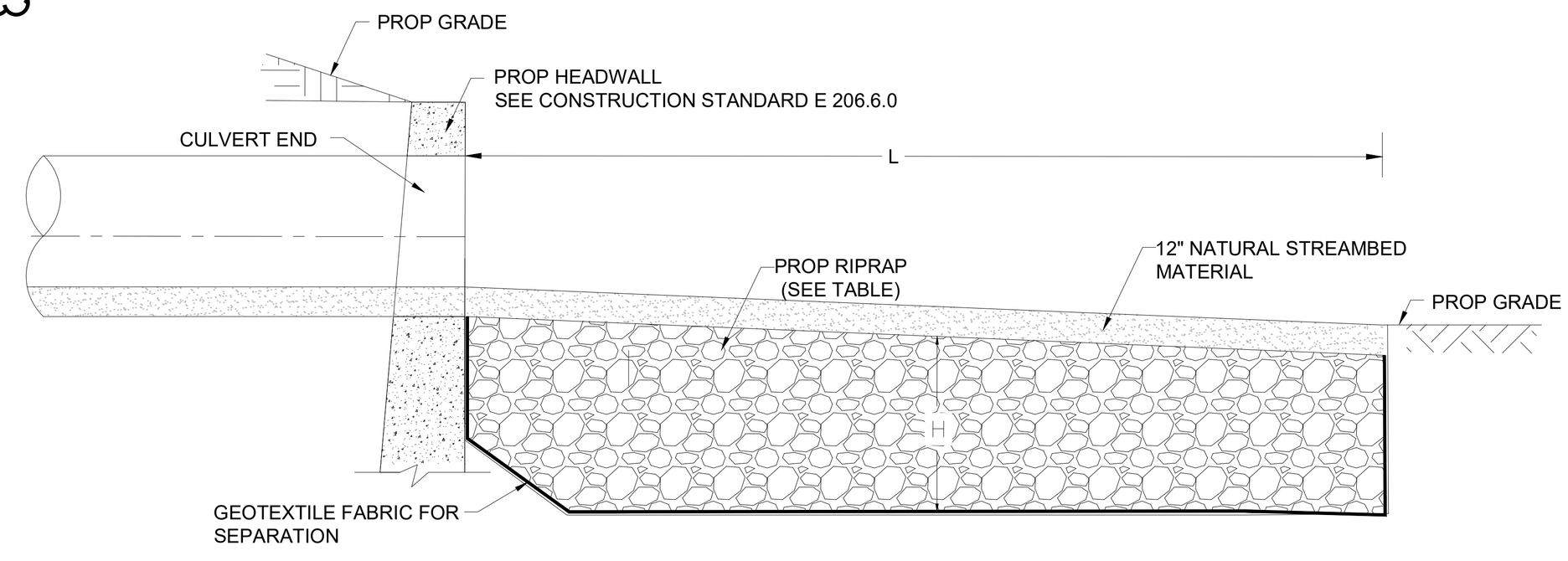
RIPRAP CLASSES AND APRON DIMENSIONS



PLAN
SCALE : 1"=10'

0 10 20 30 40
SCALE: 1" = 10'

ABUTMENT ARMORING RIPRAP PLAN



RIPRAP APRON AT INLETS AND OUTLETS OF CULVERTS

NOT TO SCALE

DOCUMENT A00861

MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

ORDER OF CONDITIONS

THIS PAGE INTENTIONALLY LEEFT BLANK

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

City of Peabody-Wetlands & Rivers Protection Ord. CH 32

A. General Information

1. Conservation Commission: PEABODY
2. Issuance: a. ☑ OOC b. ☐ Amended OOC

3. Applicant Details

a. First Name	BRENDAN		b. Last Name	CALLAHAN	
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

4. Property Owner

a. First Name			b. Last Name		
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

5. Project Location

a.Street Address	FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.		
b.City/Town	PEABODY	c. Zip Code	01960
d. Assessors Map/Plat#	00	e. Parcel/Lot#	00
f. Latitude	42.53359N	g. Longitude	70.94025W

6. Property recorded at the Registry of Deed for:

a. County	b. Certificate	c. Book	d. Page
SOUTHERN ESSEX		29182	292

7.Dates

a. Date NOI Filed : 4/16/2024 b. Date Public Hearing Closed: 6/12/2024 c. Date Of Issuance: 7/3/2024

8.Final Approved Plans and Other Documents

a. Plan Title:	b. Plan Prepared by:	c. Plan Signed/Stamped by:	d. Revised Final Date:	e. Scale:
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION- PLAN AND PROFILE OF INDEPENDENCE GREENWAY EXTENSION BRIDGE P-03-020 (CAK) IN THE CITY OF PEABODY ESSEX COUNTY	GREEN INTERNATIONAL AFFILIATES, INC.	DANIELLE SPICER	some sheets 06/11/2024	AS NOTED

CITY CLERK 2024 JUL -3 AM 9:30 CITY OF PEABODY

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

B. Findings

1.Findings pursuant to the Massachusetts Wetlands Protection Act
Following the review of the the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act.

Check all that apply:

a. ☑ Public Water Supply	b. ☐ Land Containing Shellfish	c. ☑ Prevention of Pollution
d. ☑ Private Water Supply	e. ☐ Fisheries	f. ☑ Protection of Wildlife Habitat
g. ☑ Ground Water Supply	h. ☑ Storm Damage Prevention	i. ☑ Flood Control

2. Commission hereby finds the project, as proposed, is:

Approved subject to:

a. ☑ The following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

Denied because:

b. ☐ The proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ The information submitted by the applicant is not sufficient to describe the site, the work or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the interests of the Act , and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ Buffer Zone Impacts:Shortest distance between limit of project disturbance and the wetland resource area specified in 310CMR10.02(1)(a). _____ a. linear feet

Inland Resource Area Impacts:(For Approvals Only):

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☑ Bank	754 a. linear feet	754 b. linear feet	588 c. linear feet	588 d. linear feet
5. ☑ Bordering Vegetated Wetland	7025 a. square feet	7025 b. square feet	2500 c. square feet	2500 d. square feet
6. ☑ Land under Waterbodies and Waterways	10467 a. square feet	10467 b. square feet	4271 c. square feet	4271 d. square feet

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

	1142 e. c/y dredged	1142 f. c/y dredged		
7.☑ Bordering Land Subject to Flooding	69340 a. square feet	69340 b. square feet	1630 c. square feet	1630 d. square feet
Cubic Feet Flood Storage	2982 e. cubic feet	2982 f. cubic feet	3472 g. cubic feet	3472 h. cubic feet
8.☐ Isolated Land Subject to Flooding	 a. square feet	 b. square feet		
Cubic Feet Flood Storage	 c. cubic feet	 d. cubic feet	 e. cubic feet	 f. cubic feet
9.☑ Riverfront Area	103288 a. total sq. feet	103288 b. total sq. feet		
Sq ft within 100 ft	77465 c. square feet	77465 d. square feet	 e. square feet	 f. square feet
Sq ft between 100-200 ft	25823 g. square feet	25823 h. square feet	 i. square feet	 j. square feet

Coastal Resource Area Impacts:

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10.☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11.☐ Land Under the Ocean	 a. square feet	 b. square feet		
	 c. c/y dredged	 d. c/y dredged		
12.☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13.☐ Coastal Beaches	 a. square feet	 b. square feet	 c. c/y nourishment	 d. c/y nourishment
14.☐ Coastal Dunes	 a. square feet	 b. square feet	 c. c/y nourishment	 d. c/y nourishment
15.☐ Coastal Banks	 a. linear feet	 b. linear feet		
16.☐ Rocky Intertidal Shores	 a. square feet	 b. square feet		
17.☐ Salt Marshes	 a. square feet	 b. square feet	 c. square feet	 d. square feet
18.☐ Land Under Salt Ponds	 a. square feet	 b. square feet		
	 c. c/y dredged	 d. c/y dredged		
19.☐ Land Containing Shellfish				

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

a. square feet b. square feet c. square feet d. square feet

20. ☐ Fish Runs — Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above

c. c/y dredged d. c/y dredged

21. ☐ Land Subject to Coastal Storm Flowage

a. square feet b. square feet

22.

☐ Restoration/Enhancement (For Approvals Only)

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c & d or B.17.c & d above, please entered the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

23.

☑ Streams Crossing(s)

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

0	6
a. number of new stream crossings	b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. the work is a maintenance dredging project as provided for in the Act; or
   b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not exceed the issuance date of the original Final Order of Conditions.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work..
10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

" Massachusetts Department of Environmental Protection"
[or 'MassDEP"]
File Number :"055-0939"

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before Mass DEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.
17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. The work associated with this Order(the "Project") is (1) ☑ is not (2)☐ subject to the Massachusetts Stormwater Standards. If the work is subject to Stormwater Standards, then the project is subject to the following conditions;

a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

Elimination System Construction General Permit as required by Stormwater Standard 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that: *i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures; *ii.*. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized; *iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10; *iv.* all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition; *v.* any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 19(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 19(f) through 19(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 19(f) through 19(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

g) The responsible party shall:

1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions:
SEE LOCAL CONDITIONS PAGES 9-12 ATTACHED HERETO AND MADE A PART HEREOF.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☑ Yes ☐ No

2. The Conservation Commission hereby(check one that applies):

a. ☐ DENIES the proposed work which cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw specifically:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order or Conditions is issued. Which are necessary to comply with a municipal ordinance or bylaw:

b. ☑ APPROVES the proposed work, subject to the following additional conditions.

1. Municipal Ordinance or Bylaw CHAPTER 32 2. Citation _____

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows:
SEE LOCAL CONDITIONS ON PAGES 9-12 ATTACHED HERETO AND MADE A PART HEREOF.

PEABODY CONSERVATION COMMISSION
CONDITIONS – DEP FILE # 55-939
PROJECT TITLE: INDEPENDENCE GREENWAY EXTENSION
(NEAR PROCTOR BROOK-ESSEX CENTER DR/NORTH SHORE RD/ENDICOTT ST/ FORMER RR
APPLICANT: BRENDAN CALLAHAN ON BEHALF OF THE CITY OF PEABODY
OWNERS: CITY OF PEABODY-24 LOWELL ST, PEABODY MA

ORDER OF CONDITIONS (OC)

GENERAL CONDITIONS (DEP): 1-20– SEE ATTACHED

21. This Order of Conditions also constitutes a special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody. Appeal to the Massachusetts Department of Environmental Protection (DEP), pursuant to the State Wetlands Protection Act (G.L. Chapter 131, Section 40) shall not operate to terminate or affect any of the provisions of said special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody.
22. A copy of this Order shall be present on the site at all times until the completion of all work and receipt of a Final Certification of Compliance by the Commission.
23. A copy of this Order of Conditions shall be included in all construction contracting and subcontracting documents dealing with the work proposed and shall supercede other contract requirements.
24. When the applicant applies to the Building Inspectors office for a building and/or foundation permit (or for any construction permit), within the buffer zone, the applicant must submit a copy of this Order of Conditions and accompanying plans to said Building Inspector. **Said Order of Conditions must be recorded at the Registry of Deeds and evidence of recording must be submitted to the Building Inspector and the Conservation Commission.**
25. **Prior to requesting an Occupancy Permit from the Building Inspector, the applicant shall obtain a Partial or Final Certificate of Compliance from this Order.**
26. Upon completion of the work described in a Final Order of Conditions, the applicant shall request in writing the issuance of a Certificate of Compliance stating that the work has been satisfactorily completed. In order to receive a Partial or Final Certificate of Compliance upon completion of the project, the applicant must send to the Commission two (2) hardcopies and an electronic copy of WPA Form 8A – Request for Certificate of Compliance (COC). If the project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor, two (2) hardcopies and an electronic copy of a written statement by such a professional person certifying substantial compliance with the plans and setting forth what deviation, if any, exists from the plans approved in the order shall accompany the Request for Certificate of Compliance. In all other cases, the applicant shall provide the Commission with a signed letter stating that the work has been completed in accordance with the approved Order of Conditions. The Commission shall verify the substantial completion of the work by a site inspection, prior to issuance of a Certificate of Compliance. The applicant shall include two (2) copies of a locus map of the area and recorded Order of Conditions, including the appropriate Book and Page reference. ***AS BUILT PLANS are REQUIRED for commercial projects.**
27. **Prior to construction commencement, the applicant shall:**
    A. Provide a copy of the recorded Order of Conditions to the Commission.
    B. Notify the Conservation Commission in writing 48 hours prior to construction start-up that erosion controls are in place and ready for inspection. (The erosion controls shall be placed

prior to any construction on-site. Said erosion controls shall be maintained and replaced as needed until a Certificate of Compliance is issued.)

28 Erosion control measures and barriers shall be kept in good repair, monitored daily and maintained or reinforced as necessary to ensure and prevent erosion and siltation of wetland resource areas until a Final Certificate of Compliance is issued.

29 During construction, the Commission may require additional erosion and sediment controls to be installed in areas not currently noted on the plan to contain soil on-site and to prevent erosion and siltation of wetland resource areas.

30 All debris, fill and excavated material shall be stockpiled as far away from resource areas and buffer zones as reasonably possible and surrounded by staked strawbales/compost logs to prevent sediment from surface runoff entering the wetlands. At no time shall any debris or other material be buried or disposed of within that line marked on plan as a Resource Area or No Disturb Zone.

31 After proper grading, all disturbed areas located within a buffer zone, except those areas designated as compensatory wetlands, shall be loamed and seeded with not less than four (4) inches of good quality loam. The applicant shall:

A. Install all required erosion and sedimentation control (ESC) measures\devices;
B. Notify Commission that all ESC measures are in place and receive approval of said ESC measures from Commission Agent, said notification shall be in writing and occur at least 48 hours prior to anticipated commencement of project construction;
C. Clearly mark on the field the delineation of vegetated wetlands on the site by stakes placed at 25 feet intervals.

32 The applicant shall affix the Order of Conditions to the DEP sign in a plastic envelope for review of same as needed. For Commercial projects the Order shall be available in the construction site trailer.

33 Any siltation caused onto any wetland, waterway, or No Disturb Zone shall be reported promptly to the Commission and such areas shall be restored to the satisfaction of the Commission.

34 Temporary seeding, mulching or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbance.

35 All final earth grading shall be permanently stabilized by the application of loam and seed or sod.

36 After installation of new catch basins on site, the basins shall be enveloped with silt barriers until all tributary areas have been stabilized with permanent cover.

37 Absorption batten pillows shall be used in all traps and catch basins.

38 Fertilizers used for landscaping and lawn care shall be of low-nitrogen content/zero phosphorus and used in moderation. Pesticides and herbicides shall not be used for landscaping and lawn care within Buffer Zones, Resource Areas, or No Disturb Zones.

39 Temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbances.

40 All re-vegetation of Resource Areas shall be performed according to approved and attached plans cited in this order. The proposed replacement area shall meet or exceed the General Performance Standards outlined in the Wetlands Protection Act (WPA) Regulations, 310 CMR, Section 10.55 (4) (b)-7. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

41 No work shall proceed until the applicant has received all other permits required by law, including, but not limited to any permit required by the Planning Board, Zoning Board of Appeals, Board of Health, Department of Environmental Protection or the Army Corp of Engineers.

42 Wetland flagging shall remain in place until the project has been completed and the Certificate of Compliance has been issued.

43 Signs shall be posted at the limit of work, to read as follows: **"Absolutely no work beyond this point."** Such signs shall be placed in an amount satisfactory to the Commission or its agent, with at a minimum, one such sign every **TWENTY feet along the limit of work**. Said signs shall be of such quality to last the duration of the project until a Certificate of Compliance is issued.

44 After completion of the work, the applicant shall permanently mark the edge of the wetland to ensure no further encroachment into the wetland and further the applicant shall instruct all agents to explain these markers to buyers, landscapers, tenants and all persons taking over the property from the applicant.

45 Any debris of "dumped" material placed in the resource areas shall be removed by the applicant.

46 There shall be no increase in the volume or rate of runoff, and no siltation of downstream areas as a result of the work herein permitted.

47 The Commission reserves the right to impose additional conditions on portions of this project or this site, to mitigate any actual or potential impacts resulting from the work herein permitted.

48 No earthen embankment in the Buffer Zone shall have a slope steeper than 2:1.

49 In the event a swimming pool is placed on this lot, the following condition shall apply: The content of water in swimming pools can be detrimental to wetlands plant and animal species. To remove harmful chemicals, it is the applicant's responsibility to leave the pool water standing without the addition of chlorine for a minimum of seven (7) days before draining (per the City's Stormwater System Ordinance). In this way chlorine concentration will be significantly reduced due to volatilization. All pool water, wherever possible, shall be drained through a dry well, rather than allowed to spread over the surface of the land. The City of Peabody Conservation Commission Office shall be notified prior to draining and shall approve the method of draining.

50 Work and maintenance shall be done in accordance with the following plans and reports:

►Massachusetts Department of Transportation Highway Division-Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the city of Peabody Essex County prepared by Green International Affiliates, Inc. stamped by Danielle Spicer with some sheets final revision date of June 11, 2024. (see full set of plans for each sheet date). Scale is as shown per sheet.

►Inland Wetland Replication Area narrative- MASSDOT Item 755.35

►Supplemental Plans labeled: Resource Area Impacts- Figure 6A, 6D and 6E (scale: 1"=40') revised date 6.11.24

►O&M Plan dated 2.5.23 as submitted with NOI.

51 A Pre-construction meeting must take place before work can commence. The meeting shall include The Conservation Agent, City Planning staff, the chosen contractor General Manager, commission members and other city staff as needed. A construction sequence and phasing schedule must be presented at this meeting.

52 Reports should be emailed to Conservation staff either on a monthly/quarterly or milestone basis. A monthly report is not necessary if no work has commenced. The commission needs to be kept up to date with each phase/milestone of said work. At minimum quarterly reports are due on the FIRST week of: **January/April/ June/September** once the project starts.

<u>SPECIAL CHECKLISTS:</u>

Checklist D –Proctor Brook - Channel/Culvert

1. Unless submitted with the Notice of Intent, a report, prepared by a Massachusetts Registered Professional Structural Engineer, shall be submitted to the Commission, for review and approval prior to construction. The report shall include but not be limited to the following:

- Any recommended work to repair and/or maintain the structural integrity of the channel/culvert;
- Structural Building Requirements over the culvert (foundation design, grade beams, etc.);
- Structural requirements where buildings, roadways, drives, or parking lots cross the culvert;
- Recommendations for debris removal within the channel/culvert on site;
- Results of Geotechnical Exploration.

Checklist J – Dewatering

1. Any dewatering activities on the project site in which water will be released to Resource Areas shall make use of a settling pond or similar device to remove sediment before water is released.

Checklist K – Projects Which Alter Bordering Land Subject to Flooding (BLSF)

1. The compensatory flood storage area shall be constructed prior to any filling of land subject to flooding.

Checklist L – Projects Which Alter Bordering Vegetated Wetlands (BVWs)

1. The compensatory Bordering Vegetated Wetland shall be constructed prior to any filling of Bordering Vegetated Wetland.

2. All revegetation of Resource Areas shall be performed according to the replication plan on file and dated **NOT DATED - labeled MASSDOT Item 755.35 Inland Wetland Replication Area.** The proposed replacement area shall meet or exceed the General Performance Standards outlined in Section 10.55(4)(b)-7 of 310CMR. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

3. A wetland specialist shall be on site during construction of the wetland replication area and shall supervise its construction. Two reports prepared by the Wetland Specialist shall be submitted annually to the Commission by May 1st and September 1st of each year for two years. Each report shall include an observed species list, relative abundance of each species, percent cover of wetland and upland species, the visibility of the plantings and proposed remedial measures to ensure that at least 75% of the surface of the replication area be re-established with indigenous wetland plant species within two growing seasons. Said report shall include enough photographs for proper coverage of issues/points being addressed. If monitoring data indicates that this objective cannot be met, a corrective plan of action shall be submitted to the Commission for approval and implemented under the supervision of the wetland specialist. No certificate of compliance will be granted by the Commission until such time as the replacement area has been found to meet these standards.

This Order of Conditions shall apply to any successors in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by the Order.

*As Built Plans are required when requesting a Certificate of Compliance.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
And the City of Peabody-Wetlands & Rivers Protection Ordinance

Provided by MassDEP:
55-939
MassDEP File #
1747021
eDEP Transaction #
Peabody
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

7. 3 .2024
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

7
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy must be mailed, hand delivered or filed electronically at the same time with the appropriate MassDEP Regional Office.

By VOTE ON: 10.28.2020 the individuals listed below authorized the use of their electronic signature pursuant to the Certificate of Vote recorded with Essex south Registry of Deeds in Book 39132, Page 402. They intend for their typed signatures to serve as their electronic signatures:

Signatures:

/s/ Bruce Comak

/s/ Vice Chairman Michael Rizzo

/s/ Arthur Athas

/s/ Chairman Stewart Lazares

/s/ Alt. Brian Cassidy

/s/ Sec. Michael Vivaldi

/s/ Alt. Jamie Harrop

Signed by Conservation Agent to confirm authenticity
Lucia DelNegro Signature: Conservation Agent

☒ by hand delivery on 7. 3 .2024 + via email

Date

☐ by Certified mail

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

PEABODY
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

PEABODY
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.
Project Location

055-0939
MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for:

Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Rev. 4/1/2010

To:	Lucia DelNegro, Conservation Commission Agent (lucia.delnegro@peabody-ma.gov)
Cc:	Jill Provencal, MassDEP NERO Wetlands Program (jill.provencal@mass.gov) Heidi Davis, MassDEP Wetlands Highway Unit (heidi.davis@mass.gov) Ryan Hale, MassDEP Wetlands Highway Unit (ryan.hale@mass.gov) Brendan Callahan, Peabody Community Development (brendan.callahan@peabody-ma.gov)
From:	Danielle Spicer, P.E., Green International Affiliates, Inc.
Date:	July 26, 2024
Project Name:	Independence Greenway Extension, Peabody, MA
Project Number:	Green No. 17118
Subject:	Amendment Request for OOC (DEP File No. 055-0939)

This memorandum is a request for an Amendment of the Orders of Conditions dated 7/3/2024 (DEP File No. 055-0939), for the Independence Greenway Extension transportation improvement project in the City of Peabody, MA. This memorandum provides a list of minor design modifications resulting from the additional compensatory flood storage area provided along the bikeway, which was added to this project after Order of Conditions was granted on 7/3/2024. We respectfully request that the Peabody Conservation Commission review the minor design modifications for the subject OOC to approve the proposed addition resulting in minor plan modifications under General Condition #14.

The OOC was appealed during the 10-day appeal period by the Department of Environmetal Protection Northeast Regional Office (DEP-NERO), stating that the OOC issued by the Peabody Conservation Commission (the Commission) does not meet performance standards in accordance with 310 CMR 10.57(4)(a) for work in Bordering Land Subject to Flooding (BLSF). As a result, additional areas have been identified and designed for additional proposed compensatory flood storage in order to compensate for the project's net fill on a foot-by-foot basis and comply with the performance standards in accordance with 310 CMR 10.57(4)(a).

An additional area located north of the proposed bikeway between STA. 344+00 to STA. 346+50 was identified to provide further compensatory flood storage between the elevations of 37 and 44 feet in order to provide compensation on a foot-by-foot basis in compliance with the performance standards in accordance with 310 CMR 10.57(4)(a). Borings in the area indicate groundwater at elevation 37; therefore, compensation was not provided within the 36–37-foot increment. Therefore, two additional smaller areas are also proposed at the end of the project, at STA. 356+50 and STA. 358+00, in order to provide flood compensation for the net fill of the project between the elevations of 36 and 37 feet. The proposed incremental net cut/fill volumes for the three additional proposed compensatory flood storage areas are shown in Tables 2-5 below.

As shown in Table 1 below, the additional proposed compensatory flood storage areas resulted in minor changes to 200-Foot Riverfront Areas. There is an overall increase in the work within both the 100-foot and 200-foot Riverfront Areas due to the extension of the limit of work to include the three additional

compensatory flood storage areas. The changes to BLSF impacts were a result of reduced limit of riprap within 100-year floodplain at Culvert No. 1 (per DEP's request).

Table 1: Project Resource Area Impacts Change

Resource Area Impacts	Original OOC (7/3/2024)	Amended OOC
BLSF (SF)	69,340	65,491
Compensatory Flood Storage (SF, CF)	1,630 SF / 3,472 CF	15,824 SF / -36,873 CF
Riverfront Area (SF)	103,288	134,143
0-100 (SF)	77,465	107,723
100-200 (SF)	25,823	26,419

Table 5: Total Net Cut/Fill Across the Project & Compensatory Flood Storage

Elevation (FT)	Incremental Net Cut/Fill Volume (CF)	Original Compensatory Flood Storage Cut Volume (CF)	Additional Total Compensatory Flood Storage Cut Vol (CF)	Total Net Cut/Fill Volume (CF)
34-35	301	-921	-921	-620
35-36	-159	-1,400	-1,400	-1,559
36-37	2,197	-1,151	-2,282	-85
37-38	2,033	0	-3,080	-1,047
38-39	1,305	0	-4,338	-3,033
39-40	5,246	0	-5,435	-189
40-41	2,207	0	-7,523	-5,316
41-42	-726	0	-7,308	-8,034
42-43	79	0	-3,476	-3,397
43-44	-4,458	0	-1,112	-5,570
44-45	-1,980	0	0	-1,980
45-46	-1,495	0	0	-1,495
46-47	-1,490	0	0	-1,490
47-48	-79	0	0	-79
TOTAL	**2,982**	**-3,472**	**-36,873**	**-33,893**

Additionally, during the 401/404 review process, the US ACOE requested to call out the Land Under Water (LUW)/Waters of the United States (WOTUS) impacts to the intermitted streams at Sta. 340+10 and 358+50. As a result, these impact numbers have also been added to WPA impacts to reflect the slight modifications and to be consistent with the impacts being permitted through the 401 WQC/404 PCN and are shown in Table 6 below. Also included as an attachment to this memorandum are the updated Figures 6 & 7 that reflect these resource area changes.

Table 1: Project Resource Area Impacts Change

Resource Area Impacts	Original OOC (7/3/2024)	Amended OOC
LUW – Permanent (SF)	8,287	8,661
LUW – Temporary (SF)	2,180	2,312

The following selected sheets were approved as part of the original OOC:

Sheet	Title	Prepared by	Date
1	Title Sheet & Index	Green International Affiliates, Inc	06/11/2024
2	Legend & Abbreviations	Green International Affiliates, Inc	06/11/2024
3	General Notes	Green International Affiliates, Inc	06/11/2024
4	Key Plan	Green International Affiliates, Inc	06/11/2024
5-6	Boring Logs	Green International Affiliates, Inc	06/11/2024
7-8	Typical Sections & Details 1	Green International Affiliates, Inc	06/11/2024
9-16	Construction Plans & Profiles	Green International Affiliates, Inc	06/11/2024
21-24	Drainage and Utility Plans	Green International Affiliates, Inc	06/11/2024
32	Compensatory Flood Storage Plan	Green International Affiliates, Inc	06/11/2024
33-34	Wetland Replication Plan and Sections	Green International Affiliates, Inc	06/11/2024
35-40	Culvert Plans	Green International Affiliates, Inc	06/11/2024
41-46	Construction Details	Green International Affiliates, Inc	06/11/2024
47-51	Landscape Plans	Green International Affiliates, Inc	06/11/2024
60-76	Bridge Plans	Green International Affiliates, Inc	06/11/2024

The Amended OOC plans include new and revised plan sheets reflecting the additional compensatory flood storage areas and are included for the Commissions' review and approval as part of this Amended OOC Permit Request as noted below.

Sheet	Title	Prepared by	Date
13, 14, 16	Construction Plan & Profile – 5, 6, & 8	Green International Affiliates, Inc	07/26/2024
23-24	Drainage & Utility Plans – 3 & 4	Green International Affiliates, Inc	07/26/2024
32-34	Compensatory Flood Storage Plans	Green International Affiliates, Inc	07/26/2024

As this is a Municipal project, the project is subject to local wetlands bylaw and abut ers notification is required per 310 CMR 10.05(4)(b) and has been initiated for this OOC Amendment request on 7/23/2024.

Enclosures:

- Updated WPA Form 3
- Original Signed OOC, dated 07/03/2024
- Updated Certified Abutter Notification, dated 7/23/2024
- Updated Figure 6 – Resource Area Impacts, dated 7/25/2024

- Updated Figure 7 – BLSF Impacts, dated 7/25/2024
- Amended OOC Plan Sheets, dated 7/26/2024

y:\shared\engineering\projects\2017\17118\documents\env\noi\ooc amendment\memo - amendment of ooc_dep 055-0939.docx

Updated WPA Form 3

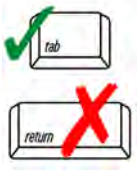
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Former B & M Railroad Easement, Northshore Road, Essex Center Drive, Endicott Street
Peabody (b. City/Town)
01960 (c. Zip Code)
Latitude and Longitude: 42°32'08"N-42°31'51"N 71°56'54"W-71°56'02"W
N/A (f. Assessors Map/Plat Number)
N/A (g. Parcel /Lot Number)

2. Applicant:

Brendan (a. First Name)
Callahan (b. Last Name)
City of Peabody (c. Organization)
24 Lowell Street (d. Street Address)
Peabody (e. City/Town)
MA (f. State)
01960 (g. Zip Code)
978-538-5780 (h. Phone Number)
(i. Fax Number)
brendan.callahan@peabody-ma.gov (j. Email Address)

3. Property owner (required if different from applicant): ☐ Check if more than one owner

(a. First Name)
(b. Last Name)
City of Peabody (c. Organization)
24 Lowell Street (d. Street Address)
Peabody (e. City/Town)
MA (f. State)
01960 (g. Zip Code)
(h. Phone Number)
(i. Fax Number)
(j. Email address)

4. Representative (if any):

Danielle (a. First Name)
Spicer (b. Last Name)
Green International Affiliates, Inc. (c. Company)
100 Ames Pond Drive Suite 200 (d. Street Address)
Tewksbury (e. City/Town)
MA (f. State)
01876 (g. Zip Code)
978-923-0400 (h. Phone Number)
(i. Fax Number)
dspicer@greenintl.com (j. Email address)

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

exempt (a. Total Fee Paid)
exempt (b. State Fee Paid)
exempt (c. City/Town Fee Paid)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

A. General Information (continued)

6. General Project Description:

The project proposes to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, MA for a total project length of approximately 1.3 miles. The proposed project is located along the former railroad right-of-way, which is owned and maintained by the City of Peabody. (see Project Narrative for more details).

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☒ Transportation
9. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☒ Yes ☐ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

310 CMR 10.52 (6), 310 CMR 10.53(3)(i), and 310 CMR 10.53(3)(f)
(see Project Narrative for more details).

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Peabody	
a. County	b. Certificate # (if registered land)
N/A	N/A
c. Book	d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☒ Bank	588 (P); 166 (T) — 1. linear feet	618 will be restored — 2. linear feet
b. ☒ Bordering Vegetated Wetland	2,350 (P); 4,675 (T) — 1. square feet	2,500 will be replaced — 2. square feet
c. ☒ Land Under Waterbodies and Waterways	8,661 (P); 2,312 (T) — 1. square feet 1,142 — 3. cubic yards dredged	4,271 - natural stream bottom will be restored

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	65,491 (includes fill and cut) — 1. square feet 2,982 — 3. cubic feet of flood storage lost	15,824 (comp.flood storage) — 2. square feet 36,873 — 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☒ Riverfront Area	Proctor Brook (inland) — 1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☒ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 294,400 square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.
134,143	107,723	26,419

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☒ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☒ Project Involves Stream Crossings

0
a. number of new stream crossings

6
b. number of replacement stream crossings

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☐ Yes ☒ No

If yes, include proof of mailing or hand delivery of NOI to:

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

August 1, 2021
b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area _____ percentage/acreage

(b) outside Resource Area _____ percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File Number
Document Transaction Number
Peabody
City/Town

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. a. NHESP Tracking # b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

c. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☒ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☐ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

NOI PROJECT PLAN SET - INDEPENDENCE GREENWAY EXTENSION
a. Plan Title

Green International Affiliates, Inc.
b. Prepared By

04/08/2024
c. Signed and Stamped by

d. Final Revision Date

As shown on each plan
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Peabody
City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

Brendan Callahan	04/09/24
1. Signature of Applicant	2. Date
3. Signature of Property Owner (if different)	4. Date
	4/09/2024
5. Signature of Representative (if any) Danielle Spicer	6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the “yes” box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Applicant Information

1. Location of Project:

Former B & M Railroad Easement, Northshore Road, EsseX Center Drive, Endicott Street	Peabody
a. Check number	b. City/Town
exempt	exempt
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Brendan		Callahan
a. First Name		b. Last Name
City of Peabody		
c. Organization		
24 Lowell Street		
d. Mailing Address		
Peabody	MA	01960
e. City/Town	f. State	g. Zip Code
978-538-5780		brendan.callahan@peabody-ma.gov
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

a. First Name		b. Last Name
City of Peabody		
c. Organization		
24 Lowell Street		
d. Mailing Address		
Peabody	MA	0160
e. City/Town	f. State	g. Zip Code
h. Phone Number	i. Fax Number	j. Email Address

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee

Step 5/Total Project Fee: _____

Step 6/Fee Payments:

Total Project Fee:	Fee Exempt a. Total Fee from Step 5
State share of filing Fee:	Fee Exempt b. 1/2 Total Fee **less $**12.50
City/Town share of filling Fee:	Fee Exempt c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

Original Signed OOC, dated 07/03/2024

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

City of Peabody-Wetlands & Rivers Protection Ord. CH 32

A. General Information

1. Conservation Commission: PEABODY
2. Issuance: a. ☑ OOC b. ☐ Amended OOC

3. Applicant Details

a. First Name	BRENDAN	b. Last Name	CALLAHAN		
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

4. Property Owner

a. First Name		b. Last Name			
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

5. Project Location

a.Street Address	FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.		
b.City/Town	PEABODY	c. Zip Code	01960
d. Assessors Map/Plat#	00	e. Parcel/Lot#	00
f. Latitude	42.53359N	g. Longitude	70.94025W

6. Property recorded at the Registry of Deed for:

a. County	b. Certificate	c. Book	d. Page
SOUTHERN ESSEX		29182	292

7.Dates

a. Date NOI Filed : 4/16/2024 b. Date Public Hearing Closed: 6/12/2024 c. Date Of Issuance: 7/3/2024

8.Final Approved Plans and Other Documents

a. Plan Title:	b. Plan Prepared by:	c. Plan Signed/Stamped by:	d. Revised Final Date:	e. Scale:
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION- PLAN AND PROFILE OF INDEPENDENCE GREENWAY EXTENSION BRIDGE P-03-020 (CAK) IN THE CITY OF PEABODY ESSEX COUNTY	GREEN INTERNATIONAL AFFILIATES, INC.	DANIELLE SPICER	some sheets 06/11/2024	AS NOTED

CITY CLERK 2024 JUL -3 AM 9:30 CITY OF PEABODY

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

B. Findings

1.Findings pursuant to the Massachusetts Wetlands Protection Act
Following the review of the the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act.

Check all that apply:

a. ☑ Public Water Supply	b. ☐ Land Containing Shellfish	c. ☑ Prevention of Pollution
d. ☑ Private Water Supply	e. ☐ Fisheries	f. ☑ Protection of Wildlife Habitat
g. ☑ Ground Water Supply	h. ☑ Storm Damage Prevention	i. ☑ Flood Control

2. Commission hereby finds the project, as proposed, is:

Approved subject to:

a. ☑ The following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

Denied because:

b. ☐ The proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ The information submitted by the applicant is not sufficient to describe the site, the work or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the interests of the Act , and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ Buffer Zone Impacts:Shortest distance between limit of project disturbance and the wetland resource area specified in 310CMR10.02(1)(a). ____ a. linear feet

Inland Resource Area Impacts:(For Approvals Only):

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☑ Bank	754 a. linear feet	754 b. linear feet	588 c. linear feet	588 d. linear feet
5. ☑ Bordering Vegetated Wetland	7025 a. square feet	7025 b. square feet	2500 c. square feet	2500 d. square feet
6. ☑ Land under Waterbodies and Waterways	10467 a. square feet	10467 b. square feet	4271 c. square feet	4271 d. square feet

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

	1142 e. c/y dredged	1142 f. c/y dredged		
7.☑ Bordering Land Subject to Flooding	69340 a. square feet	69340 b. square feet	1630 c. square feet	1630 d. square feet
Cubic Feet Flood Storage	2982 e. cubic feet	2982 f. cubic feet	3472 g. cubic feet	3472 h. cubic feet
8.☐ Isolated Land Subject to Flooding	 a. square feet	 b. square feet		
Cubic Feet Flood Storage	 c. cubic feet	 d. cubic feet	 e. cubic feet	 f. cubic feet
9.☑ Riverfront Area	103288 a. total sq. feet	103288 b. total sq. feet		
Sq ft within 100 ft	77465 c. square feet	77465 d. square feet	 e. square feet	 f. square feet
Sq ft between 100-200 ft	25823 g. square feet	25823 h. square feet	 i. square feet	 j. square feet

Coastal Resource Area Impacts:

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10.☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11.☐ Land Under the Ocean	 a. square feet	 b. square feet		
	 c. c/y dredged	 d. c/y dredged		
12.☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13.☐ Coastal Beaches	 a. square feet	 b. square feet	 c. c/y nourishment	 d. c/y nourishment
14.☐ Coastal Dunes	 a. square feet	 b. square feet	 c. c/y nourishment	 d. c/y nourishment
15.☐ Coastal Banks	 a. linear feet	 b. linear feet		
16.☐ Rocky Intertidal Shores	 a. square feet	 b. square feet		
17.☐ Salt Marshes	 a. square feet	 b. square feet	 c. square feet	 d. square feet
18.☐ Land Under Salt Ponds	 a. square feet	 b. square feet		
	 c. c/y dredged	 d. c/y dredged		
19.☐ Land Containing Shellfish				

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

a. square feet b. square feet c. square feet d. square feet

20. ☐ Fish Runs — Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above

c. c/y dredged d. c/y dredged

21. ☐ Land Subject to Coastal Storm Flowage

a. square feet b. square feet

22.

☐ Restoration/Enhancement (For Approvals Only)

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c & d or B.17.c & d above, please entered the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

23.

☑ Streams Crossing(s)

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

0	6
a. number of new stream crossings	b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. the work is a maintenance dredging project as provided for in the Act; or
   b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not exceed the issuance date of the original Final Order of Conditions.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work..
10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

" Massachusetts Department of Environmental Protection"
[or 'MassDEP"]
File Number :"055-0939"

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before Mass DEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.
17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. The work associated with this Order(the "Project") is (1) ☑ is not (2)☐ subject to the Massachusetts Stormwater Standards. If the work is subject to Stormwater Standards, then the project is subject to the following conditions;

a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge

Elimination System Construction General Permit as required by Stormwater Standard 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that: *i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures; *ii.*. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized; *iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10; *iv.* all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition; *v.* any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 19(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 19(f) through 19(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 19(f) through 19(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

g) The responsible party shall:

1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);

2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions:

SEE LOCAL CONDITIONS PAGES 9-12 ATTACHED HERETO AND MADE A PART HEREOF.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☑ Yes ☐ No

2. The Conservation Commission hereby(check one that applies):

a. ☐ DENIES the proposed work which cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw specifically:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order or Conditions is issued. Which are necessary to comply with a municipal ordinance or bylaw:

b. ☑ APPROVES the proposed work, subject to the following additional conditions.

1. Municipal Ordinance or Bylaw CHAPTER 32 2. Citation _____

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows:
SEE LOCAL CONDITIONS ON PAGES 9-12 ATTACHED HERETO AND MADE A PART HEREOF.

PEABODY CONSERVATION COMMISSION
CONDITIONS – DEP FILE # 55-939
PROJECT TITLE: INDEPENDENCE GREENWAY EXTENSION
(NEAR PROCTOR BROOK-ESSEX CENTER DR/NORTH SHORE RD/ENDICOTT ST/ FORMER RR
APPLICANT: BRENDAN CALLAHAN ON BEHALF OF THE CITY OF PEABODY
OWNERS: CITY OF PEABODY-24 LOWELL ST, PEABODY MA

ORDER OF CONDITIONS (OC)

GENERAL CONDITIONS (DEP): 1-20– SEE ATTACHED

21. This Order of Conditions also constitutes a special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody. Appeal to the Massachusetts Department of Environmental Protection (DEP), pursuant to the State Wetlands Protection Act (G.L. Chapter 131, Section 40) shall not operate to terminate or affect any of the provisions of said special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody.
22. A copy of this Order shall be present on the site at all times until the completion of all work and receipt of a Final Certification of Compliance by the Commission.
23. A copy of this Order of Conditions shall be included in all construction contracting and subcontracting documents dealing with the work proposed and shall supercede other contract requirements.
24. When the applicant applies to the Building Inspectors office for a building and/or foundation permit (or for any construction permit), within the buffer zone, the applicant must submit a copy of this Order of Conditions and accompanying plans to said Building Inspector. **Said Order of Conditions must be recorded at the Registry of Deeds and evidence of recording must be submitted to the Building Inspector and the Conservation Commission.**
25. **Prior to requesting an Occupancy Permit from the Building Inspector, the applicant shall obtain a Partial or Final Certificate of Compliance from this Order.**
26. Upon completion of the work described in a Final Order of Conditions, the applicant shall request in writing the issuance of a Certificate of Compliance stating that the work has been satisfactorily completed. In order to receive a Partial or Final Certificate of Compliance upon completion of the project, the applicant must send to the Commission two (2) hardcopies and an electronic copy of WPA Form 8A – Request for Certificate of Compliance (COC). If the project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor, two (2) hardcopies and an electronic copy of a written statement by such a professional person certifying substantial compliance with the plans and setting forth what deviation, if any, exists from the plans approved in the order shall accompany the Request for Certificate of Compliance. In all other cases, the applicant shall provide the Commission with a signed letter stating that the work has been completed in accordance with the approved Order of Conditions. The Commission shall verify the substantial completion of the work by a site inspection, prior to issuance of a Certificate of Compliance. The applicant shall include two (2) copies of a locus map of the area and recorded Order of Conditions, including the appropriate Book and Page reference. ***AS BUILT PLANS are REQUIRED for commercial projects.**
27. **Prior to construction commencement, the applicant shall:**
    A. Provide a copy of the recorded Order of Conditions to the Commission.
    B. Notify the Conservation Commission in writing 48 hours prior to construction start-up that erosion controls are in place and ready for inspection. (The erosion controls shall be placed

prior to any construction on-site. Said erosion controls shall be maintained and replaced as needed until a Certificate of Compliance is issued.)

28 Erosion control measures and barriers shall be kept in good repair, monitored daily and maintained or reinforced as necessary to ensure and prevent erosion and siltation of wetland resource areas until a Final Certificate of Compliance is issued.

29 During construction, the Commission may require additional erosion and sediment controls to be installed in areas not currently noted on the plan to contain soil on-site and to prevent erosion and siltation of wetland resource areas.

30 All debris, fill and excavated material shall be stockpiled as far away from resource areas and buffer zones as reasonably possible and surrounded by staked strawbales/compost logs to prevent sediment from surface runoff entering the wetlands. At no time shall any debris or other material be buried or disposed of within that line marked on plan as a Resource Area or No Disturb Zone.

31 After proper grading, all disturbed areas located within a buffer zone, except those areas designated as compensatory wetlands, shall be loamed and seeded with not less than four (4) inches of good quality loam. The applicant shall:

A. Install all required erosion and sedimentation control (ESC) measures\devices;
B. Notify Commission that all ESC measures are in place and receive approval of said ESC measures from Commission Agent, said notification shall be in writing and occur at least 48 hours prior to anticipated commencement of project construction;
C. Clearly mark on the field the delineation of vegetated wetlands on the site by stakes placed at 25 feet intervals.

32 The applicant shall affix the Order of Conditions to the DEP sign in a plastic envelope for review of same as needed. For Commercial projects the Order shall be available in the construction site trailer.

33 Any siltation caused onto any wetland, waterway, or No Disturb Zone shall be reported promptly to the Commission and such areas shall be restored to the satisfaction of the Commission.

34 Temporary seeding, mulching or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbance.

35 All final earth grading shall be permanently stabilized by the application of loam and seed or sod.

36 After installation of new catch basins on site, the basins shall be enveloped with silt barriers until all tributary areas have been stabilized with permanent cover.

37 Absorption batten pillows shall be used in all traps and catch basins.

38 Fertilizers used for landscaping and lawn care shall be of low-nitrogen content/zero phosphorus and used in moderation. Pesticides and herbicides shall not be used for landscaping and lawn care within Buffer Zones, Resource Areas, or No Disturb Zones.

39 Temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbances.

40 All re-vegetation of Resource Areas shall be performed according to approved and attached plans cited in this order. The proposed replacement area shall meet or exceed the General Performance Standards outlined in the Wetlands Protection Act (WPA) Regulations, 310 CMR, Section 10.55 (4) (b)-7. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

41 No work shall proceed until the applicant has received all other permits required by law, including, but not limited to any permit required by the Planning Board, Zoning Board of Appeals, Board of Health, Department of Environmental Protection or the Army Corp of Engineers.

42 Wetland flagging shall remain in place until the project has been completed and the Certificate of Compliance has been issued.

43 Signs shall be posted at the limit of work, to read as follows: **"Absolutely no work beyond this point."** Such signs shall be placed in an amount satisfactory to the Commission or its agent, with at a minimum, one such sign every **TWENTY feet along the limit of work**. Said signs shall be of such quality to last the duration of the project until a Certificate of Compliance is issued.

44 After completion of the work, the applicant shall permanently mark the edge of the wetland to ensure no further encroachment into the wetland and further the applicant shall instruct all agents to explain these markers to buyers, landscapers, tenants and all persons taking over the property from the applicant.

45 Any debris of "dumped" material placed in the resource areas shall be removed by the applicant.

46 There shall be no increase in the volume or rate of runoff, and no siltation of downstream areas as a result of the work herein permitted.

47 The Commission reserves the right to impose additional conditions on portions of this project or this site, to mitigate any actual or potential impacts resulting from the work herein permitted.

48 No earthen embankment in the Buffer Zone shall have a slope steeper than 2:1.

49 In the event a swimming pool is placed on this lot, the following condition shall apply: The content of water in swimming pools can be detrimental to wetlands plant and animal species. To remove harmful chemicals, it is the applicant's responsibility to leave the pool water standing without the addition of chlorine for a minimum of seven (7) days before draining (per the City's Stormwater System Ordinance). In this way chlorine concentration will be significantly reduced due to volatilization. All pool water, wherever possible, shall be drained through a dry well, rather than allowed to spread over the surface of the land. The City of Peabody Conservation Commission Office shall be notified prior to draining and shall approve the method of draining.

50 Work and maintenance shall be done in accordance with the following plans and reports:

►Massachusetts Department of Transportation Highway Division-Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the city of Peabody Essex County prepared by Green International Affiliates, Inc. stamped by Danielle Spicer with some sheets final revision date of June 11, 2024. (see full set of plans for each sheet date). Scale is as shown per sheet.

►Inland Wetland Replication Area narrative- MASSDOT Item 755.35

►Supplemental Plans labeled: Resource Area Impacts- Figure 6A, 6D and 6E (scale: 1"=40') revised date 6.11.24

►O&M Plan dated 2.5.23 as submitted with NOI.

51 A Pre-construction meeting must take place before work can commence. The meeting shall include The Conservation Agent, City Planning staff, the chosen contractor General Manager, commission members and other city staff as needed. A construction sequence and phasing schedule must be presented at this meeting.

52 Reports should be emailed to Conservation staff either on a monthly/quarterly or milestone basis. A monthly report is not necessary if no work has commenced. The commission needs to be kept up to date with each phase/milestone of said work. At minimum quarterly reports are due on the FIRST week of: **January/April/ June/September** once the project starts.

<u>SPECIAL CHECKLISTS:</u>

Checklist D –Proctor Brook - Channel/Culvert

1. Unless submitted with the Notice of Intent, a report, prepared by a Massachusetts Registered Professional Structural Engineer, shall be submitted to the Commission, for review and approval prior to construction. The report shall include but not be limited to the following:

- Any recommended work to repair and/or maintain the structural integrity of the channel/culvert;
- Structural Building Requirements over the culvert (foundation design, grade beams, etc.);
- Structural requirements where buildings, roadways, drives, or parking lots cross the culvert;
- Recommendations for debris removal within the channel/culvert on site;
- Results of Geotechnical Exploration.

Checklist J – Dewatering

1. Any dewatering activities on the project site in which water will be released to Resource Areas shall make use of a settling pond or similar device to remove sediment before water is released.

Checklist K – Projects Which Alter Bordering Land Subject to Flooding (BLSF)

1. The compensatory flood storage area shall be constructed prior to any filling of land subject to flooding.

Checklist L – Projects Which Alter Bordering Vegetated Wetlands (BVWs)

1. The compensatory Bordering Vegetated Wetland shall be constructed prior to any filling of Bordering Vegetated Wetland.

2. All revegetation of Resource Areas shall be performed according to the replication plan on file and dated **NOT DATED - labeled MASSDOT Item 755.35 Inland Wetland Replication Area.** The proposed replacement area shall meet or exceed the General Performance Standards outlined in Section 10.55(4)(b)-7 of 310CMR. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

3. A wetland specialist shall be on site during construction of the wetland replication area and shall supervise its construction. Two reports prepared by the Wetland Specialist shall be submitted annually to the Commission by May 1st and September 1st of each year for two years. Each report shall include an observed species list, relative abundance of each species, percent cover of wetland and upland species, the visibility of the plantings and proposed remedial measures to ensure that at least 75% of the surface of the replication area be re-established with indigenous wetland plant species within two growing seasons. Said report shall include enough photographs for proper coverage of issues/points being addressed. If monitoring data indicates that this objective cannot be met, a corrective plan of action shall be submitted to the Commission for approval and implemented under the supervision of the wetland specialist. No certificate of compliance will be granted by the Commission until such time as the replacement area has been found to meet these standards.

This Order of Conditions shall apply to any successors in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by the Order.

*As Built Plans are required when requesting a Certificate of Compliance.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
And the City of Peabody-Wetlands & Rivers Protection Ordinance

Provided by MassDEP:
55-939
MassDEP File #
1747021
eDEP Transaction #
Peabody
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

7. 3 .2024
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

7
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy must be mailed, hand delivered or filed electronically at the same time with the appropriate MassDEP Regional Office.

By VOTE ON: 10.28.2020 the individuals listed below authorized the use of their electronic signature pursuant to the Certificate of Vote recorded with Essex south Registry of Deeds in Book 39132, Page 402. They intend for their typed signatures to serve as their electronic signatures:

Signatures:

/s/ Bruce Comak

/s/ Vice Chairman Michael Rizzo

/s/ Arthur Athas

/s/ Chairman Stewart Lazares

/s/ Alt. Brian Cassidy

/s/ Sec. Michael Vivaldi

Signed by Conservation Agent to confirm authenticity
Lucia DelNegro Signature: Conservation Agent

/s/ Alt. Jamie Harrop

☒ by hand delivery on 7. 3 .2024 + via email

Date

☐ by Certified mail

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1747021
City/Town:PEABODY

subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

PEABODY
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

PEABODY
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.
Project Location

055-0939
MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for:

Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Rev. 4/1/2010

Updated Certified Abutter Notification, dated 7/23/2024

Notification to Abutters
Under the Massachusetts Wetlands Protection Act

In accordance with the second paragraph of Massachusetts General Laws, Chapter 131, Section 40 and/or Chapter 32 the City of Peabody's Local Wetlands and Rivers Protection Act, you are hereby notified of the following:

A. The name of the **Applicant** is: The City of Peabody

B. The Applicant has filed a **NOI/RDA/ANOI/ANRAD/AMEND OOC** (circle one) with the PEABODY Conservation Commission for the seeking permission to remove, fill, dredge or alter an Area Subject to Protection (Wetland Resource Area and/or Buffer Zone) Under the Massachusetts Wetlands Protection Act (General Laws Chapter 131, Sec.40).

C. The **address** of the lot where the activity is proposed: Former B&M Railroad Easement, Northshore Road, Essex Center Drive, Endicott Street

D. The **proposed activity** is:

The project proposed to extend the existing Independence Greenway from its current eastern terminus at Essex Center Drive to Endicott Street in Peabody, MA for a total project length of approximately 1.3 miles.

E. A **Public Hearing** regarding this application will be held on:
Wednesday, July 31, 2024 at 7 PM.

F. **Public Participation will be via Virtual Means Only** - At this time the Peabody Conservation Commission hearings will continue to be held remotely. Remote participation is allowed in accordance with Section 20 of Chapter 22 of the Acts of 2021 signed into law by Governor Baker on February 12, 2022, suspending provisions of the Open Meeting Law, G.L. c. 30A, Section 18. as extended by Section 20 of Chapter 22 of the Acts of 2022 and further extended by the Final Compromise Bill enacted by the House and Senate on March 23, 2023, and signed by Governor Maura Healey on March 29, 2023.

G The public may participate in this meeting via Remote Participation:

- From your computer, smart phone or tablet: https://zoom.us/join
- Meeting ID: **841 1498 2174**
- From your phone: Dial +1 646 558 8656; Meeting ID: **841 1498 2174**

H Copies of the application may be examined by contacting: The Conservation Commission Office at 978-538-5782 or the Applicant at the contact below.

I. Copies of the application may be obtained from either The Applicant, or the Applicant's representative Danielle Spicer, P.E., Green International Affiliates, by calling this telephone number: (978) 843-5218 between the hours of 9am-5pm, M-F.

Note: Public Hearing Notice, including its date, time, and place, will be published at least 5 days in advance in the *hearing* at the applicant's expense.

Note: You also may contact the Department of Environmental Protection (DEP) for more information about this application or the Wetlands Protection Act. To contact your local Conservation Agent at: lucia.delnegro@peabody-ma.gov or 978-538-5782

"At this time the Peabody Conservation Commission hearings will continue to be held remotely. Remote participation is allowed in accordance with Section 20 of Chapter 22 of the Acts of 2021 signed into law by Governor Baker on February 12, 2022, suspending provisions of the Open Meeting Law, G.L. c. 30A, Section 18. as extended by Section 20 of Chapter 22 of the Acts of 2022 and further extended by the Final Compromise Bill enacted by the House and Senate on March 23, 2023, and signed by Governor Maura Healey on March 29, 2023. In the event that we are unable to do so on matters not requiring a public hearing, we will post on the City of Peabody's website an audio or video recording, transcript, or other comprehensive recording as soon as possible after the meeting. The public may participate in this meeting via Remote Participation: A meeting ID will be provided on the Conservation Agenda posted on the City's website and outside/inside city hall at least 48 hours prior to the meeting: https://www.peabody-ma.gov/"

1. All or any of the members of the public body may choose to participate in a public meeting via remote access. Meetings may be virtual, in their entirety.
2. The public will be provided with alternative access through which they can watch or listen to meetings "in real time," and meeting notices will specify the manner in which members of the public may access audio or video of the meeting as it is occurring.
3. If, despite our best efforts, our technological capabilities do not adequately support public access to virtual or remote meetings, the Peabody will ensure that an audio or video recording, transcript, or other comprehensive record of the proceedings at the meeting is posted on the City's website as soon as possible after the meeting.
4. **Notices for public hearings will contain additional information about how the public may participate via electronic/technological means.** (youtube or facebook)
5. Where individuals have a right, or are required, to attend a public meeting or hearing, they will be provided with information about how to participate in the meeting/hearing remotely.
6. Meeting notices will still be posted at least 48 hours in advance (not counting Saturdays, Sundays, or legal holidays), unless it is an emergency meeting as defined under the Open Meeting Law (in which event, the meeting notice will be posted with as much advanced notice as is possible in the circumstances). Minutes will still be taken.

Please check individual meeting agendas on the calendar on the City's website, located at https://www.peabody-ma.gov/ for the latest information regarding meetings. Each meeting may experience unique circumstances that may require last minute changes in protocol, including cancellation or rescheduling. We appreciate your patience as we undergo this shift in a significant aspect of how the City of Peabody conducts business.

RECEIVED
APR 03 2024
By

City of Peabody
CERTIFICATION OF ABUTTERS

DATE: 4/3/24

PROPERTY OWNER: City of Peabody

PROPERTY LOCATION: Essex Center Drive to Endicott St, Peabody, MA MAP: _____ LOT: _____

REQUESTED BY: Green International Affiliates PHONE: 978-843-5225

email : JKeel@greenintl.com

_____ **Chapter 138, Section 15A** – direct abutters & churches, synagogues, hospitals, & schools within 500'

_____ **Chapter 40A, Section 11** – abutter to abutter within 300'

Special Permit _____ **Variance** _____ **Entertainment License** _____ **Site Plan Review** _____

_____ **Chapter 41, Section 81T** – Notice of Submission of Plan – direct abutters

__X__ **Chapter 32, City of Peabody Code** – Wetlands & Rivers Protection Regulations – abutter to abutter within 300'

__X__ **Chapter 131, Section 40** – Notice of Intent – all abutters within 100'

_____ **700 CMR 3.06**, State Permits for billboard signs – Notification within 500'

Please allow up to 5 business days for the completion of your request.

Project Location: The project will consist of modification of the existing eastern terminus of the Independence Greenway at the Essex Center Drive behind the Northshore Mall, its Route 128 underpass, and a portion of the Northshore Road from the Northshore Mall driveway to Proctor Brook to accommodate the connection to the proposed shared-use path; construction of the proposed bituminous shared-use trail along the existing abandoned railroad right-of-way between Northshore Road and Endicott Street; construction of a light duty timber boardwalk structure supported on helical piles; and various drainage improvements, including replacement of the existing culverts that convey Proctor Brook or its tributaries beneath the abandoned track bed; and construction of modifications at Endicott Street, including sidewalk reconstruction and drainage improvements. Please see the attached locus map.

See Attached

BOARD OF ASSESSORS
CITY OF PEABODY

CERTIFIED 4/5/24

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
062-017	LAHEY CLINIC FOUNDATION INC		41 MALL RD	BURLINGTON, MA 01803
051-001	J C PENNEY PROPERTIES INC		6501 LEGACY DR	PLANO, TX 75024
051-008	MALL AT NORTHSHORE LLC		PO BOX 6120	INDIANAPOLIS, IN 46206
062-005	EVANGELIDIS KOSMA L & ZOE		309 LOWELL ST	PEABODY, MA 01960
062-006	COSTA BOB F & TONIA		305 LOWELL ST	PEABODY, MA 01960
062-007	GOULOS JOHN L & VALERIE A		299 LOWELL ST	PEABODY, MA 01960
062-008	VENTURA GUSTAVO &	GUZMAN ERIDANIA VICIOSO	301 LOWELL ST	PEABODY, MA 01960
062-009	GOULOS JOHN L & VALERIE A		299 LOWELL ST	PEABODY, MA 01960
062-017B	MALL AT NORTHSHORE LLC	C/O NO SHORE ORTHOPEDICS RLTY LLC	1 ORTHOPEDICS DR	PEABODY, MA 01960
062-018	ATRIUS MSO LLC		275 GROVE ST	NEWTON, MA 02446
062-018A	U S POSTAL SERVICE		4 ESSEX CENTER DR	PEABODY, MA 01960
062-033	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-034	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-036	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-038	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-047	CORREA SEBASTIAO A & CREUZA M		41 CASTLE CIR	PEABODY, MA 01960
062-048	YASSIN HUSAIN & SABRAH ZAINAB		43 CASTLE CIR	PEABODY, MA 01960
062-049	SMITH SUSAN F & ERIC W		45 CASTLE CIR	PEABODY, MA 01960
062-050	GIUNTA PHILIP		47 CASTLE CIR	PEABODY, MA 01960
062-051	LESSARD RONALD J & LISA M		49 CASTLE CIR	PEABODY, MA 01960
062-052	OLDYTOWSKI STANLEY J		51 CASTLE CIR	PEABODY, MA 01960
062-053	VESS JACK & JO ANN P		53 CASTLE CIR	PEABODY, MA 01960
062-054	ZARRO SALVATORE G & MARY ELLEN		55 CASTLE CIR	PEABODY, MA 01960
062-055	LATACZ MARK & MALGORZATA TRS	KML FAMILY TRUST	57 CASTLE CIR	PEABODY, MA 01960
062-056	BUCKLEY KEVIN J & DIANE K		59 CASTLE CIR	PEABODY, MA 01960
062-057	KOLA ALEKSANDER & IRENA		61 CASTLE CIR	PEABODY, MA 01960
062-058	DUGAN DAVID T & ANDREA		63 CASTLE CIR	PEABODY, MA 01960
062-059	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
062-072	SILVA LUDGERO A & MARIA B		22 CASTLE CIR	PEABODY, MA 01960
062-073	MEMMOLO SHAUNA		20 CASTLE CIR	PEABODY, MA 01960
062-074	CAMPBELL JOYCE A & JASON		18 CASTLE CIR	PEABODY, MA 01960
062-075	MCKINNEY C L & J G TRS/LIFE ESTATE	CL MCKINNEY FAM & JG MCKINNEY FAM TRS	16 CASTLE CIR	PEABODY, MA 01960
062-500	KAVJIAN DONNA M TRUSTEE	DONNA M KAVJIAN REVOC TRUST	9 SNOWY OWL LN	MARSHFIELD, MA 02050
062-501	INNIS WARREN A TRUSTEE	A & W REALTY TRUST II	8 GOODRIDGE ST	PEABODY, MA 01960
062-502	ROHNKE MATTHEW KARL		500 NO SHORE RD - UNIT 3A	PEABODY, MA 01960
062-503	ATHAS KENNETH A		500 NO SHORE RD - APT 4A	PEABODY, MA 01960
062-504	THRASIVOULOS JOHN &	KETTINGER ROXANA	500 NO SHORE RD - UN 5A	PEABODY, MA 01960
062-505	INNIS WARREN A & ALDYTH M TRS	CHATEAU ROYALE #6A TRUST	3 LONGSPUR RD	IPSWICH, MA 01938
062-506	DARCY JR CORNELIUS J &	SWEENEY-DARCY DIANE J CO-TRS	500 NO SHORE RD UNIT 7A	PEABODY, MA 01960
062-507	DESPRES EUGENE D &	DUNN VIRLEIA M	500 NORTH SHORE RD - UNIT 8A	PEABODY, MA 01960
062-508	MANUEL THOMAS F & KAREN A		500 NO SHORE RD UNIT 9A	PEABODY, MA 01960
062-509	MACHADO MARIA E LF EST	KANELLOS SANDRA MACHADO	91 MAPLEWOOD RD	LYNN, MA 01904
062-510	MCGONNELL RICHARD P & DIANA		500 NO SHORE RD UNIT 11A	PEABODY, MA 01960
062-511	BORDONARO JOSEPH		500 NO SHORE RD - UNIT 12A	PEABODY, MA 01960
062-512	OSTROWSKI RAYMOND E TR	RAYMOND E OSTROWSKI REVOC TR	17 LEDGEWOOD DR	DANVERS, MA 01923
062-513	VISCONTE LOUISE J M LIFE ESTATE	DREW JOANNE R	500 NO SHORE RD UNIT 2B	PEABODY, MA 01960
062-514	MCGUIRE JEREMY		500 NO SHORE RD - UNIT 3B	PEABODY, MA 01960
062-515	BROOKS COREY J		500 NO SHORE RD UNIT 4B	PEABODY, MA 01960
062-516	STOWELL AMY		500 NO SHORE RD - UNIT 5B	PEABODY, MA 01960
062-517	OLSON DIANNE M		500 NO SHORE RD - UNIT 6B	PEABODY, MA 01960
062-518	ARCHIBALD DANIEL A & CARLA M TRS	ARCHIBALD FAMILY TRUST OF 2021	6 PROCTOR CIR	PEABODY, MA 01960
062-519	PATTEN NANCY M TRUSTEE	THE NANCY M PATTEN REVOCABLE TRUST	500 NO SHORE RD - UNIT 8B	PEABODY, MA 01960

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
062-520	LINEHAN BRIAN		500 NO SHORE RD - UNIT 9B	PEABODY, MA 01960
062-521	DASILVA ELIZABETH		500 NO SHORE RD - UNIT 10B	PEABODY, MA 01960
062-522	STENSON DAVID K		500 NO SHORE RD UNIT 11B	PEABODY, MA 01960
062-523	ALSAYEDALI ANAS		500 NO SHORE RD - UNIT 12B	PEABODY, MA 01960
062-524	BARRETO YVONNE M TRUSTEE	YVONNE M BARETTO TRUST	15 CROWN WAY	MARBLEHEAD, MA 01945
062-525	MACHADO MARIA LF EST	KANELLOS SANDRA MARCHADO	91 MAPLEWOOD RD	LYNN, MA 01904
062-526	BARRETO JOHN S V TRUSTEE	UN 1C NO SHORE RD PBDY RLTY TRUST	15 CROWN WAY	MARBLEHEAD, MA 01945
062-527	BORGES SALVIO & IVANETE		500 NO SHORE RD - UNIT 2C	PEABODY, MA 01960
062-528	PANTANO ANGELINA		500 NO SHORE RD UNIT 3C	PEABODY, MA 01960
062-529	D'ENTREMONT ROLAND R		500 NO SHORE RD UNIT 4C	PEABODY, MA 01960
062-530	DE LOS SANTOS EURYES		500 NO SHORE RD - UNIT 5C	PEABODY, MA 01960
062-531	KETTINGER DARLYN		500 NORTH SHORE RD - UNIT 6-C	PEABODY, MA 01960
062-532	RIVERA SAULO M TERRERO		500 NO SHORE RD - UNIT 7C	PEABODY, MA 01960
062-533	THRASIVOULOS JOHN & ROXANA		500 NO SHORE ROAD- UNIT 8C	PEABODY, MA 01960
062-534	WENG YUJIA & ZHENG YUANMING		1 PARTRIDGEBERRY LN	SOUTH HAMILTON, MA 01982
062-535	DONAHUE ELIZABETH A TRUSTEE	ELIZABETH A DONAHUE TRUST	500 NO SHORE RD - UNIT 10C	PEABODY, MA 01960
062-536	RICCIARDI MELINA		3 GEMMA DR	PEABODY, MA 01960
062-537	KIERE GEORGE		500 NO SHORE RD UNIT 12C	PEABODY, MA 01960
062-538	CAMPBELL JONATHAN		500 NO SHORE RD - UNIT 13C	PEABODY, MA 01960
062-539	INNIS ALVAN A & GRACE M TRS	CHATEAU ROYALE #14C TRUST	8 GOODRIDGE ST	PEABODY, MA 01960
062-700	MATTIVELLO CAMILLE P LF EST	MANZO CAMILLE M	7 KARELITZ RD - UNIT A	PEABODY, MA 01960
062-701	GITTER TAMMY R		7 KARELITZ RD - UNIT B	PEABODY, MA 01960
062-800	BUNNELL PATRICK		6 KARELITZ RD - UNIT A	PEABODY, MA 01960
062-801	SYLVESTER JOANNE M LF EST	SYLVESTER JULIE M	6 KARELITZ RD - UNIT B	PEABODY, MA 01960
063-095	CITY OF PEABODY	MUNICIPAL LIGHT PLANT	201 WARREN ST EXT	PEABODY, MA 01960
063-096A	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
063-162X	BANDICOOT LLC	C/O BRICKPOINT PROPERTIES INC	2 MAIN ST - SUITE 310	STONEHAM, MA 02180
063-164	CITY OF PEABODY	OLD ELECTRIC POWER PLANT	201 WARREN ST EXT	PEABODY, MA 01960
063-166	MANIERI WANDA		16 JENNIFER LN	PEABODY, MA 01960
063-167	LEONE CHRISTOPHER & MARIA		18 JENNIFER LN	PEABODY, MA 01960
063-168	SKORY STEVEN A & LORI T		20 JENNIFER LN	PEABODY, MA 01960
063-169	CARTER JR ROBERT T & CINDY TRS	CARTER LIVING TRUST	22 JENNIFER LN	PEABODY, MA 01960
073-207	CITY OF PEABODY		24 LOWELL ST	PEABODY, MA 01960
074-004	MERCER MARK A & JEFFREY W		193 LOWELL ST	PEABODY, MA 01960
074-006A	ARSENAULT EDWARD J & GEORGIA E TRS	185 LOWELL STREET REALTY TRUST	185 LOWELL ST	PEABODY, MA 01960
074-007	BOSTON COMMUNITY PROPERTIES LLC		231 EAST MAIN ST	WESTBOROUGH, MA 01581
074-009	CASHIN ROSA A		179 LOWELL ST	PEABODY, MA 01960
074-010	DELOSA RYAN S & MOLLY E		175 LOWELL ST	PEABODY, MA 01960
074-011	ELWELL WILLIAM A & ANN L		173 LOWELL ST	PEABODY, MA 01960
074-012	BUCHANAN JENNIFER L		171 LOWELL ST	PEABODY, MA 01960
074-013	GRENHAM KAREN M & ROBERT H JR		169 LOWELL ST	PEABODY, MA 01960
074-014	CRISOSTOMO ESCARLYN M		163 LOWELL ST	PEABODY, MA 01960
074-015	SPYROPOULOS STELLA LF EST	BERUBE JOYCE Z	161 LOWELL ST	PEABODY, MA 01960
074-016	JOUNI RABEA & SOUHAIL		159 LOWELL ST	PEABODY, MA 01960
074-017	BISHOP JOHN J & MARIE E		157 LOWELL ST	PEABODY, MA 01960
074-018	ELWELL W A & DONOVAN D M &	KARAZURNA K A TRUSTEES	155 LOWELL ST	PEABODY, MA 01960
074-019	NUNZIATO JOHN		151 LOWELL ST	PEABODY, MA 01960
074-020	DONOVAN KEVIN R & DEBORAH M		151 LOWELL ST (R)	PEABODY, MA 01960
074-021C	PEPIN MARK R		147 LOWELL ST	PEABODY, MA 01960
074-021X	VULAJ VAT		143 LOWELL ST	PEABODY, MA 01960
074-023	AMPET INC		164 DAYTON ST	DANVERS, MA 01923
074-024	CARRION JUAN		P O. BOX 294	MARBLEHEAD, MA 01945

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
074-025	CIKO NIKOLLA & MARIKA		87 ENDICOTT ST	PEABODY, MA 01960
074-025A	DUTRA JOSSANIA		81 ENDICOTT ST	PEABODY, MA 01960
074-025C	KHATRI POOJA		83 ENDICOTT ST	PEABODY, MA 01960
074-026	MCGINNESS ROBERT M & LORI E TRS	MCGINNESS FAMILY REVOCABLE TR	75 ENDICOTT ST	PEABODY, MA 01960
074-027	KELLEHER MICHAEL W & SHERI A		73 ENDICOTT ST	PEABODY, MA 01960
074-028	BETTENCOURT JOHN M &	BETTENCOURT ANA MARIA A TRS	71 ENDICOTT ST	PEABODY, MA 01960
074-029	SANCHEZ ALBERTO		54 WARREN ST EXT	PEABODY, MA 01960
074-030	LOVATO DONALD J & MARILYN J		56 WARREN ST EXT	PEABODY, MA 01960
074-030A	OUELLETTE ROBERT F & MAUREEN D		58 WARREN ST EXT	PEABODY, MA 01960
074-031	POLINI PEDRO		60 WARREN ST EXT	PEABODY, MA 01960
074-032	PILKONS WALTER T & DORTHEA L		159 BAHIA VIA	FORT MYERS BEACH, FL 33931
074-033	CANAS JOAQUIM C & MARIA O TRS	CANAS 2015 FAMILY TRUST	14 DANIEL TER	PEABODY, MA 01960
074-034	TEJADA JOHANNA		69 ENDICOTT ST	PEABODY, MA 01960
074-065	CITY OF PEABODY	SCHOOL ADMIN OFFICE	70 ENDICOTT ST	PEABODY, MA 01960
074-075B	LCM REALTY MANAGEMENT LLC		PO BOX 433	DANVERS, MA 01923
074-075C	SPENCER III GERALD D & JEFFREY V		78 ENDICOTT ST	PEABODY, MA 01960
074-265	WHEATON JR CHARLES E		13 JENNIFER LN	PEABODY, MA 01960
074-267	ARSENAULT EDWARD J JR & JEANNE		187R LOWELL ST	PEABODY, MA 01960
074-268	MOTTA MICHAEL L & TINA M		24 JENNIFER LN	PEABODY, MA 01960
074-269	NAVARRO JESSICA M & ANDREW F		26 JENNIFER LN	PEABODY, MA 01960
074-270	HAJRO TAULANT & INA		28 JENNIFER LN	PEABODY, MA 01960
074-277	SAINI BALBIR		15 JENNIFER LN	PEABODY, MA 01960
074-278X	PEABODY CONGREGATION OF	JEHOVAH'S WITNESSES INC	79 ENDICOTT ST	PEABODY, MA 01960
074-283	PEABODY CROSSING LLC		9 ATLANTIC AVE	MARBLEHEAD, MA 01945
074-502	ECK THOMAS J & WALLINS VICTORIA J		P.O. BOX 217	ROCKPORT, MA 01966
074-503	DELANEY DENISE A		129 LOWELL ST - UNIT 2	PEABODY, MA 01960
074-504	NGUYEN JOHN V & TRAM PHOEBE T		129 LOWELL ST - UNIT 3	PEABODY, MA 01960
074-505	KOVIL NICOLE FRANCES		49 BELLINGTON AVE	REVERE, MA 02151
074-506	KWONG JOHN C & DEBORAH M		129 LOWELL ST - UNIT 5	PEABODY, MA 01960
074-507	RAZA REBWAR & ASHNA		129 LOWELL ST - UNIT 6B	PEABODY, MA 01960
074-508	JONES JR WILLIAM & JACLYN		129 LOWELL ST - UNIT 7	PEABODY, MA 01960
074-509	CLIFFORD LAWRENCE & SHEILA		129 LOWELL ST - UNIT 8	PEABODY, MA 01960
074-510	BEALE ANDREW		129 LOWELL ST - UNIT 9	PEABODY, MA 01960
074-511	HAM DEBORAH		129 LOWELL ST - UNIT 10	PEABODY, MA 01960
074-512	CARON BRUCE R & GAIL E		129 LOWELL ST - UNIT 11	PEABODY, MA 01960
074-513	MARC AMINADA		129 LOWELL ST - UNIT 12	PEABODY, MA 01960
074-514	O'CONNELL CAROLYN TRUSTEE	CAROLYN O'CONNELL REVOCABLE TR	129 LOWELL ST - UNIT 13	PEABODY, MA 01960
074-515	DOYLE CHARLES L &	MAHONEY-DOYLE ANNE M	129 LOWELL ST UNIT 14	PEABODY, MA 01960
074-516	DALLAIRE STEPHANIE		129 LOWELL ST - UNIT 15	PEABODY, MA 01960
074-517	GANGI SUSAN		129 LOWELL ST UNIT 16	PEABODY, MA 01960
074-518	OCAMPO PATRICIA M		129 LOWELL ST - UNIT 17	PEABODY, MA 01960
074-519	LAMOUREUX MATTHEW M		129 LOWELL ST - UNIT 18	PEABODY, MA 01960
074-520	GUARINO JAMES & ANDREA M		129 LOWELL ST - UNIT 19	PEABODY, MA 01960
074-521	MARRS DAVID P		129 LOWELL ST - UNIT 20	PEABODY, MA 01960
074-522	GILDEA MICHAEL C & LIU YEWEI		129 LOWELL ST - UNIT 21	PEABODY, MA 01960
074-523	BISEGNA BONITA A		129 LOWELL ST - UNIT 22	PEABODY, MA 01960
074-524	HANSON RHEA		129 LOWELL ST - UNIT 23	PEABODY, MA 01960
074-525	BRUCE RICHARD P		129 LOWELL ST - UNIT 24	PEABODY, MA 01960
074-526	WEED PATRICIA A		129 LOWELL ST UN 25	PEABODY, MA 01960
074-527	ARMSTRONG RICHARD		129 LOWELL ST UNIT 26	PEABODY, MA 01960
074-528	MULLEN ERIN N		129 LOWELL ST - UNIT 27	PEABODY, MA 01960
074-529	DOE VIRGINIA MARIE		129 LOWELL ST #28	PEABODY, MA 01960

Property ID	Owner	Owner 2	Owner Address	Owner Address 2
074-530	CORBETT STEVEN M		129 LOWELL ST - UNIT 29	PEABODY, MA 01960
074-531	LISA ROAD LLC		5 LISA RD	PEABODY, MA 01960
074-532	SILVA GORETI		129 LOWELL ST-UN31	PEABODY, MA 01960
074-533	MACKENZIE AMANDA JOY		129 LOWELL ST - UNIT 32	PEABODY, MA 01960
074-534	MCKEEN DOROTHY J		129 LOWELL ST - UNIT 33	PEABODY, MA 01960
074-535	CHONG DIANA G		129 LOWELL ST - UNIT 34	PEABODY, MA 01960
074-536	DOMBROWSKI DAVID J		129 LOWELL ST - UNIT 35	PEABODY, MA 01960
074-537	KISCHEL MICHAEL & ALYSSA T C		129 LOWELL ST - UNIT 36	PEABODY, MA 01960
074-538	HAN HYUNGSOON		129 LOWELL ST - UNIT 37	PEABODY, MA 01960
074-539	SHULMAN STEPHEN & MEGAN		129 LOWELL ST - UNIT 38	PEABODY, MA 01960
074-540	BRENNAN LISA M TRUSTEE	THE LISA M BRENNAN REALTY TRUST	129 LOWELL ST - UNIT 39	PEABODY, MA 01960
074-541	PATEL MARGI		129 LOWELL ST - UNIT 40	PEABODY, MA 01960
074-542	OGRABISZ GAYLE		129 LOWELL ST UNIT 41	PEABODY, MA 01960
074-543	HYLAND MICHAEL		129 LOWELL ST - UNIT 42	PEABODY, MA 01960
074-544	BOGGOCH EDWARD J		129 LOWELL ST - UNIT 43	PEABODY, MA 01960
074-545	WENDT DANIEL R		129 LOWELL ST - UNIT 44	PEABODY, MA 01960
074-546	ATAIDE MARIA G		129 LOWELL ST - UNIT 45	PEABODY, MA 01960
074-547	SILVA FERNANDA M & ZELIO M		129 LOWELL ST - UNIT 46	PEABODY, MA 01960
074-548	MOREAU TRACY A		129 LOWELL ST - UNIT 47	PEABODY, MA 01960
074-549	MARTIN KATHLEEN D		129 LOWELL ST - UNIT 48	PEABODY, MA 01960
074-550	DUNNE MAUREEN A &	TSONIS DEMETRI G	129 LOWELL ST - UNIT 49	PEABODY, MA 01960
074-551	GALLAGHER SEAN P TRUSTEE	GALLAGHER FAMILY TRUST	129 LOWELL ST - UNIT 50	PEABODY, MA 01960
074-552	COYNE JEAN M		129 LOWELL ST - UNIT 51	PEABODY, MA 01960
074-553	BETTENCOURT B T & C M LIFE ESTATE	BETTENCOURT DAVID M	129 LOWELL ST - UNIT 52	PEABODY, MA 01960
074-554	GOMES ANA PAULA		129 LOWELL ST - UNIT 53	PEABODY, MA 01960
074-555	MUSE DONNA L		129 LOWELL ST - UNIT 54	PEABODY, MA 01960
074-556	KYMINAS DANA		129 LOWELL ST - UNIT 55	PEABODY, MA 01960
074-725	DAVIS EDWARD & GIA L		354 LOWELL ST	PEABODY, MA 01960
074-726	MARC-AURELE ALEXANDER J &	RICE LINDSAY G	30 JENNIFER LN - UNIT B	PEABODY, MA 01960
085-221	CITY OF PEABODY	CITY HALL	24 LOWELL ST	PEABODY, MA 01960

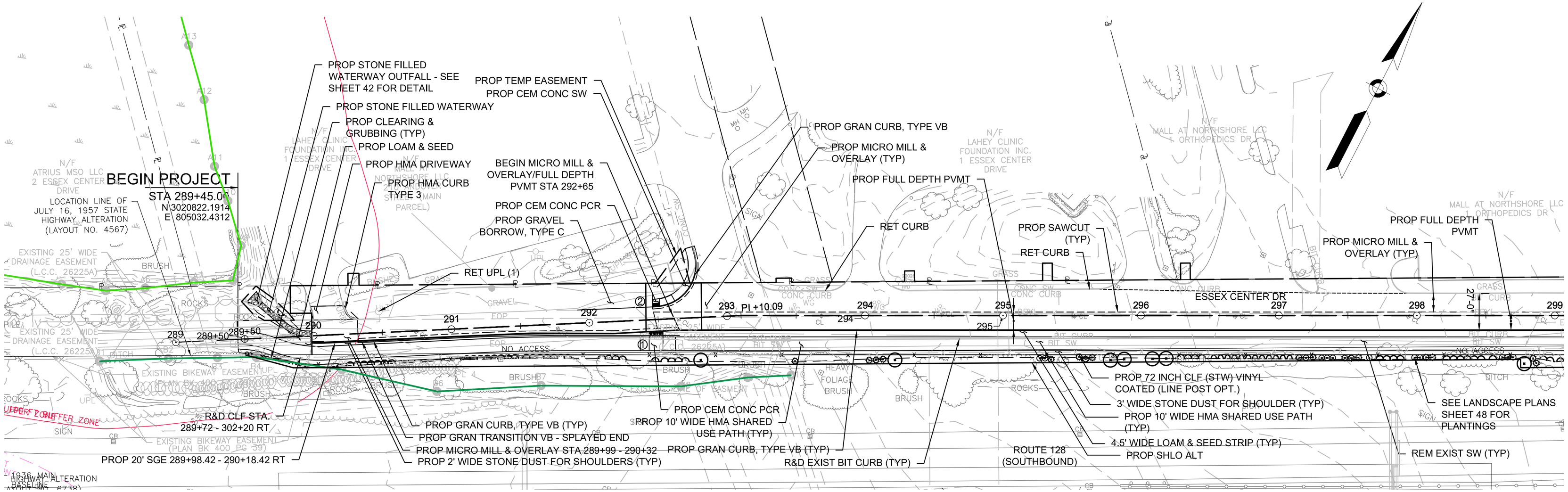
Teresa Reardo
Lesley George
Susan E. Ambrellos

4/5/24

A00861 - 55

Proposal No. 609211-132091

Updated Figure 6 - Resource Area Impacts & Figure 7 - BLSF Impacts



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS	TOTAL IMPACTS
PERMANENT LUW/WATERWAYS (SF)	8,661
TEMPORARY LUW/WATERWAYS (SF)	2,312
PERMANENT BVW IMPACT (SF)	2,538
TEMPORARY BVW IMPACT (SF)	4,675
WETLAND REPLICATION AREA (SF)	2,500
RIVERFRONT AREA (SF)	134,143
0–100 (SF)	107,723
100–200 (SF)	26,419
100–FT BUFFER ZONES (SF)	54,594
PERMANENT BANK IMPACT (LF)	588
TEMPORARY BANK IMPACT (LF)	166

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

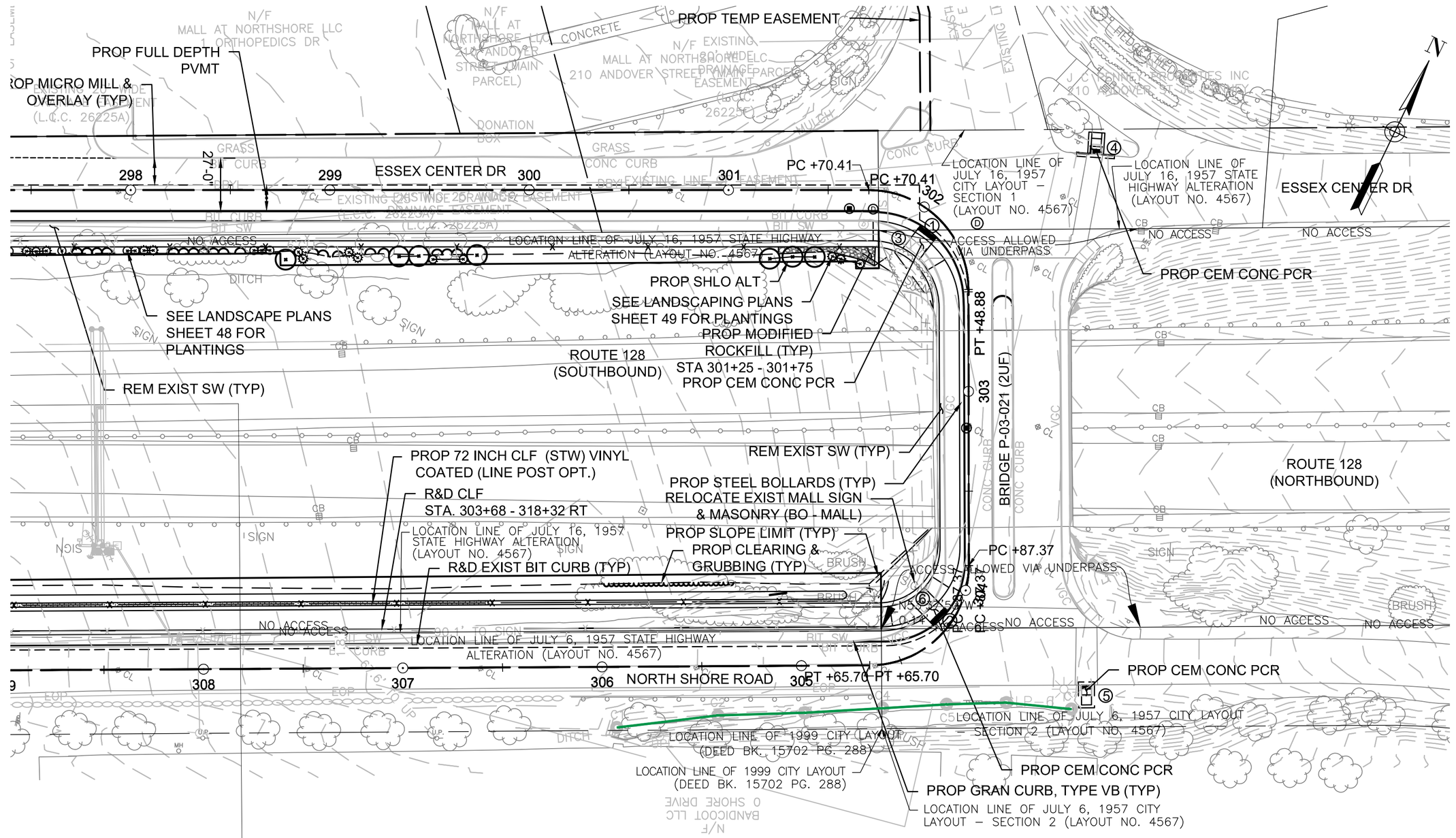
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: 07/22/2024 | CHECKED BY: DS/OF

FIGURE 6A



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

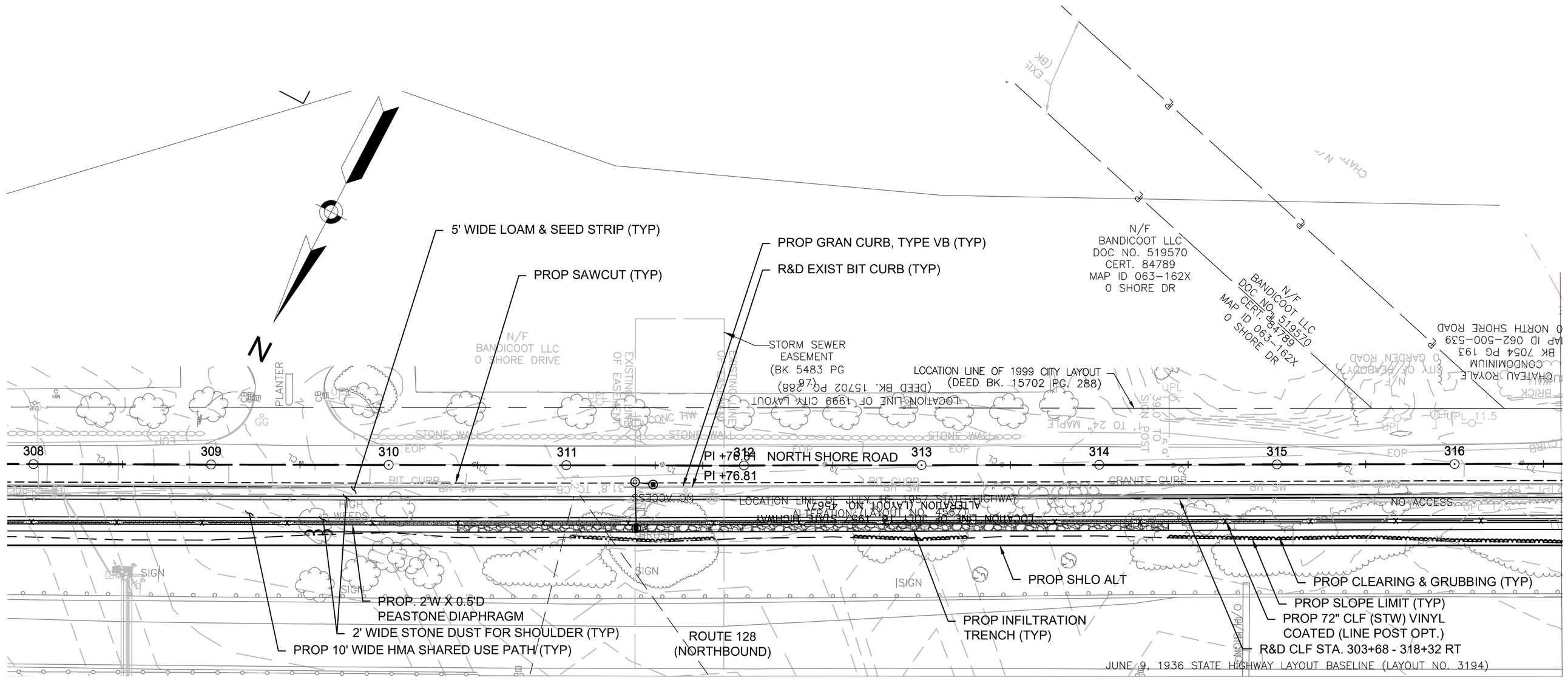
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: 07/16/2024 | CHECKED BY: DS/OF

FIGURE 6B

17118_EV IMPACTS.DWG Plotted on 24-Jul-2024 3:04 PM



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 09/29/2023 | DRAWN BY: JK
REVISED: 07/16/2024 | CHECKED BY: DS/OF

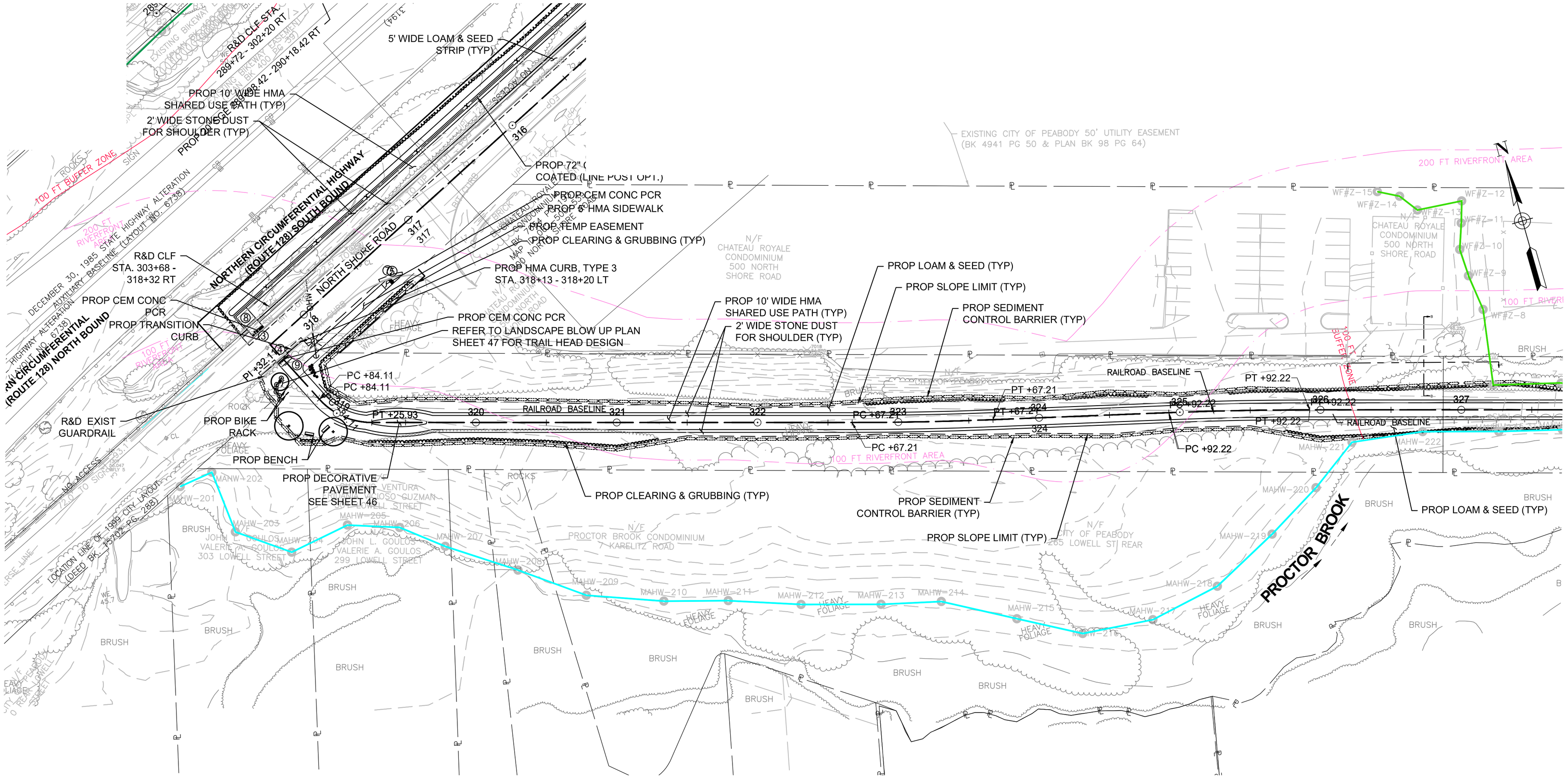
FIGURE 6C

17118_EV IMPACTS.DWG Plotted on 24-Jul-2024 3:06 PM

Proposal No. 609211-132091

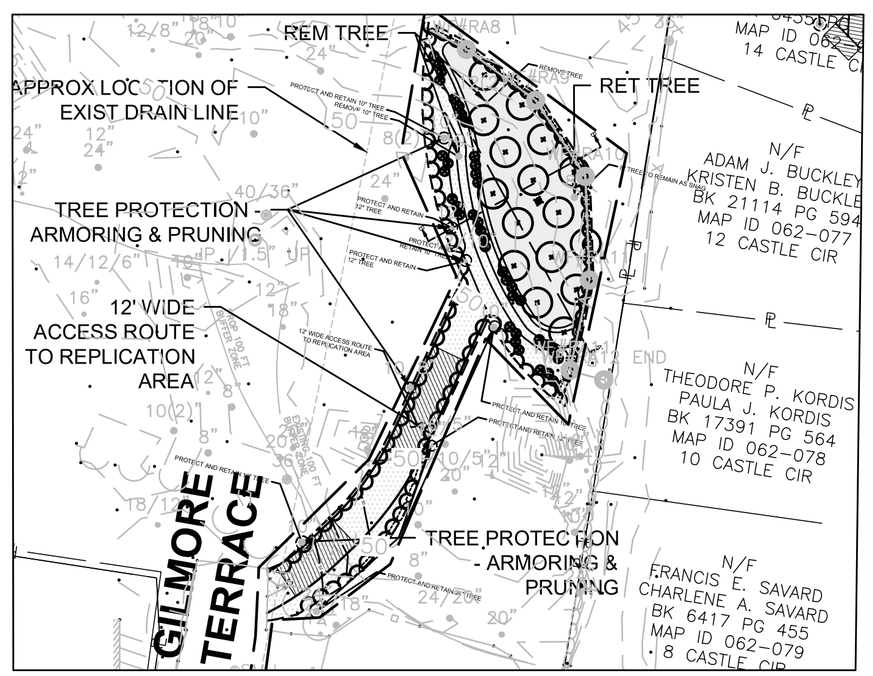
A00861 - 60

17118_EV IMPACTS.DWG Plotted on 24-Jul-2024 3:36 PM



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)
- WETLAND REPLICATION AREA



INSET A - WETLAND REPLICATION AREA

40 0 40 80

SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

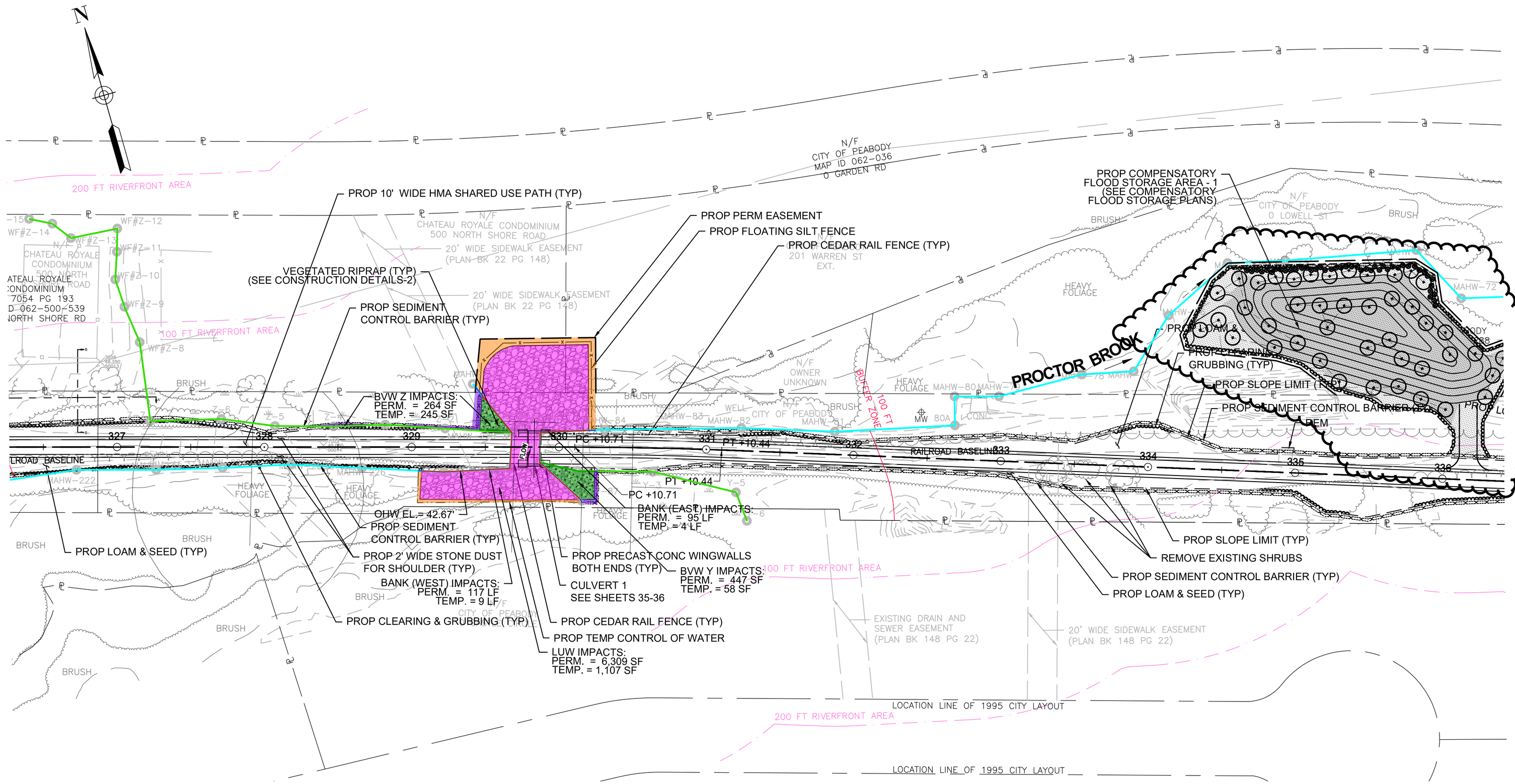
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED: 07/16/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6D

Proposal No. 609211-132091



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

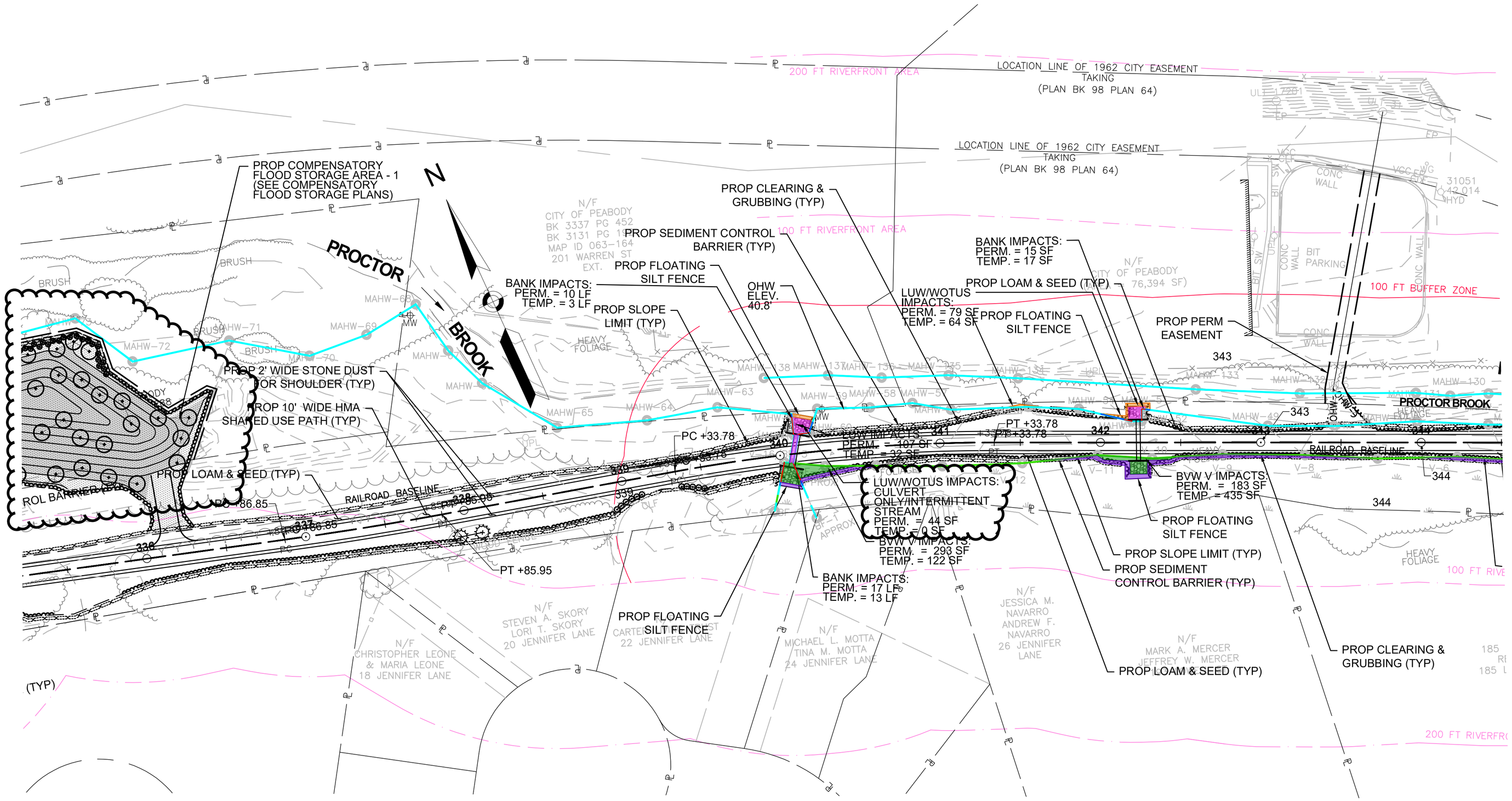
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED: 07/16/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6E

17118_EV IMPACTS.DWG Plotted on 24-Jul-2024 3:58 PM



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

40 0 40 80
SCALE IN FEET
1" = 40'

RESOURCE AREA IMPACTS

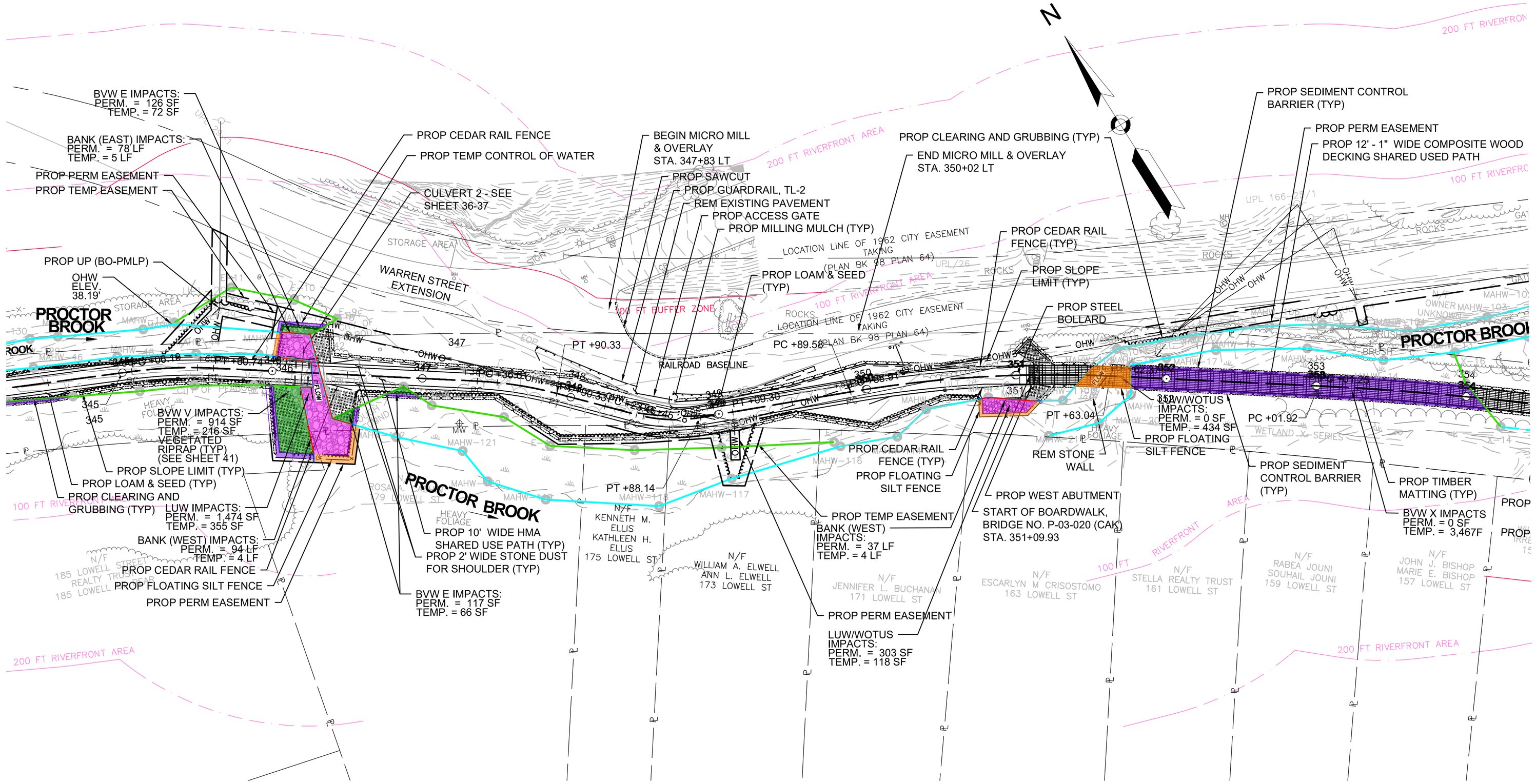
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED: 07/16/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6F



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS

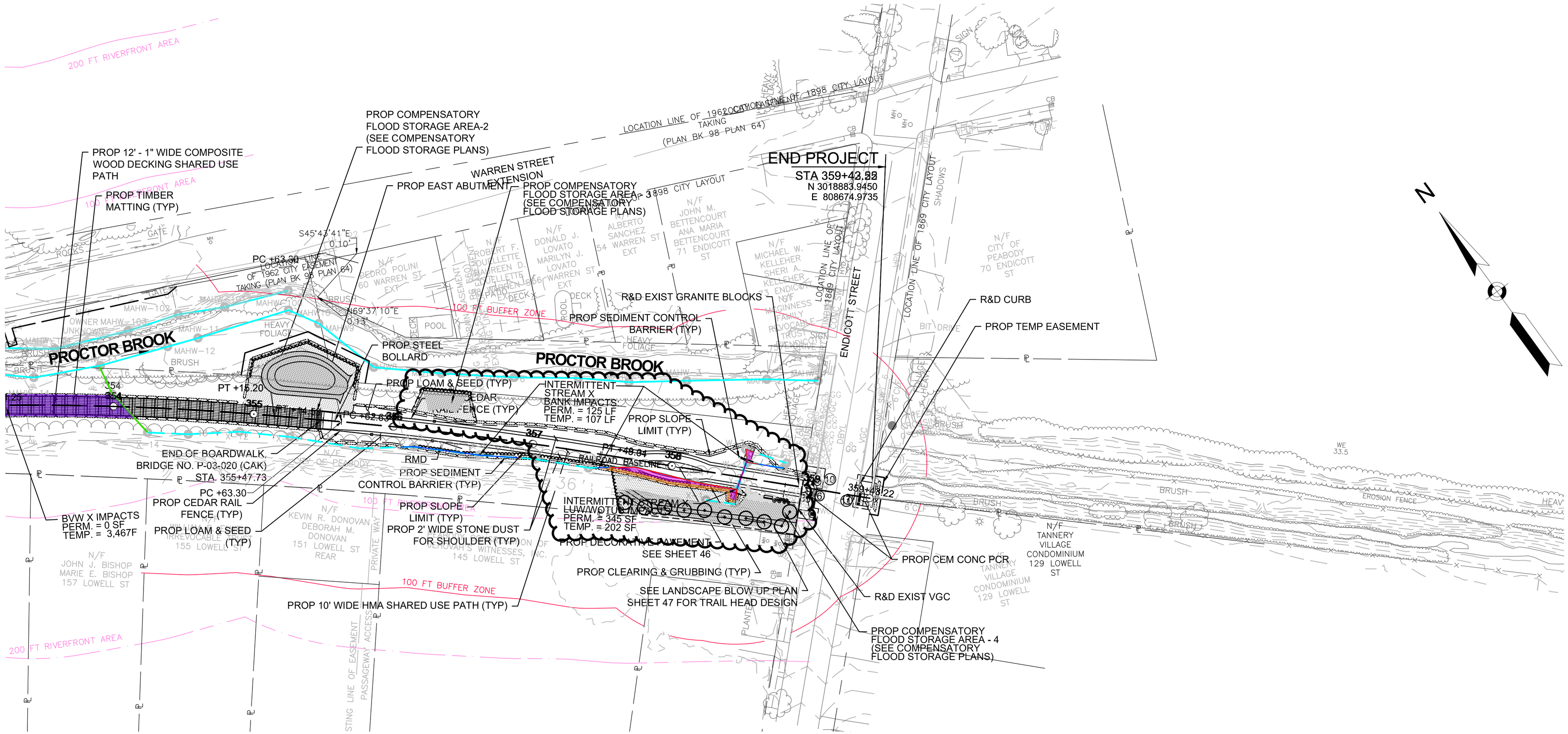
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 09/29/2023
REVISED: 07/16/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6G



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- STREAM/BANK IMPACT (PERM.)
- STREAM/BANK IMPACT (TEMP.)
- BVW IMPACT (PERM.)
- BVW IMPACT (TEMP.)
- LUW/WATERWAYS IMPACT (PERM.)
- LUW/WATERWAYS IMPACT (TEMP.)

RESOURCE AREA IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

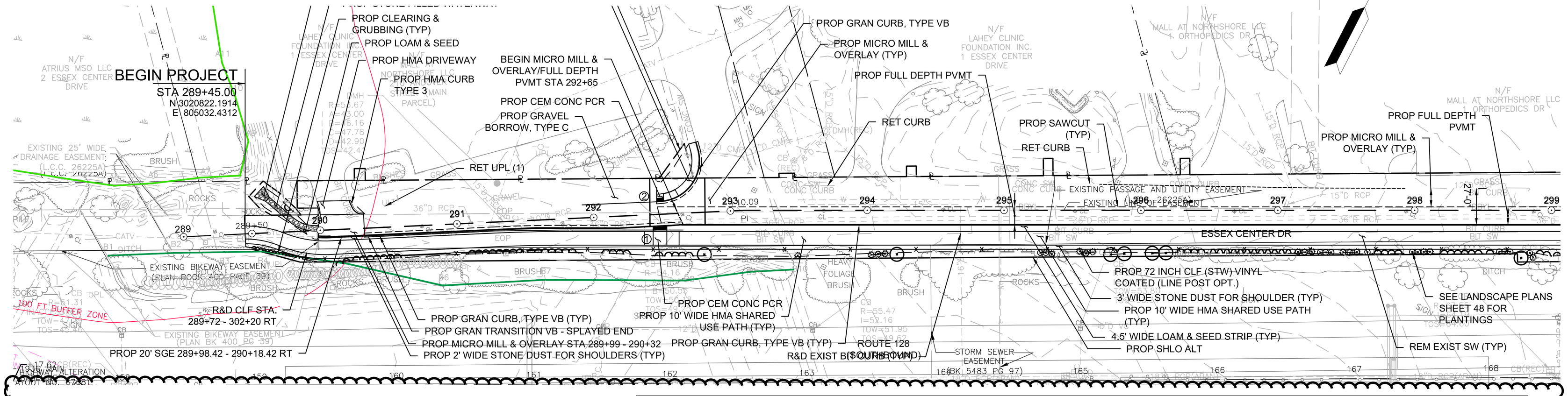
PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118

DATE: 09/29/2023
REVISED: 07/22/2024

DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 6H



RESOURCE AREA IMPACTS	TOTAL IMPACTS
BORDERING LAND SUBJECT TO FLOODING (SF)	65,491
TOTAL COMPENSATORY FLOOD STORAGE (CF)	-36,873
NET CUT/FILL ACROSS PROJECT (CF)	-33,893

CUT/FILL WITHIN THE FLOODPLAIN

ELEVATION	INCREMENTAL NET CUT/FILL VOLUME (CF)	COMPENSATORY FLOOD STORAGE CUT VOL (CF) - STA. 355+00	ADDITIONAL COMPENSATORY FLOOD STORAGE CUT VOL (CF) - STA. 336+00	ADDITIONAL COMPENSATORY FLOOD STORAGE CUT VOL (CF) - STA. 356+50	ADDITIONAL COMPENSATORY FLOOD STORAGE CUT VOL (CF) - STA. 358+00	TOTAL CUT/FILL VOLUME (CF)
34-35	301	-921	0	0	0	-620
35-56	-159	-1,400	0	0	0	-1,559
36-37	2,197	-1,151	0	-167	-964	-85
37-38	2,033	0	-2,245	0	-835	-1,047
38-39	1,305	0	-3,744	0	-594	-3,033
39-40	5,246	0	-5,435	0	0	-189
40-41	2,207	0	-7,523	0	0	-5,316
41-42	-726	0	-7,308	0	0	-8,034
42-43	79	0	-3,476	0	0	-3,397
43-44	-4,458	0	-1,112	0	0	-5,570
44-45	-1,980	0	0	0	0	-1,980
45-46	-1,495	0	0	0	0	-1,495
46-47	-1,490	0	0	0	0	-1,490
47-48	-79	0	0	0	0	-79
TOTAL:	**2,982**	**-3,472**	**-30,842**	**-167**	**-2,392**	**-33,893**

LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

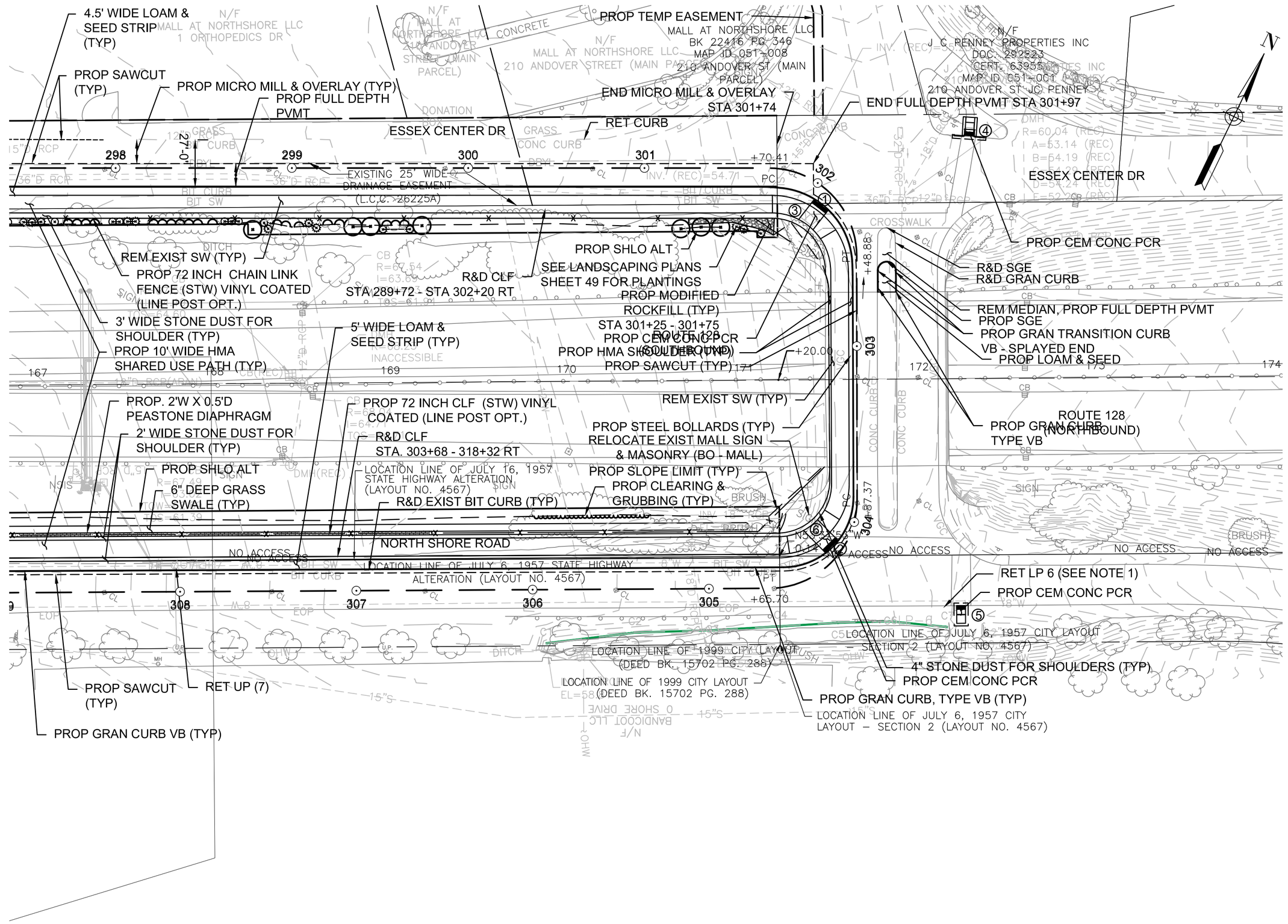
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118
DATE: 10/18/2023 | DRAWN BY: JK
REVISED: 07/26/2024 | CHECKED BY: DS/OF

FIGURE 7A



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

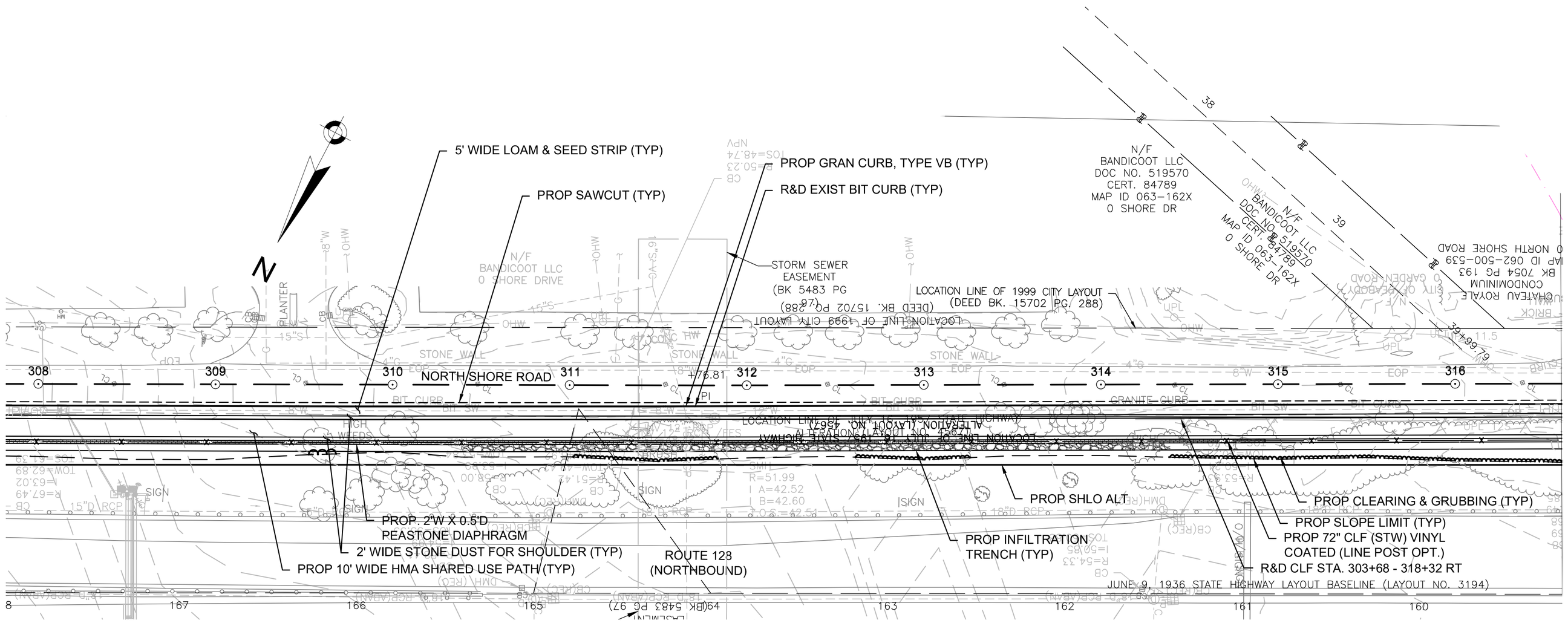
BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118	FIGURE 7B
DATE: 10/18/2023 REVISED: 07/26/2024	DRAWN BY: JK CHECKED BY: DS/OF	



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED: 07/26/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7C

Proposal No. 609211-132091

A00861 - 68

FIGURE 7 - BLSF IMPACTS.DWG Plotted on 25-Jul-2024 5:15 PM

5' WIDE LOAM & SEED STRIP (TYP.)

PROP 10' WIDE HMA SHARED USE PATH (TYP)

2' WIDE STONE DUST FOR SHOULDER (TYP)

PROP 72" (COATED (LINE POST OPT.)

PROP CEM CONC PCR

PROP 5' HMA SIDEWALK

PROP TEMP EASEMENT

PROP CLEARING & GRUBBING (TYP)

PROP HMA CURB, TYPE 3 STA. 318+13 - 318+20 LT

R&D CLF STA. 303+68 - 318+32 RT

PROP CEM CONC PCR

PROP TRANSITION CURB

PROP CEM CONC PCR

REFER TO LANDSCAPE BLOW UP PLAN SHEET 47 FOR TRAIL HEAD DESIGN

R&D EXIST GUARDRAIL

PROP BIKE RACK

PROP BENCH

PROP DECORATIVE PAVEMENT SEE SHEET 48

PROP CLEARING & GRUBBING (TYP)

PROP 10' WIDE HMA SHARED USE PATH (TYP)

2' WIDE STONE DUST FOR SHOULDER (TYP)

PROP LOAM & SEED (TYP)

PROP SLOPE LIMIT (TYP)

PROP SEDIMENT CONTROL BARRIER (TYP)

PROP SEDIMENT CONTROL BARRIER (TYP)

PROP SLOPE LIMIT (TYP)

BLSF IMPACT: 15,375 SF

100-YEAR FLOOD ELEVATION 47.1'

NORTH SHORE ROAD

RAILROAD BASELINE

100 FT BUFFER ZONE

200 FT RIVERFRONT AREA

100 FT RIVERFRONT AREA

CHATEAU ROYALE CONDOMINIUM
BK 7054 PG 193
MAP ID 062-500-539
500 NORTH SHORE RD

PROCTOR BROOK

EXISTING CATCH BASIN (PRIVATE)

EDGE

TOS=47.69

TOS=45.40

TOS=43.24

TOS=41.09

TOS=38.93

TOS=36.78

TOS=34.62

12"W

WE 45.7

WE 50.1

CB(REC)

DMH(REC)

4"D PVC

RCP

BRUSH

ROCKS

HEAVY FOLIAGE

+08.65

+90.14

+26.95

+87.21

+92.25

MAHW-201

MAHW-202

MAHW-204

MAHW-205

MAHW-206

MAHW-207

MAHW-208

MAHW-209

MAHW-210

MAHW-211

MAHW-212

MAHW-213

MAHW-214

MAHW-215

MAHW-216

MAHW-217

MAHW-218

MAHW-219

MAHW-220

MAHW-221

MAHW-222

WF#Z-8

WF#Z-9

WF#Z-10

WF#Z-11

WF#Z-12

WF#Z-13

WF#Z-14

WF#Z-15

316

317

318

319

320

321

322

323

324

325

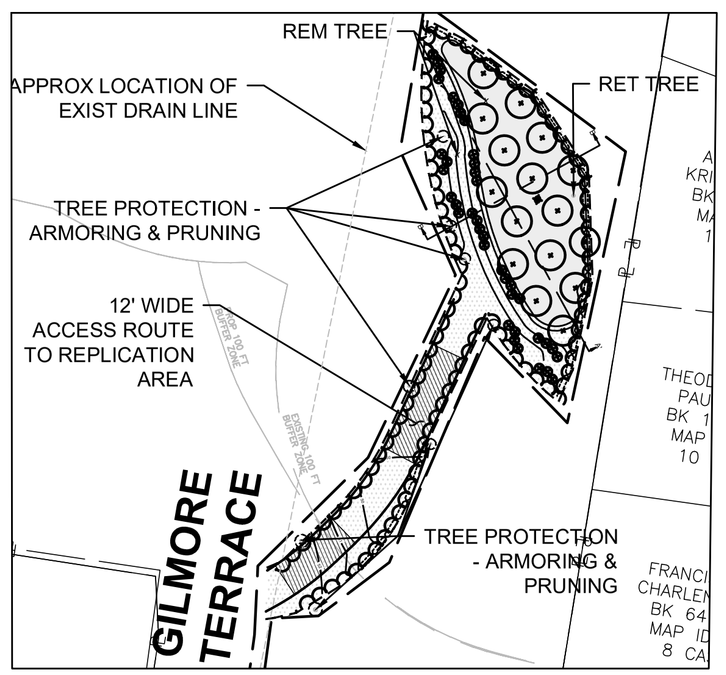
326

327

N

LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100-FOOT BUFFER ZONE
- 200-FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100-YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA



INSET A - WETLAND REPLICATION AREA

40 0 40 80

SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

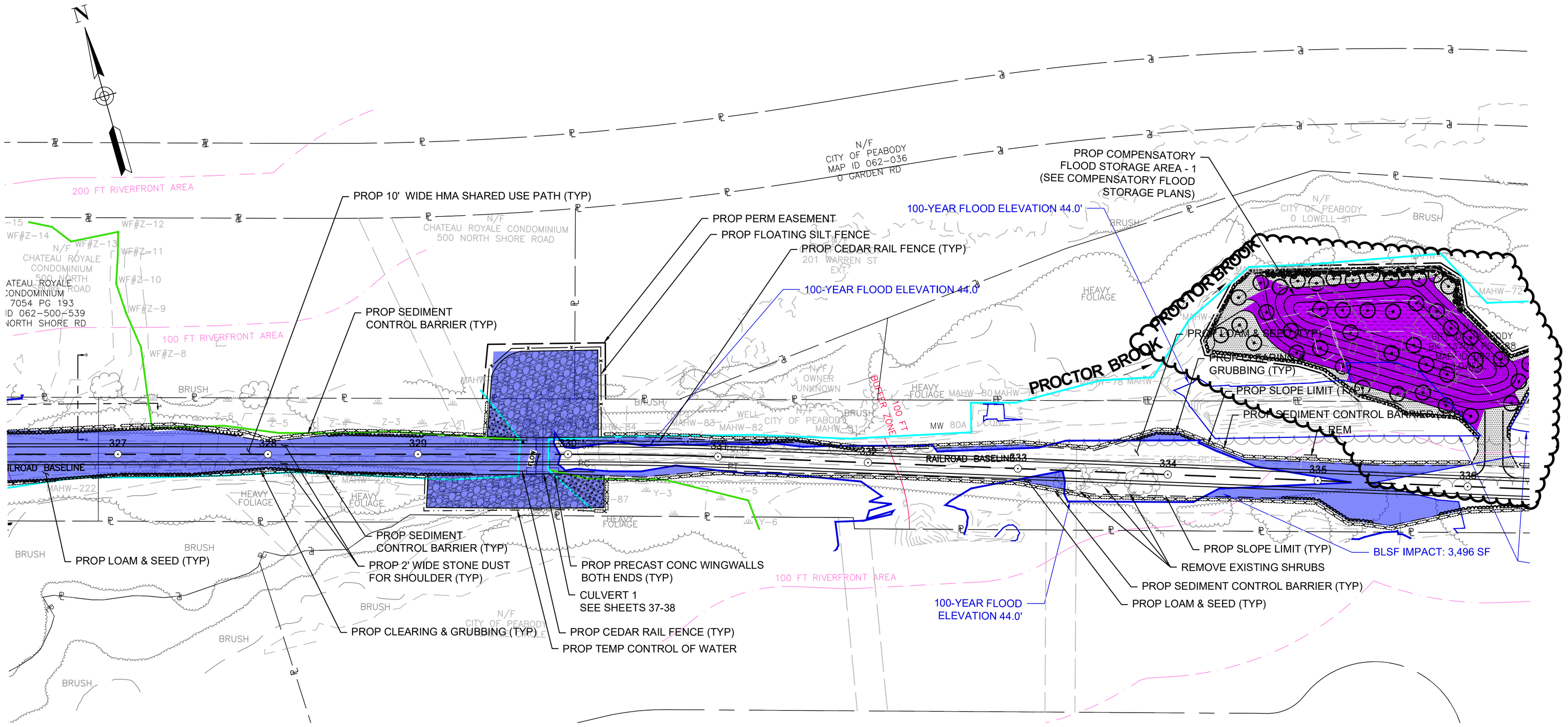
PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED | PROJECT NO. 17118

DATE: 10/18/2023 | DRAWN BY: JK
REVISED: 07/26/2024 | CHECKED BY: DS/OF

FIGURE 7D



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

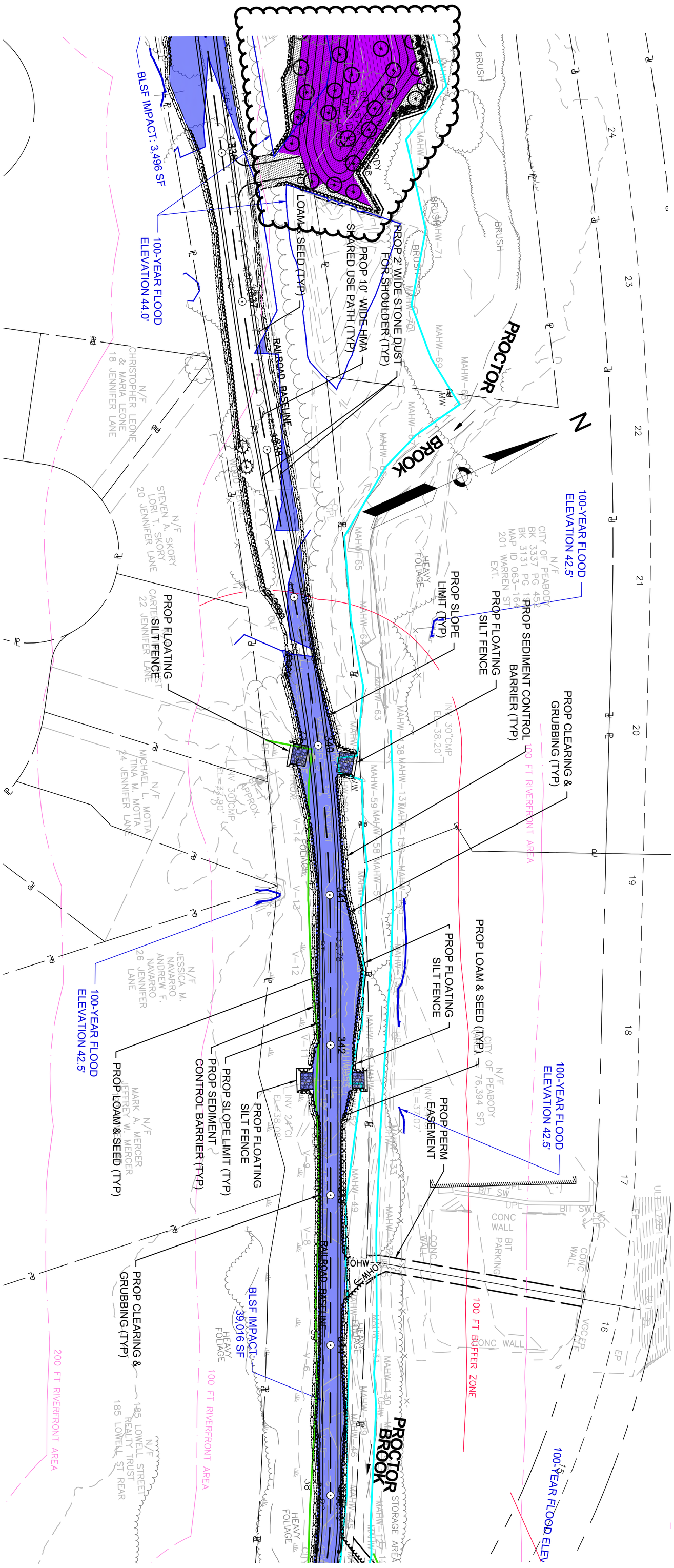
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:
GREEN INTERNATIONAL AFFILIATES, INC.
CIVIL AND STRUCTURAL ENGINEERS
100 AMES POND DR. SUITE 200, TEWKSBURY, MA
24 ALBION RD, LINCOLN, RI

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA 01960

SCALE: AS NOTED
PROJECT NO. 17118
DATE: 10/18/2023
REVISED: 07/26/2024
DRAWN BY: JK
CHECKED BY: DS/OF

FIGURE 7E

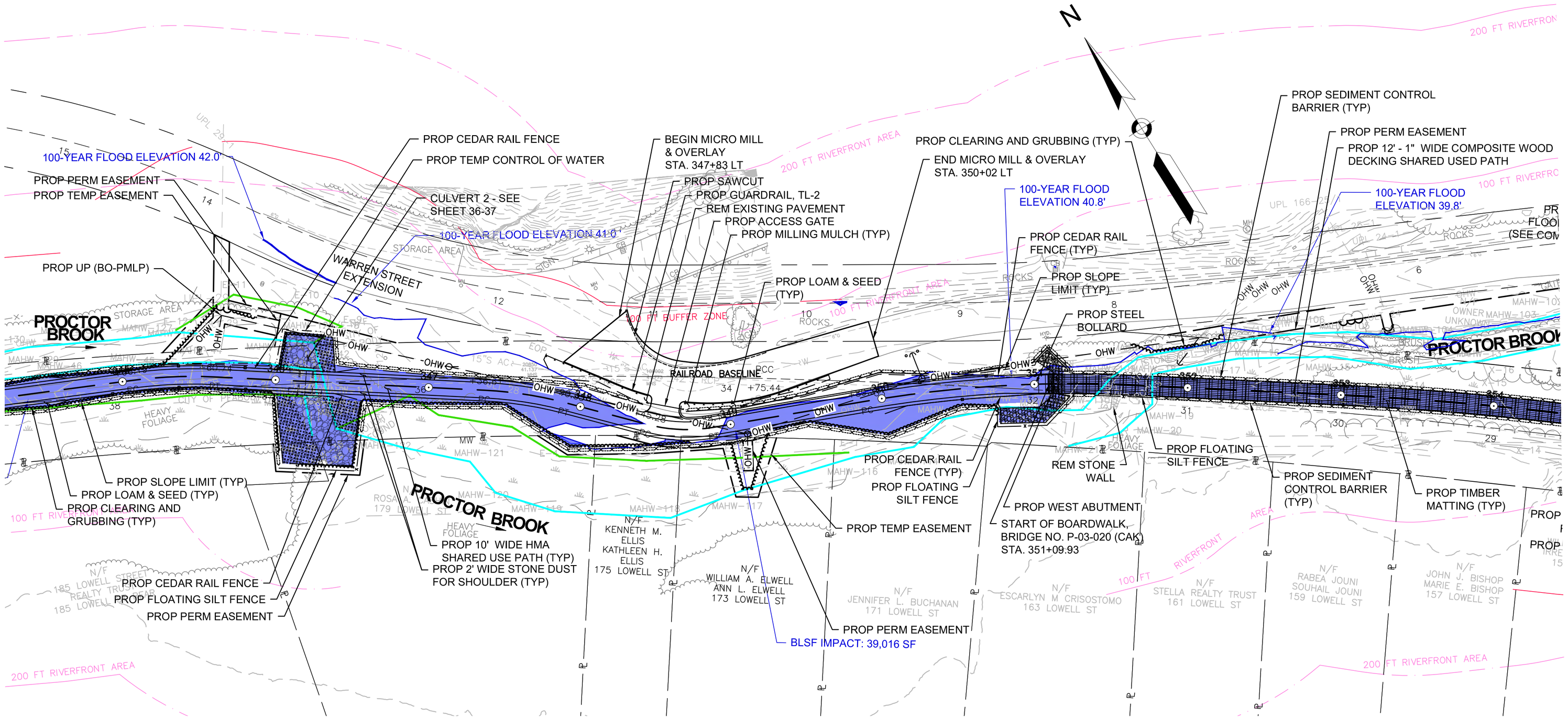


BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY: GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DR. SUITE 200, TEWKSBURY, MA 24 ALBION RD, LINCOLN, RI	PREPARED FOR: CITY OF PEABODY 24 LOWELL STREET PEABODY, MA 01960
SCALE: AS NOTED	PROJECT NO. 17118
DATE: 10/18/2023	DRAWN BY: JK
REVISED: 07/26/2024	CHECKED BY: DS/OF

FIGURE 7F



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- BLSF IMPACT AREA

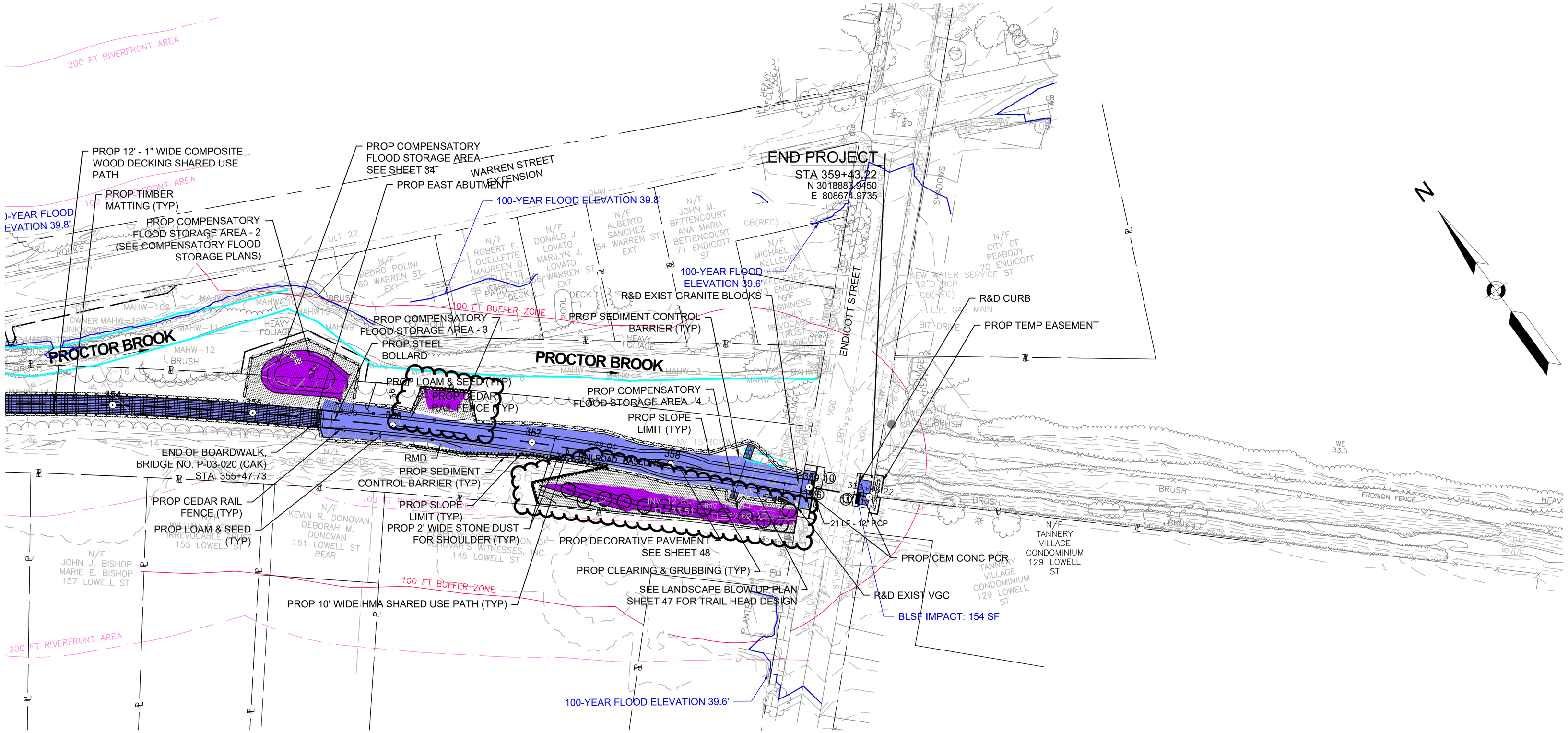
40 0 40 80
SCALE IN FEET
1" = 40'

BLSF IMPACTS

PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:	PREPARED FOR:
GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DR. SUITE 200, TEWKSBURY, MA 24 ALBION RD, LINCOLN, RI	CITY OF PEABODY 24 LOWELL STREET PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118	FIGURE 7G
DATE: 10/18/2023 REVISED: 07/26/2024	DRAWN BY: JK CHECKED BY: DS/OF	



LEGEND

- BORDERING VEGETATED WETLAND (BVW)
- DITCH
- 100–FOOT BUFFER ZONE
- 200–FOOT RIVERFRONT AREA
- PERENNIAL STREAM/BANK (MAHW)
- INTERMITTENT STREAM/BANK
- 100–YEAR FLOODPLAIN LINE
- SEDIMENT CONTROL BARRIER
- 100 PROPOSED CONTOUR
- 100 EXISTING CONTOUR
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPENSATORY FLOOD STORAGE AREA
- BLSF IMPACT AREA

BLSF IMPACTS

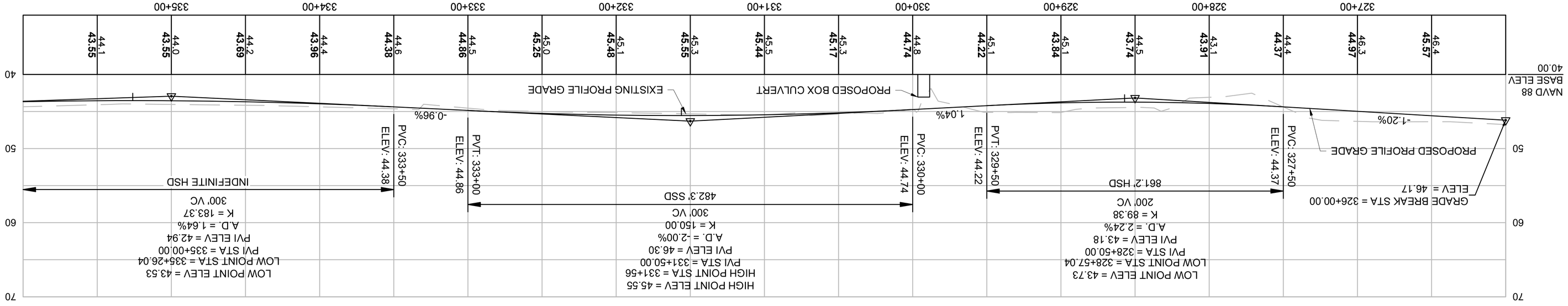
PEABODY – INDEPENDENCE GREENWAY EXTENSION
PEABODY, MA
MASSDOT PROJECT NO. 609211

PREPARED BY:	PREPARED FOR:
GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DR. SUITE 200, TEWKSBURY, MA 24 ALBION RD, LINCOLN, RI	CITY OF PEABODY 24 LOWELL STREET PEABODY, MA 01960

SCALE: AS NOTED	PROJECT NO. 17118	FIGURE 7H
DATE: 10/18/2023 REVISED: 07/26/2024	DRAWN BY: JK CHECKED BY: DS/OF	

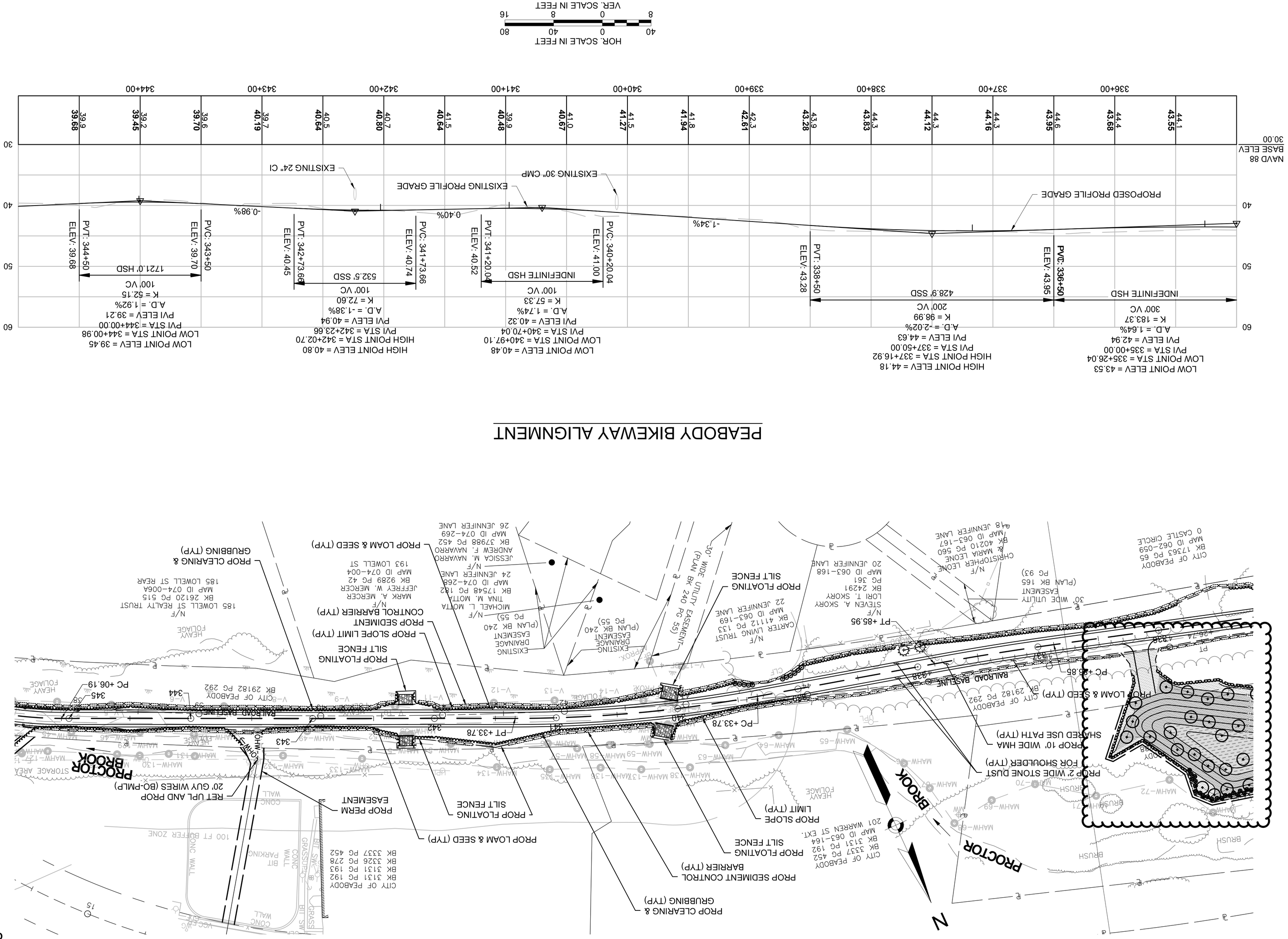
Amended OOC Plan Sheets, dated 7/25/2024

PEABODY BIKEWAY ALIGNMENT



CONTINUED ON SHEET NO. 13

CONTINUED ON SHEET NO. 15



HIGHWAY GUARD DETAILS — NONE

TRAFFIC SIGNAL CONDUIT — NONE

WATER SUPPLY ALTERATIONS — NONE

DRAINAGE DETAILS — SHEET 23

CONSTRUCTION PLAN & PROFILE - 6
OOC AMENDMENT PLANS - 7/25/2024

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	14	143
PROJECT FILE NO. 609211			

SHT005_HOICONSTRUCTION PLANS & PROFILESJ.DWG Plotted on: 25-Jul-2024 5:30 PM

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	143
PROJECT FILE NO.	609211		

CONSTRUCTION PLAN & PROFILE - 8
OOC AMENDMENT PLANS - 7/25/2024

SHT005_HD(CONSTRUCTION PLANS & PROFILES).DWG Plotted on 25-Jul-2024 5:31 PM

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

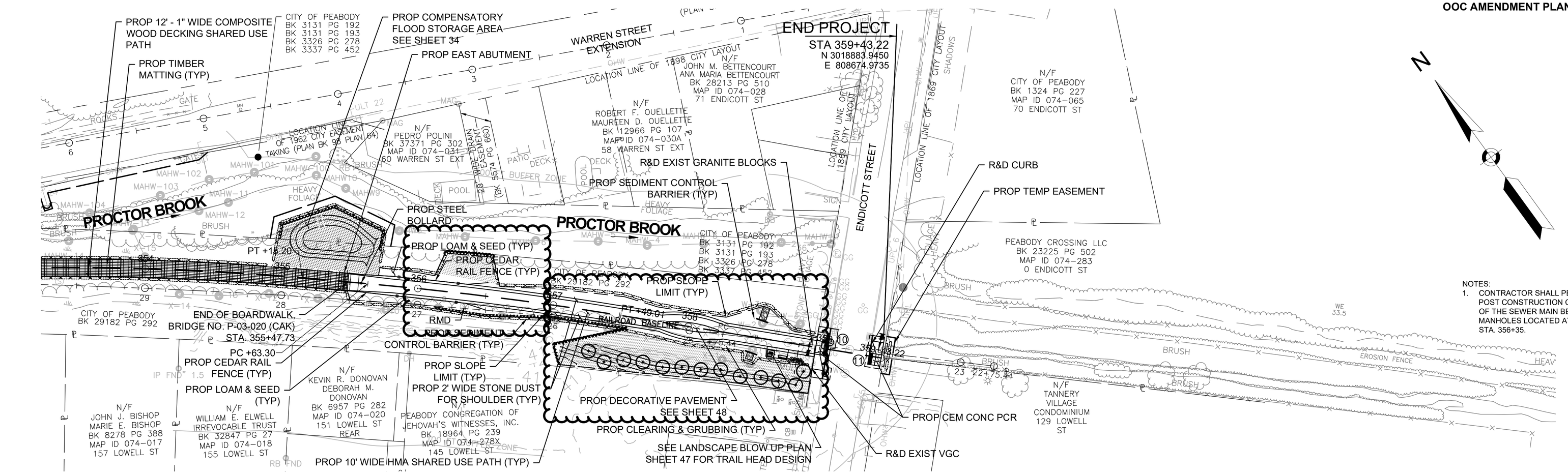
NONE

WATER SUPPLY ALTERATIONS

NONE

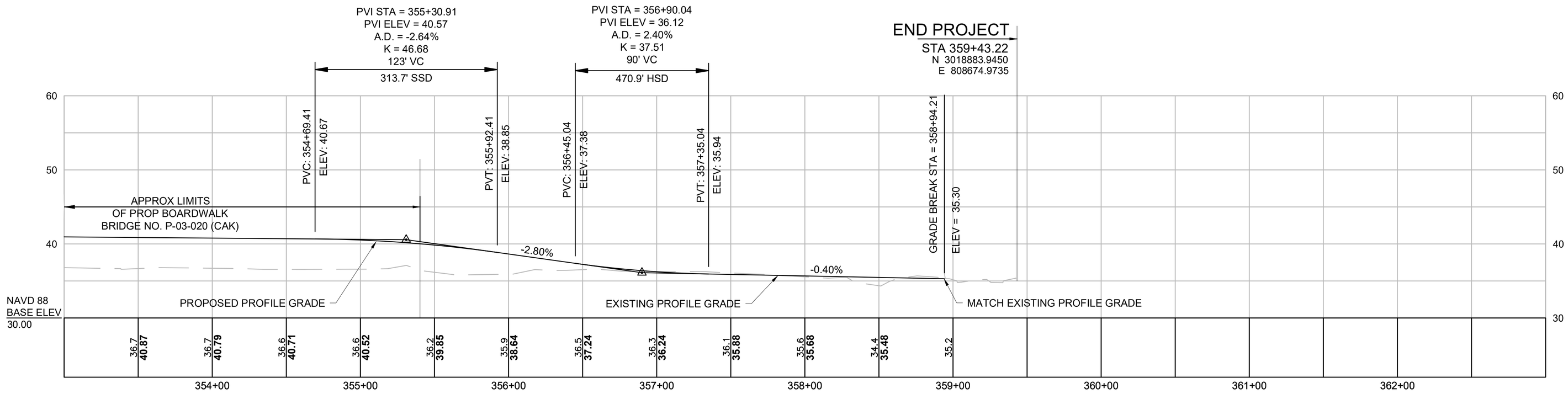
DRAINAGE DETAILS

SEE SHEET 24



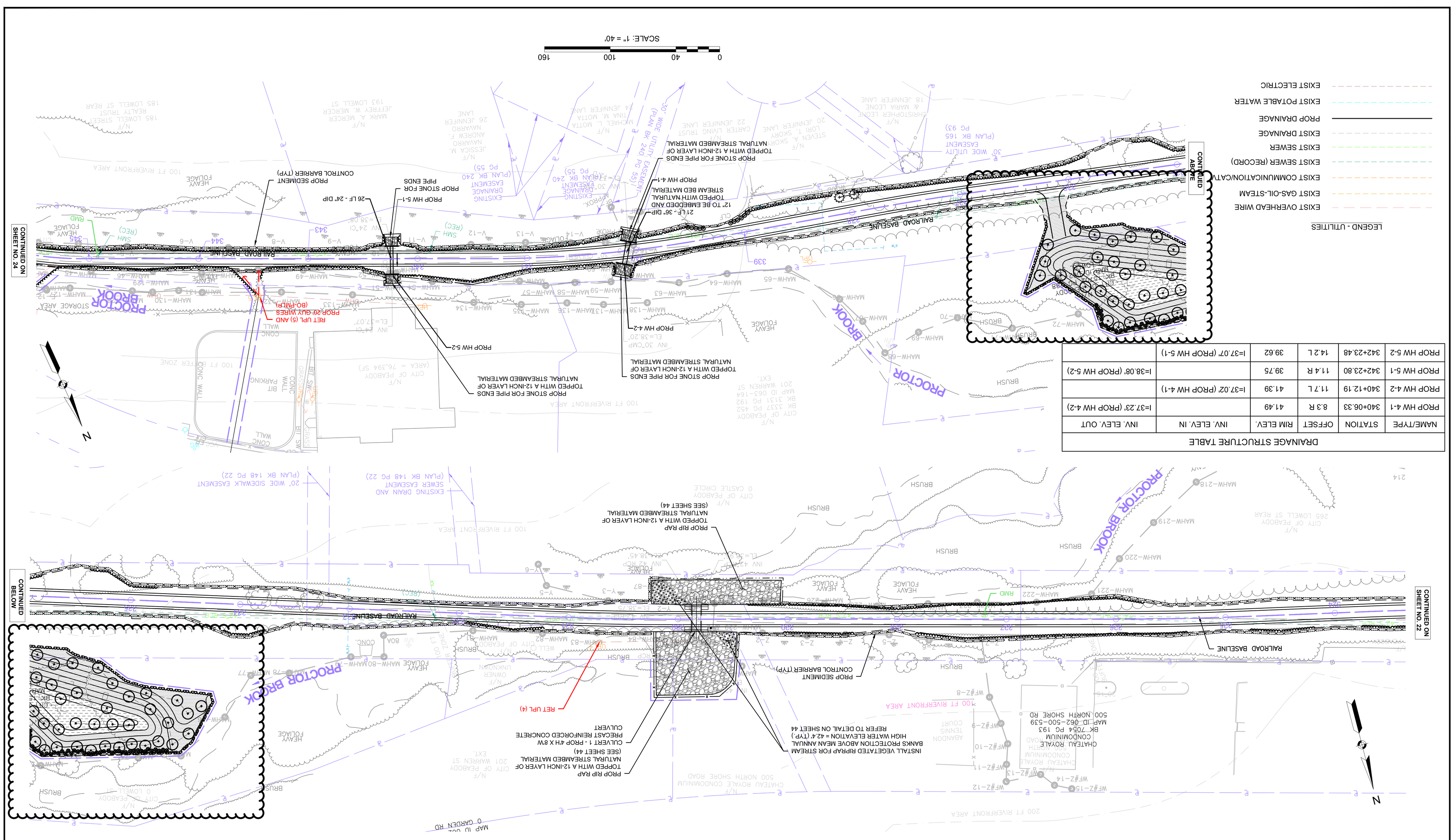
CONTINUED ON SHEET NO. 15

PEABODY BIKEWAY ALIGNMENT



NOTE: CONTRACTOR TO USE TIMBER MATTING FOR BOARDWALK INSTALLATION FOR WORK WITHIN WETLAND AND PROCTOR BROOK.

HOR. SCALE IN FEET
40 0 40 80
VER. SCALE IN FEET
8 0 8 16



DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 4-1	340+06.33	8.3 R	41.49		=37.23' (PROP HW 4-2)
PROP HW 4-2	340+12.19	11.7 L	41.39		=37.02' (PROP HW 4-1)
PROP HW 5-1	342+23.80	11.4 R	39.75		=38.08' (PROP HW 5-2)
PROP HW 5-2	342+23.48	14.2 L	39.62	=37.07' (PROP HW 5-1)	

HIGHWAY GUARD DETAILS	TRAFFIC SIGNAL CONDUIT	WATER SUPPLY ALTERATIONS	DRAINAGE DETAILS
NONE	NONE	NONE	SEE BELOW

DRAINAGE AND UTILITY PLAN - 3
OOC AMENDMENT PLANS - 7/25/2024

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	143
PROJECT FILE NO. 609211			

A00861 - 77

SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG Plotted on 25-Jul-2024 6:07 PM

Proposal No. 609211-132091

HIGHWAY GUARD DETAILS

NONE

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

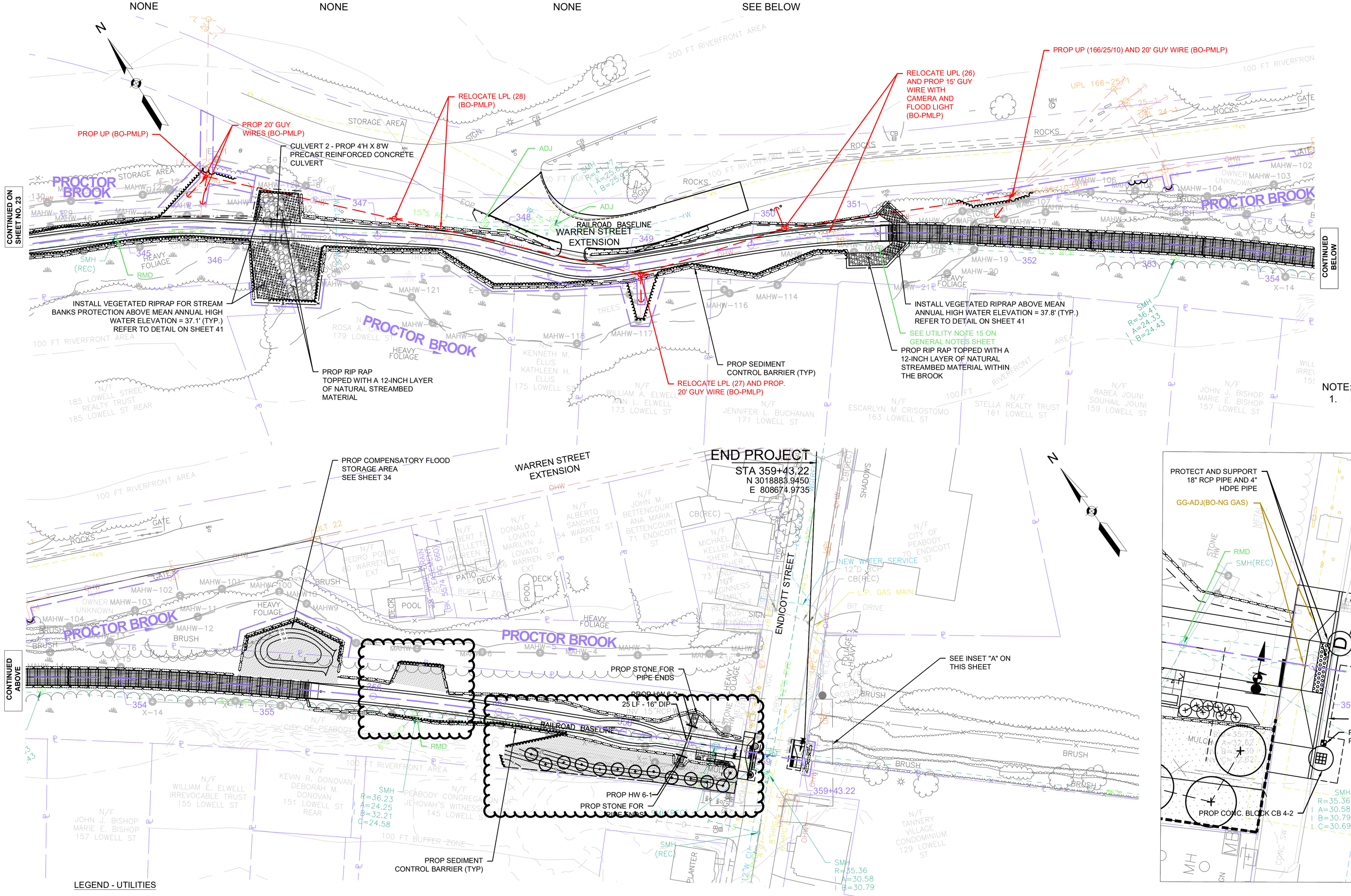
SEE BELOW

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	143
PROJECT FILE NO.	609211		

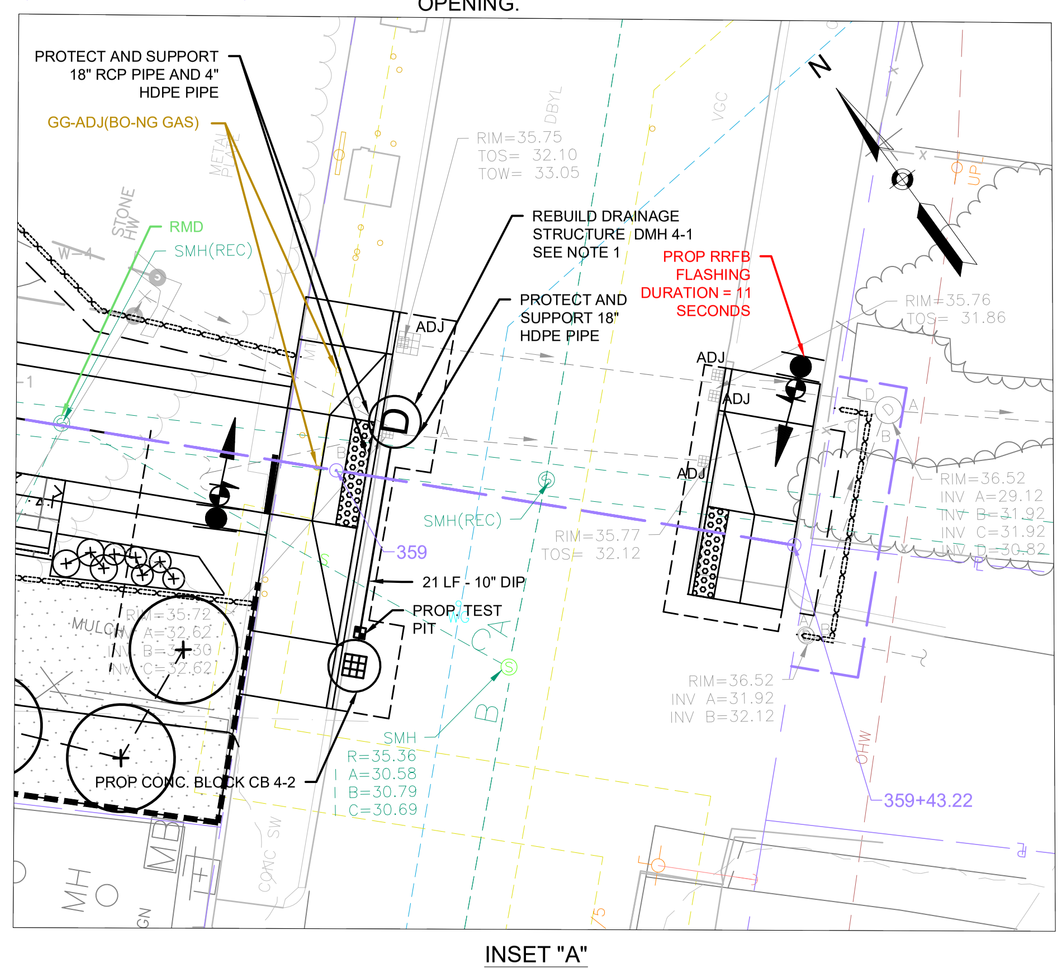
DRAINAGE AND UTILITY PLAN - 4
OOC AMENDMENT PLANS - 7/25/2024

Plotted on 25-Jul-2024 6:09 PM
SHT005_HD(DRAINAGE AND UTILITY PLANS).DWG



NOTE:

1. REBUILD DRAINAGE STRUCTURE DMH 4-1 AS CONCRETE BLOCK STRUCTURE. REMOVE AND DISPOSE EXISTING FRAME AND GRATE AND REPLACE WITH 4" FRAME AND COVER. LOCATE FRAME AND COVER OUTSIDE OF CURB OPENING.



INSET "A"

LEGEND - UTILITIES

- EXIST OVERHEAD WIRE
- EXIST GAS-OIL-STEAM
- EXIST COMMUNICATION/CATV
- EXIST SEWER (RECORD)
- EXIST SEWER
- EXIST DRAINAGE
- PROP DRAINAGE
- EXIST POTABLE WATER
- EXIST ELECTRIC

SCALE: 1" = 40'

SCALE: 1" = 10'

DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP HW 6-1	358+48.46	11.6 R	35.47		I=33.51' (PROP HW 6-2)
PROP HW 6-2	358+52.79	12.9 L	34.88	I=32.92' (PROP HW 6-1)	

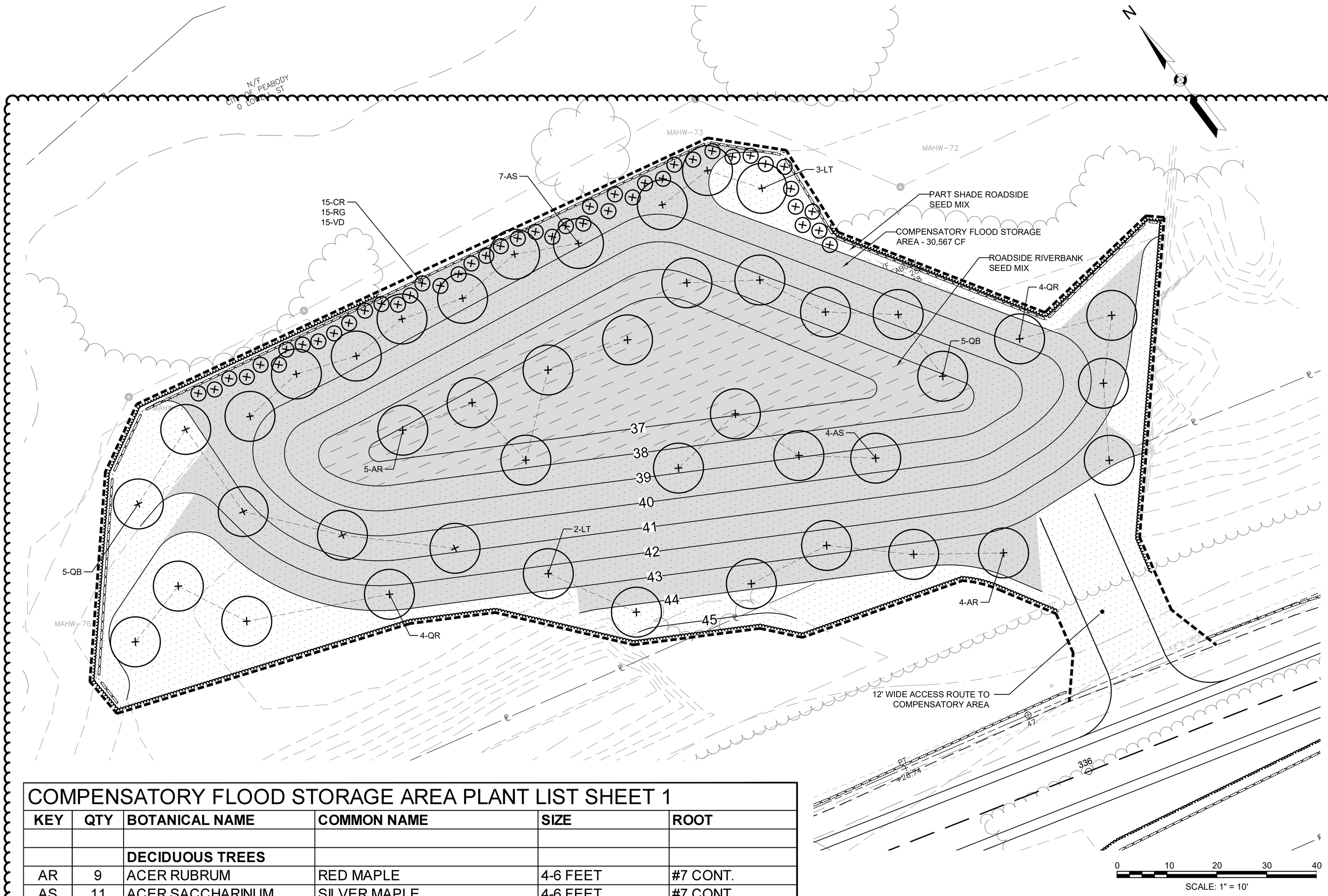
DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT
PROP CB 4-2	359+04.67	17.6 R	35.63		I=33.50' (PROP DMH 4-1)
PROP DMH 4-1 (DRAINAGE STRUCTURE REBUILT)	359+04.67	5.3 L	34.76	I=33.29 (PROP CB 4-2) I=MATCH EXISTING	I=MATCH EXISTING

PEABODY, MA
INDEPENDENCE GREENWAY EXTENSION

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	143
PROJECT FILE NO.	609211		

COMPENSATORY FLOOD STORAGE 1 OF 3
OOC AMENDMENT PLANS - 7/25/2024



LEGEND

- LIMIT OF WORK
- SEDIMENT CONTROL BARRIER
- 100 — PROPOSED CONTOUR
- 100 — EXISTING CONTOUR
- LIMIT OF CLEARING
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPOST BLANKET AND ROADSIDE RIVERBANK SEED MIX
- COMPENSATORY FLOOD STORAGE

299 FT LENGTH OF SEDIMENT CONTROL BARRIER
2,941 SQ FT AREA OF ROADSIDE RIVERBANK SEED MIX
13,118 SQ FT AREA OF PART SHADE ROADSIDE SEED MIX

NOTES:

1. PRIOR TO ANY CLEARING AND GRUBBING, THE CONTRACTOR SHALL STAKE THE LIMITS OF THE FLOOD COMPENSATION AREA AS SHOWN ON THIS PLAN.
2. THE CONTRACTOR SHALL ARRANGE WITH THE ENGINEER TO HAVE THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION ON SITE DURING CONSTRUCTION.
3. THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION FOR THIS PROJECT IS MAXWELL MCNULTY - MAXWELL.R.MCNULTY@DOT.STATE.MA.US

COMPENSATORY FLOOD STORAGE NET CUT 100 YEAR FLOOD ELEVATION = 44.0'		
ELEVATION	ELEVATION	INCREMENTAL NET CUT VOLUME
37-38	37	2245
	38	
38-39	38	3744
	39	
39-40	39	5435
	40	
40-41	40	7523
	41	
41-42	41	7308
	42	
42-43	42	3476
	43	
43-44	43	1112
	44	
TOTAL		30842

COMPENSATORY FLOOD STORAGE AREA PLANT LIST SHEET 1

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
AR	9	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
AS	11	ACER SACCHARINUM	SILVER MAPLE	4-6 FEET	#7 CONT.
LT	5	LIRIODENDRON TULIPIFERA	TULIP TREE	4-6 FEET	#7 CONT.
QB	10	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.
QR	8	QUERCUS RUBRA	NORTHERN RED OAK	4-6 FEET	#7 CONT.
		DECIDUOUS SHRUBS			
CR	15	CORNUS RACEMOSA	GRAY TWIG DOGWOOD	2-3 FEET	#2 CONT.
RG	15	RHUS GLABRA	SMOOTH SUMAC	2-3 FEET	#2 CONT.
VD	15	VIBURNUM DENTATUM	ARROWWOOD VIBURNUM	2-3 FEET	#2 CONT.

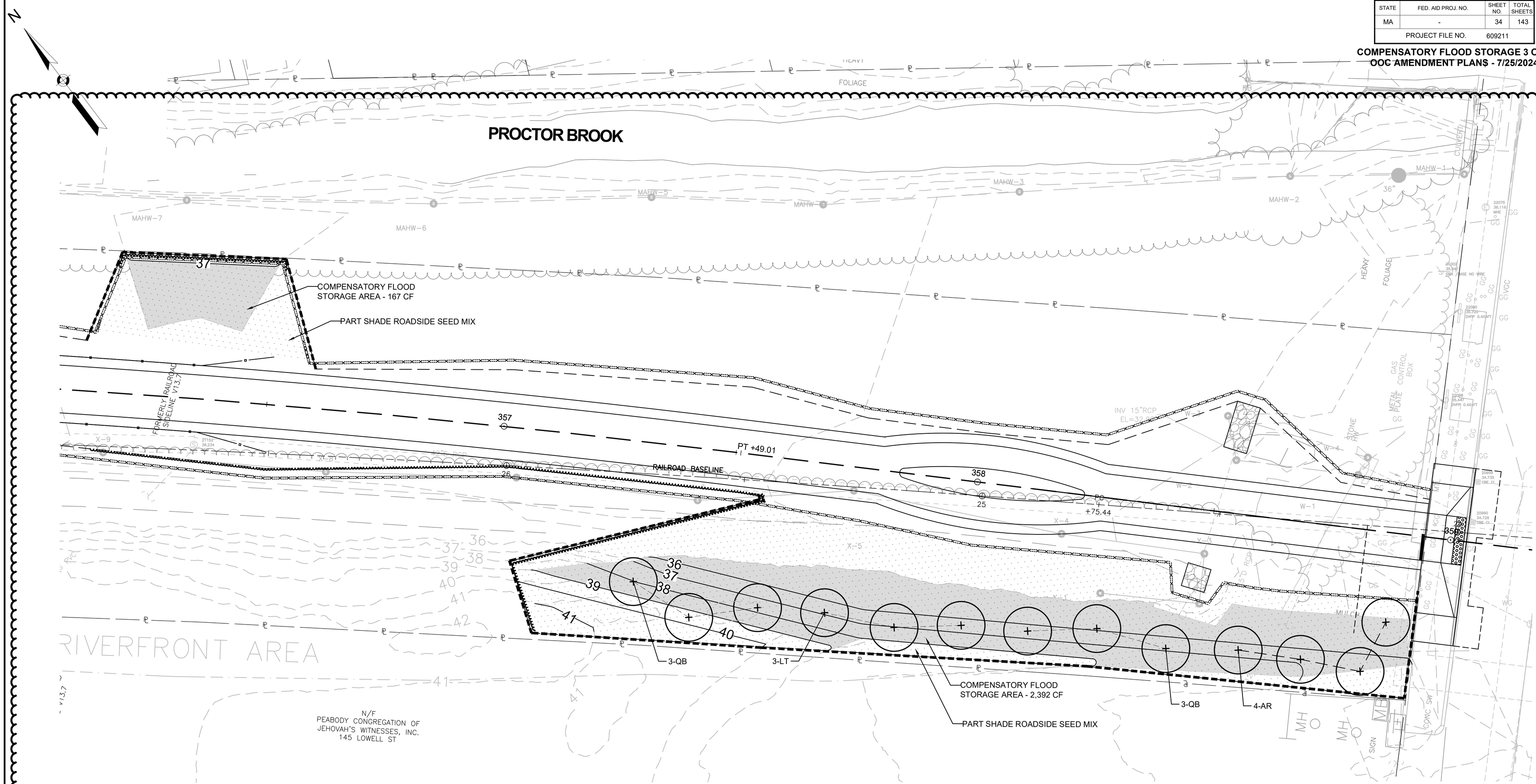
NOTE:
PLANT SHURBS IN GROUPS OF THREE OF THE SAME SPECIES +_ X FEET ON CENTER ALONG EDGE OF COMPENSATION AREA ADJACENT TO THE BROOK

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	143
PROJECT FILE NO.	609211		

COMPENSATORY FLOOD STORAGE 3 OF 3
OOC AMENDMENT PLAN$ - 7/25/2024

Proposal No. 609211-132091

SHT0XX_EV(COMPENSATORY FLOOD STORAGE).DWG Plotted on 25-Jul-2024 5:36 PM



COMPENSATORY FLOOD STORAGE AREA PLANT LIST SHEET 3

KEY	QTY	BOTANICAL NAME	COMMON NAME	SIZE	ROOT
		DECIDUOUS TREES			
AR	4	ACER RUBRUM	RED MAPLE	4-6 FEET	#7 CONT.
LT	3	LIRIODENDRON TULIPIFERA	TULIP TREE	4-6 FEET	#7 CONT.
QB	6	QUERCUS BICOLOR	SWAMP WHITE OAK	4-6 FEET	#7 CONT.

COMPENSATORY FLOOD STORAGE NET CUT 100 YEAR FLOOD ELEVATION = 39.8'		
ELEVATION	ELEVATION	INCREMENTAL NET CUT VOLUME
36-37	36	167
	37	
TOTAL		167

COMPENSATORY FLOOD STORAGE NET CUT 100 YEAR FLOOD ELEVATION = 39.8'		
ELEVATION	ELEVATION	INCREMENTAL NET CUT VOLUME
36-37	36	964
	37	
37-38	37	835
	38	
38-39	38	594
	39	
TOTAL		2392

LEGEND

- LIMIT OF WORK
- SEDIMENT CONTROL BARRIER
- PROPOSED CONTOUR
- EXISTING CONTOUR
- LIMIT OF CLEARING
- COMPOST BLANKET AND PART SHADE ROADSIDE SEED MIX
- COMPENSATORY FLOOD STORAGE

72 FT LENGTH OF SEDIMENT CONTROL BARRIER
5,131 SQ FT AREA OF PART SHADE ROADSIDE SEED MIX

NOTES:

1. PRIOR TO ANY CLEARING AND GRUBBING, THE CONTRACTOR SHALL STAKE THE LIMITS OF THE FLOOD COMPENSATION AREA AS SHOWN ON THIS PLAN.
2. THE CONTRACTOR SHALL ARRANGE WITH THE ENGINEER TO HAVE THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION ON SITE DURING CONSTRUCTION.
3. THE REPRESENTATIVE FROM MASSDOT LANDSCAPE DESIGN SECTION FOR THIS PROJECT IS MAXWELL MCNULTY - MAXWELL.R.MCNULTY@DOT.STATE.MA.US

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

City of Peabody-Wetlands & Rivers Protection Ord. CH32

A. General Information

Amended

1. Conservation Commission: PEABODY
2. Issuance: a. ☐ OOC *b. ☑ Amended OOC*

3. Applicant Details

a. First Name	BRENDAN	b. Last Name	CALLAHAN		
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

4. Property Owner

a. First Name	BRENDAN	b. Last Name	CALLAHAN		
c. Organization	CITY OF PEABODY				
d. Mailing Address	24 LOWELL STREET				
e. City/Town	PEABODY	f. State	MA	g. Zip Code	01960

5. Project Location

a.Street Address	FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.		
b.City/Town	PEABODY	c. Zip Code	01960
d. Assessors Map/Plat#	00	e. Parcel/Lot#	00
f. Latitude	42.53359N	g. Longitude	70.94025W

6. Property recorded at the Registry of Deed for:

a. County	b. Certificate	c. Book	d. Page
SOUTHERN ESSEX		29182	292

7.Dates Amendment

a. Date NOI Filed : 7.26.24 b. Date Public Hearing Closed: 7/31/2024 c. Date Of Issuance: 8/2/2024

8.Final Approved Plans and Other Documents

a. Plan Title:	b. Plan Prepared by:	c. Plan Signed/Stamped by:	d. Revised Final Date:	e. Scale:
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION-PLAN AND PROFILE OF INDEPENDENCE GREENWAY EXTENSION BRIDGE P-03-020 (CAK) IN THE CITY OF PEABODY ESSEX COUNTY	GREEN INTERNATIONAL AFFILIATES, INC.	DANIELLE SPICER	amended sheets July 25, 2024	AS NOTED

CITY CLERK
2024 AUG -2 AM 11:04
CITY OF PEABODY

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

B. Findings

1.Findings pursuant to the Massachusetts Wetlands Protection Act
Following the review of the the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act.

Check all that apply:

a. ☑ Public Water Supply	b. ☐ Land Containing Shellfish	c.☑ Prevention of Pollution
d. ☑ Private Water Supply	e. ☐ Fisheries	f. ☑ Protection of Wildlife Habitat
g. ☑ Ground Water Supply	h. ☑ Storm Damage Prevention	i. ☑ Flood Control

2. Commission hereby finds the project, as proposed, is:

Approved subject to:

a.☑ The following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

Denied because:

b.☐ The proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c.☐ The information submitted by the applicant is not sufficient to describe the site, the work or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the interests of the Act , and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3.☐ Buffer Zone Impacts:Shortest distance between limit of project disturbance and the wetland resource area specified in 310CMR10.02(1)(a). _____ a. linear feet

Inland Resource Area Impacts:(For Approvals Only):

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☑ Bank	754 a. linear feet	754 b. linear feet	618 c. linear feet	618 d. linear feet
5.☑ Bordering Vegetated Wetland	7025 a. square feet	7025 b. square feet	2500 c. square feet	2500 d. square feet
6. ☑ Land under Waterbodies and Waterways	10973 a. square feet	10973 b. square feet	4271 c. square feet	4271 d. square feet

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

	1142 e. c/y dredged	1142 f. c/y dredged		
7.☑ Bordering Land Subject to Flooding	65491 a. square feet	65491 b. square feet	15824 c. square feet	15824 d. square feet
Cubic Feet Flood Storage	2982 e. cubic feet	2982 f. cubic feet	36873 g. cubic feet	36873 h. cubic feet
8.☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9.☑ Riverfront Area	134143 a. total sq. feet	134143 b. total sq. feet		
Sq ft within 100 ft	107723 c. square feet	107723 d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	26419 g. square feet	26419 h. square feet	i. square feet	j. square feet

Coastal Resource Area Impacts:

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10.☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11.☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12.☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13.☐ Coastal Beaches	a. square feet	b. square feet	c. c/y nourishment	d. c/y nourishment
14.☐ Coastal Dunes	a. square feet	b. square feet	c. c/y nourishment	d. c/y nourishment
15.☐ Coastal Banks	a. linear feet	b. linear feet		
16.☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17.☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18.☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19.☐ Land Containing Shellfish				

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

a. square feet b. square feet c. square feet d. square feet

20.☐ Fish Runs

Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above

c. c/y dredged d. c/y dredged

21.☐ Land Subject to Coastal Storm Flowage

a. square feet b. square feet

22.

☐ Restoration/Enhancement (For Approvals Only)

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c & d or B.17.c & d above, please entered the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

23.

☑ Streams Crossing(s)

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

0	6
a. number of new stream crossings	b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. the work is a maintenance dredging project as provided for in the Act; or
   b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not exceed the issuance date of the original Final Order of Conditions.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work..
10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

" Massachusetts Department of Environmental Protection"
[or 'MassDEP"]
File Number :"055-0939"

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before Mass DEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.
17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. The work associated with this Order(the "Project") is (1) ☑ is not (2)☐ subject to the Massachusetts Stormwater Standards. If the work is subject to Stormwater Standards, then the project is subject to the following conditions;
    a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge

Elimination System Construction General Permit as required by Stormwater Standard 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that: *i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures; *ii.*. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized; *iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10; *iv.* all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition; *v.* any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 19(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 19(f) through 19(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 19(f) through 19(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

g) The responsible party shall:

1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions:
SEE LOCAL CONDITIONS PAGES 9- 12 ATTACHED HERETO AND MADE A PART HEREOF.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☑ Yes ☐ No

2. The Conservation Commission hereby(check one that applies):

a. ☐ DENIES the proposed work which cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw specifically:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order or Conditions is issued. Which are necessary to comply with a municipal ordinance or bylaw:

b. ☑ APPROVES the proposed work, subject to the following additional conditions.

1. Municipal Ordinance or Bylaw CH 32 2. Citation _____

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows:
SEE LOCAL CONDITIONS PAGES 9 - 12 ATTACHED HERETO AND A MADE A PART HEREOF.

AMENDMENT 55-939

PEABODY CONSERVATION COMMISSION
AMDNENDMENT TO ORDER OF CONDITIONS – DEP FILE # 55-939
PROJECT TITLE: INDEPENDENCE GREENWAY EXTENSION
(NEAR PROCTOR BROOK-ESSEX CENTER DR/NORTH SHORE RD/ENDICOTT ST/ FORMER RR
APPLICANT: BRENDAN CALLAHAN ON BEHALF OF THE CITY OF PEABODY
OWNERS: CITY OF PEABODY-24 LOWELL ST, PEABODY MA

ORDER OF CONDITIONS (OC)

GENERAL CONDITIONS (DEP): 1-20– SEE ATTACHED

21. This Order of Conditions also constitutes a special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody. Appeal to the Massachusetts Department of Environmental Protection (DEP), pursuant to the State Wetlands Protection Act (G.L. Chapter 131, Section 40) shall not operate to terminate or affect any of the provisions of said special Order of Conditions pursuant to the Wetlands and Rivers Protection Regulations, Chapter 32 of the Code of the City of Peabody.
22. A copy of this Order shall be present on the site at all times until the completion of all work and receipt of a Final Certification of Compliance by the Commission.
23. A copy of this Order of Conditions shall be included in all construction contracting and subcontracting documents dealing with the work proposed and shall supercede other contract requirements.
24. When the applicant applies to the Building Inspectors office for a building and/or foundation permit (or for any construction permit), within the buffer zone, the applicant must submit a copy of this Order of Conditions and accompanying plans to said Building Inspector. **Said Order of Conditions must be recorded at the Registry of Deeds and evidence of recording must be submitted to the Building Inspector and the Conservation Commission.**
25. **Prior to requesting an Occupancy Permit from the Building Inspector, the applicant shall obtain a Partial or Final Certificate of Compliance from this Order.**
26. Upon completion of the work described in a Final Order of Conditions, the applicant shall request in writing the issuance of a Certificate of Compliance stating that the work has been satisfactorily completed. In order to receive a Partial or Final Certificate of Compliance upon completion of the project, the applicant must send to the Commission two (2) hardcopies and an electronic copy of WPA Form 8A – Request for Certificate of Compliance (COC). If the project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor, two (2) hardcopies and an electronic copy of a written statement by such a professional person certifying substantial compliance with the plans and setting forth what deviation, if any, exists from the plans approved in the order shall accompany the Request for Certificate of Compliance. In all other cases, the applicant shall provide the Commission with a signed letter stating that the work has been completed in accordance with the approved Order of Conditions. The Commission shall verify the substantial completion of the work by a site inspection, prior to issuance of a Certificate of Compliance. The applicant shall include two (2) copies of a locus map of the area and recorded Order of Conditions, including the appropriate Book and Page reference. ***AS BUILT PLANS are REQUIRED for commercial projects.**
27. **Prior to construction commencement, the applicant shall:**
    A. Provide a copy of the recorded Order of Conditions to the Commission.

B. Notify the Conservation Commission in writing 48 hours prior to construction start-up that erosion controls are in place and ready for inspection. (The erosion controls shall be placed prior to any construction on-site. Said erosion controls shall be maintained and replaced as needed until a Certificate of Compliance is issued.)

28 Erosion control measures and barriers shall be kept in good repair, monitored daily and maintained or reinforced as necessary to ensure and prevent erosion and siltation of wetland resource areas until a Final Certificate of Compliance is issued.

29 During construction, the Commission may require additional erosion and sediment controls to be installed in areas not currently noted on the plan to contain soil on-site and to prevent erosion and siltation of wetland resource areas.

30 All debris, fill and excavated material shall be stockpiled as far away from resource areas and buffer zones as reasonably possible and surrounded by staked strawbales/compost logs to prevent sediment from surface runoff entering the wetlands. At no time shall any debris or other material be buried or disposed of within that line marked on plan as a Resource Area or No Disturb Zone.

31 After proper grading, all disturbed areas located within a buffer zone, except those areas designated as compensatory wetlands, shall be loamed and seeded with not less than four (4) inches of good quality loam. The applicant shall:

A. Install all required erosion and sedimentation control (ESC) measures\devices;

B. Notify Commission that all ESC measures are in place and receive approval of said ESC measures from Commission Agent, said notification shall be in writing and occur at least 48 hours prior to anticipated commencement of project construction;

C. Clearly mark on the field the delineation of vegetated wetlands on the site by stakes placed at 25 feet intervals.

32 **The applicant shall affix the Order of Conditions to the DEP sign in a plastic envelope for review of same as needed. For Commercial projects the Order shall be available in the construction site trailer.**

33 Any siltation caused onto any wetland, waterway, or No Disturb Zone shall be reported promptly to the Commission and such areas shall be restored to the satisfaction of the Commission.

34 Temporary seeding, mulching or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbance.

35 All final earth grading shall be permanently stabilized by the application of loam and seed or sod.

36 After installation of new catch basins on site, the basins shall be enveloped with silt barriers until all tributary areas have been stabilized with permanent cover.

37 Absorption batten pillows shall be used in all traps and catch basins.

38 Fertilizers used for landscaping and lawn care shall be of low-nitrogen content/zero phosphorus and used in moderation. Pesticides and herbicides shall not be used for landscaping and lawn care within Buffer Zones, Resource Areas, or No Disturb Zones.

39 Temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed areas during prolonged construction or other disturbances.

40 All re-vegetation of Resource Areas shall be performed according to approved and attached plans cited in this order. The proposed replacement area shall meet or exceed the General Performance Standards outlined in the Wetlands Protection Act (WPA) Regulations, 310 CMR, Section 10.55 (4) (b)-7. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

41 No work shall proceed until the applicant has received all other permits required by law, including, but not limited to any permit required by the Planning Board, Zoning Board of Appeals, Board of Health, Department of Environmental Protection or the Army Corp of Engineers.

42 **Wetland flagging shall remain in place until the project has been completed and the Certificate of Compliance has been issued.**

43 Signs shall be posted at the limit of work, to read as follows: **"Absolutely no work beyond this point."** Such signs shall be placed in an amount satisfactory to the Commission or its agent, with at

a minimum, one such sign every **TWENTY feet along the limit of work.** Said signs shall be of such quality to last the duration of the project until a Certificate of Compliance is issued.

44 After completion of the work, the applicant shall permanently mark the edge of the wetland to ensure no further encroachment into the wetland and further the applicant shall instruct all agents to explain these markers to buyers, landscapers, tenants and all persons taking over the property from the applicant.

45 Any debris of "dumped" material placed in the resource areas shall be removed by the applicant.

46 There shall be no increase in the volume or rate of runoff, and no siltation of downstream areas as a result of the work herein permitted.

47 The Commission reserves the right to impose additional conditions on portions of this project or this site, to mitigate any actual or potential impacts resulting from the work herein permitted.

48 No earthen embankment in the Buffer Zone shall have a slope steeper than 2:1.

49 In the event a swimming pool is placed on this lot, the following condition shall apply: The content of water in swimming pools can be detrimental to wetlands plant and animal species. To remove harmful chemicals, it is the applicant's responsibility to leave the pool water standing without the addition of chlorine for a minimum of seven (7) days before draining (per the City's Stormwater System Ordinance). In this way chlorine concentration will be significantly reduced due to volatilization. All pool water, wherever possible, shall be drained through a dry well, rather than allowed to spread over the surface of the land. The City of Peabody Conservation Commission Office shall be notified prior to draining and shall approve the method of draining.

50 Work and maintenance shall be done in accordance with the following plans and reports:

►Massachusetts Department of Transportation Highway Division-Plan and Profile of Independence Greenway Extension Bridge P-03-020 (CAK) in the city of Peabody Essex County prepared by Green International Affiliates, Inc. stamped by Danielle Spicer with some sheets final revision date of July 25, 2024. (see full set of plans for each sheet date). Scale is as shown per sheet. SHEETS REVISED FOR AMENDMENT ARE:

-Construction Plan & Profile-5
-Construction Plan & Profile-6
-Construction & Plan Profile-8
-Drainage and Utility Plan-3
-Drainage and Utility Plan-4
-Compensatory Flood Storage 1 of 3
-Compensatory Flood Storage 3 of 3

SEE electronic plans uploaded with this OOC for other dates.

Also SEE REVISED figures as submitted with Amendment Memorandum:

•Resource Area Impacts-Figure 6A, Figure 6B, Figure 6C, Figure 6D, Figure 6E, Figure 6G and Figure 6H

•BLSF Impacts- Figure 7A, Figure 7B, Figure 7C, Figure 7D, Figure 7E, Figure 7F, Figure G and Figure 7H

► Inland Wetland Replication Area narrative- MASSDOT Item 755.35

► O&M Plan dated 2.5.23 as submitted with NOI.

51 A Pre-construction meeting must take place before work can commence. The meeting shall include The Conservation Agent, City Planning staff, the chosen contractor General Manager, commission members and other city staff as needed. A construction sequence and phasing schedule must be presented at this meeting.

52 Reports should be emailed to Conservation staff either on a monthly/quarterly or milestone basis. A monthly report is not necessary if no work has commenced. The commission needs to be kept up to date with each phase/milestone of said work. At minimum quarterly reports are due on the FIRST week of: **January/April/ June/September** once the project starts.

SPECIAL CHECKLISTS:

Checklist D –Proctor Brook - Channel/Culvert

1. Unless submitted with the Notice of Intent, a report, prepared by a Massachusetts Registered Professional Structural Engineer, shall be submitted to the Commission, for review and approval prior to construction. The report shall include but not be limited to the following:

- Any recommended work to repair and/or maintain the structural integrity of the channel/culvert;
- Structural Building Requirements over the culvert (foundation design, grade beams, etc.);
- Structural requirements where buildings, roadways, drives, or parking lots cross the culvert;
- Recommendations for debris removal within the channel/culvert on site;
- Results of Geotechnical Exploration.

Checklist J – Dewatering

1. Any dewatering activities on the project site in which water will be released to Resource Areas shall make use of a settling pond or similar device to remove sediment before water is released.

Checklist K – Projects Which Alter Bordering Land Subject to Flooding (BLSF)

1. The compensatory flood storage area shall be constructed prior to any filling of land subject to flooding.

Checklist L – Projects Which Alter Bordering Vegetated Wetlands (BVWs)

1. The compensatory Bordering Vegetated Wetland shall be constructed prior to any filling of Bordering Vegetated Wetland.

2. All revegetation of Resource Areas shall be performed according to the replication plan on file and dated **NOT DATED - labeled MASSDOT Item 755.35 Inland Wetland Replication Area.** The proposed replacement area shall meet or exceed the General Performance Standards outlined in Section 10.55(4)(b)-7 of 310CMR. Should the replacement area fail to meet any of these standards the Commission reserves the right to require measures necessary to achieve compliance.

3. A wetland specialist shall be on site during construction of the wetland replication area and shall supervise its construction. Two reports prepared by the Wetland Specialist shall be submitted annually to the Commission by May 1st and September 1st of each year for two years. Each report shall include an observed species list, relative abundance of each species, percent cover of wetland and upland species, the visibility of the plantings and proposed remedial measures to ensure that at least 75% of the surface of the replication area be re-established with indigenous wetland plant species within two growing seasons. Said report shall include enough photographs for proper coverage of issues/points being addressed. If monitoring data indicates that this objective cannot be met, a corrective plan of action shall be submitted to the Commission for approval and implemented under the supervision of the wetland specialist. No certificate of compliance will be granted by the Commission until such time as the replacement area has been found to meet these standards.

This Order of Conditions shall apply to any successors in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by the Order.

*As Built Plans are required when requesting a Certificate of Compliance.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

City of Peabody-Wetlands & Rivers Prot. Ord. CH32

Provided by MassDEP:
55-939
MassDEP File #
1768841
eDEP Transaction #
Peabody
City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

8.2.2024
1. Date of Issuance

Please indicate the number of members who will sign this form. This Order must be signed by a majority of the Conservation Commission.

7
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

By VOTE on: 10.28.2020 the individuals listed below authorized the use of their electronic signature pursuant to the Certificate of Vote recorded with the Essex South Registry of Deeds in Book 39132, Page 402. They intend for their typed signatures ot serve as their electronic signatures:

Signed by Conservation Agent to confirm authenticity	/s/ Stewart Lazares e-signature
Lucia DelNegro-ConComm Agent Signature	/s/ Michael Rizzo e-signature
Signature	/s/ Michael Vivaldi e-signature
Signature	/s/ Bruce Comak e-signature
Signature	/s/ Arthur Athas e-signature
Signature	/s/ Jamie Harrop e-signature
Signature	/s/ Brian Cassidy e-signature
Signature	e-signature

☒ by hand delivery and email

8.2.2024
Date

☐ by certified mail, return receipt requested, on

Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:055-0939
eDEP Transaction #:1768841
City/Town:PEABODY

subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

PEABODY
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

PEABODY
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

FORMER B & M RAILROAD EASMENT, NORTHSHORE ROAD, ENDICOTT ST.
Project Location

055-0939
MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for:

Property Owner BRENDAN CALLAHAN

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Rev 4/1/2010

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Northeast Regional Office • 150 Presidential Way Woburn, MA 01801 • 978-694-3200

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 28, 2024

Brendan Callahan
City of Peabody
24 Lowell Street
Peabody, MA 01960

RE: WETLANDS/Peabody
DEP File #055-0939
Former B&M Railroad Easement/
Northshore Road/Endicott Street
Withdrawal of Appeal

Dear Mr. Callahan:

As you are aware, the Northeast Regional Office of the Department of Environmental Protection (MassDEP) appealed the above-referenced filing of its own volition in its letter of July 15, 2024. Upon receipt of an Amended Order of Conditions from the Peabody Conservation Commission dated August 2, 2024, MassDEP is hereby withdrawing its appeal.

This withdrawal thereby abrogates any further action by MassDEP in this matter and the associated appeal. You are further notified that the Amended Order of Conditions for DEP File #055-0939, as issued by the Peabody Conservation Commission on August 2, 2024, is now considered the Final Order of Conditions governing jurisdiction at this site.

If you have any questions regarding this letter, please do not hesitate to email me at jill.provencal@mass.gov.

Sincerely,

For - Jill Provencal
Section Chief
Wetlands Program – NERO

Ecc: Peabody Conservation Commission, Lucia DelNegro – lucia.delnegro@peabody-ma.gov
Heidi Davis, MassDEP Wetlands Highway Unit – heidi.davis@mass.gov
Melissa Lenker, MassDOT – melissa.lenker@dot.state.ma.us
Danielle Spicer, Green International – dspicer@greenintl.com

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT A00875

POLICY DIRECTIVE P-22-001
AND
POLICY DIRECTIVE P-22-002

THIS PAGE INTENTIONALLY LEFT BLANK

massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-001
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Off-Site Stockpiling of Soil from MassDOT Construction Projects

Purpose

The purpose of this Policy Directive is to formally establish a policy and procedures for managing and stockpiling soil generated and transported from MassDOT construction projects. This Policy Directive does not supersede any Federal, State, or Local regulations.

Date of Effect

This Policy Directive is effective immediately for all projects, including active construction projects.

For active construction projects and for other projects advertised prior to October 15, 2022, changes to the contract documents needed to implement the requirements of this Policy Directive will be considered on a case-by-case basis and shall be approved by the District Highway Director, as necessary.

For projects advertised on or after October 15, 2022, MassDOT will include the requirements and implementation procedures of this Policy Directive in the construction contract documents.

Policy Requirements

This policy is intended to prevent the off-site relocation of excavated soil generated from MassDOT projects to areas near residential receptors and to control potential fugitive dusts and/or contaminants. To that end, excavated soil may not be moved from the project site without knowledge of the content of the material. Knowledge may include visual field observations for presence of staining, odor, and/or debris, screening with a photoionization detector (PID), laboratory analysis, and/or site history. Pavement millings and other non-soil materials are not subject to the requirements of this Policy Directive.

Moving soil from a MassDOT project site to a temporary off-site storage location must be approved in writing by the District Highway Director.

The Contractor must select a storage location that is at least 500 feet away from residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially

zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.

Temporary off-site storage of excavated soil from a MassDOT project is only permissible at a location approved and permitted by MassDOT. The temporary storage location should be located within the same municipality where the soil was excavated, where possible. Stockpiled soil must be securely covered, and appropriate measures must be taken to minimize fugitive dust and erosion.

Signs indicating the source of the soil, the date the soil was generated, and contact information must be erected and maintained until the stockpiled soils are transported to a disposal facility or reused on the project site.

Implementation Procedures

To ensure that off-site storage of excavated soils is managed properly on MassDOT projects, this policy requires the following:

1. **Off-Site Stockpile Storage Locations**
    a. The Contractor shall provide proposed off-site storage locations to the Engineer for approval at least 30 days prior to transporting soil off site. Off-site storage locations should be in the same municipality as the work site.
    b. The Contractor shall keep excavated soil on site until adequately characterized to the satisfaction of the Engineer.
    c. The Contractor shall provide notification of the approved off-site storage location to the local Board of Health and the Town Manager's/Mayor's Office at least 7-days prior to transporting soil off site.
    d. The Contractor shall provide the Engineer with at least 3-days' notice prior to transporting soil off site.
    e. For off-site storage locations on MassDOT property, the Contractor is required to obtain an Access Permit through the District Permits Office prior to storage of soil or other materials. MassDOT will issue these permits at no cost to the Contractor. Information to be submitted by the Contractor as part of the permit application shall include:
        i. A description of material to be stored off-site, including available analytical data;
        ii. A figure of the location with distances to residences and residential receptors; and
        iii. Anticipated duration of temporary storage.
    f. Stockpile locations should not be within 500 feet of residential receptors (e.g., residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities).
        i. If the stockpile location must be within 500 feet of residential receptors, then soil must be less than RCS-1 (per 310 CMR 40.1600) and free of potentially hazardous or regulated items.

g. For off-site storage locations on non-MassDOT property, the Contractor must notify the property owner(s) at least 7 days prior to transporting material.
h. Exceptions to these rules will be reviewed by MassDOT and may be approved by the District Highway Director on a case-by-case basis.

2. Off-Site Stockpile Management

a. The Contractor shall keep soil stockpiles on impermeable surfaces (e.g., asphalt or concrete) or on 10-mil polyethylene sheeting.
b. The Contractor shall cover soil stockpiles with 10-mil polyethylene sheeting and surround with a berm made of hay bales, straw wattles, or similar.
    i. Piles that are actively being worked on must be covered and re-secured at the end of the work shift.
c. The Contractor shall label stockpiles with signs, including:
    i. Location of origin (including any Release Tracking Numbers)
    ii. Stockpile ID number (including MassDOT District office-assigned tracking ID, if different)
    iii. Date of initial accumulation
    iv. Applicable telephone numbers for the Contractor and MassDOT.
d. The Contractor shall mitigate fugitive dust at storage locations under the direction of an appropriately trained/certified environmental professional.
e. The Contractor shall remedy noncompliance with this policy within 48 hours.
f. The Contractor shall remedy noncompliance with this policy on the SAME DAY for potentially hazardous material, as determined by the Engineer.
g. The Contractor shall handle excavated soil according to federal, state, and local regulations.
h. The Contractor shall use appropriate shipping documents for all movements of excavated soil on public roadways (e.g., Bill of Lading, Material Shipping Record, Manifest, Asbestos Waste Shipment Record, etc.).

THIS PAGE INTENTIONALLY LEFT BLANK

massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-002
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Use of MassDOT Property for Staging and other Construction-Related Operations

Purpose

This Policy Directive is intended to address the use of MassDOT property by MassDOT Contractors for construction staging and other construction-related operations that are not specifically defined in the construction contract. Such use of MassDOT property will only be allowed if permitted by the District Office in accordance with 700 CMR 13.00, Approval of Access to MassDOT Highways and Other Property. This includes the use of MassDOT property for staging, laydown, and storage of equipment and materials, including soil excavated from a project site.

This Policy Directive requires the Contractor/applicant to obtain a Non-Vehicular Access Permit from MassDOT to use MassDOT property for these purposes.

This Policy Directive is effective immediately and applies to all MassDOT construction projects.

General Permit Considerations and Conditions

In addition to other normal MassDOT Access Permit procedures, MassDOT shall consider the following during the application, review, implementation and monitoring processes of Access Permits required by this Policy Directive:

- Storage and placement of the Contractor's equipment and materials should not be allowed within the clear zone of the roadway.
- Stockpiled soils should not be located within 500 feet of residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.
- The Contractor/applicant shall identify the access/egress locations of the proposed storage areas. MassDOT will only approve locations determined to be safe for roadway users, construction workers and the general public.
- The Contractor may be required to submit a Traffic Management Plan and/or Lighting Plan for MassDOT review and approval as part of the permit application, depending on the proposed use of the area.

- The Contractor shall submit the permit application through MassDOT's online State Highway Access Permit System (SHAPS).
- MassDOT will waive the permit application fee for any application received from a MassDOT Contractor for any permit required by this Policy Directive and will waive any subsequent amendment and extension fees that may otherwise be required.
- MassDOT will review the permit application in accordance with applicable standard procedures and will apply standard permit terms and conditions, as necessary.
- The Resident Engineer will verify that the permit is approved before allowing the Contractor to use the affected area for the requested purpose.
- Areas permitted are for use by the approved applicant only and are not to be shared with or used by other vendors. Subcontractors specifically engaged with the applicant working on the specific MassDOT project will be allowed to use the area in accordance with the terms of the permit.
- Permits are issued on an annual basis and will require the Contractor to file for an extension each year to continue use.

Exemptions from Permit Requirements

Equipment and materials being used for active construction operations and located within the work zone of the construction contract are exempt from this permit requirement, provided they do not interfere with the safety or operation of the roadway or the work zone. Examples of these types of exempt uses are:

- Equipment and materials parked or stored within a protected (barriered) work zone.
- Materials placed in the work zone prior to same-day installation or use.
- Soils excavated temporarily and scheduled to be replaced, such as for trenching operations or for installation of drainage structures.

DOCUMENT B00420

PROPOSAL

PEABODY

For: **Independence Greenway Extension**

COMMONWEALTH OF MASSACHUSETTS

LOCATION

The work referred to herein is in the City of PEABODY in Essex County, in the Commonwealth of Massachusetts, and is shown by the locus map (Document 00331) in the Proposal Pamphlet, the work locations extend as follows:

Essex Center Drive

Beginning – Station 289+45.00 +/-

Endicott Street

Ending –Station 20+05.00 +/-

Bridge P-03-020 (CAK)

The contract prices shall include the furnishing of all materials (except as otherwise herein specified), the performing of all the labor requisite or proper, the providing of all necessary machinery, tools, apparatus and other means of construction, the doing of all the abovementioned work in the manner set forth, described and shown in the specifications and on the drawings for the work, and in the form of contract, and the completion thereof within **889 CALENDAR DAYS** upon receipt of a Notice to Proceed, except that if the completion date falls between December 1 and March 15 then the same number of days beyond December 1st will be extended after March 15th.

The Work of this project is described by the following Items and quantities.

THIS PAGE INTENTIONALLY LEFT BLANK

Project # 609211 **Contract # 132091**

Location : PEABODY

Description : Independence Greenway Extension

ITEM #	QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	AMOUNT
101.	2	CLEARING AND GRUBBING AT _____ PER ACRE		
102.1	100	TREE TRIMMING AT _____ PER FOOT		
102.3	30	HERBICIDE TREATMENT OF INVASIVE PLANTS AT _____ PER HOUR		
102.33	8	INVASIVE PLANT MANAGEMENT STRATEGY AT _____ PER HOUR		
102.511	18	TREE PROTECTION - ARMORING AND PRUNING AT _____ EACH		
102.521	200	TREE AND PLANT PROTECTION FENCE AT _____ PER FOOT		
103.	5	TREE REMOVED - DIAMETER UNDER 24 INCHES AT _____ EACH		
119.	1	RODENT CONTROL AT _____ LUMP SUM		
120.	7,600	EARTH EXCAVATION AT _____ PER CUBIC YARD		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
121.	370	CLASS A ROCK EXCAVATION AT _____ PER CUBIC YARD		
140.	40	BRIDGE EXCAVATION AT _____ PER CUBIC YARD		
141.	250	CLASS A TRENCH EXCAVATION AT _____ PER CUBIC YARD		
141.1	30	TEST PIT FOR EXPLORATION AT _____ PER CUBIC YARD		
142.	10	CLASS B TRENCH EXCAVATION AT _____ PER CUBIC YARD		
143.	1,400	CHANNEL EXCAVATION AT _____ PER CUBIC YARD		
144.	60	CLASS B ROCK EXCAVATION AT _____ PER CUBIC YARD		
146.	4	DRAINAGE STRUCTURE REMOVED AT _____ EACH		
150.	550	ORDINARY BORROW AT _____ PER CUBIC YARD		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
151.	3,570	GRAVEL BORROW AT _____ PER CUBIC YARD		
151.01	30	GRAVEL BORROW - TYPE C AT _____ PER CUBIC YARD		
151.2	40	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES AT _____ PER CUBIC YARD		
152.71	1	PEASTONE DIAPHRAGM AT _____ LUMP SUM		
156.	80	CRUSHED STONE AT _____ PER TON		
156.1	35	CRUSHED STONE FOR BRIDGE FOUNDATIONS AT _____ PER TON		
170.	12,400	FINE GRADING AND COMPACTING - SUBGRADE AREA AT _____ PER SQUARE YARD		
180.01	1	ENVIRONMENTAL HEALTH AND SAFETY PROGRAM AT _____ LUMP SUM		
180.02	80	PERSONAL PROTECTION LEVEL C UPGRADE AT _____ PER HOUR		

Project # 609211 Contract # 132091				
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
180.03	100	LICENSED SITE PROFESSIONAL SERVICES AT _____ PER HOUR		
181.11	4,228	DISPOSAL OF UNREGULATED SOIL AT _____ PER TON		
181.12	894	DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY AT _____ PER TON		
181.13	447	DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY AT _____ PER TON		
181.14	90	DISPOSAL OF HAZARDOUS WASTE AT _____ PER TON		
182.1	1	INSPECTION AND TESTING FOR ASBESTOS AT _____ LUMP SUM		
184.1	25	DISPOSAL OF TREATED WOOD PRODUCTS AT _____ PER TON		
191.	30	DRIVE SAMPLE BORING AT _____ PER FOOT		
201.	5	CATCH BASIN AT _____ EACH		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
201.7	2	CATCH BASIN - DOUBLE GRATE AT _____ EACH		
202.	4	MANHOLE AT _____ EACH		
203.	1	SPECIAL MANHOLE AT _____ EACH		
220.	11	DRAINAGE STRUCTURE ADJUSTED AT _____ EACH		
220.3	1	DRAINAGE STRUCTURE CHANGE IN TYPE AT _____ EACH		
220.7	5	SANITARY STRUCTURE ADJUSTED AT _____ EACH		
220.8	4	SANITARY STRUCTURE REMODELED AT _____ EACH		
221.	7	FRAME AND COVER AT _____ EACH		
222.	2	FRAME AND GRATE - MASSDOT BAR TYPE AT _____ EACH		

Project # 609211 Contract # 132091				
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
222.1	3	FRAME AND GRATE - MASSDOT CASCADE TYPE AT _____ EACH		
223.1	4	FRAME AND GRATE (OR COVER) REMOVED AND STACKED AT _____ EACH		
224.12	4	12 INCH HOOD AT _____ EACH		
227.3	11	REMOVAL OF DRAINAGE STRUCTURE SEDIMENT AT _____ PER CUBIC YARD		
227.31	50	REMOVAL OF DRAINAGE PIPE SEDIMENT AT _____ PER FOOT		
228.	1	CLOSED CIRCUIT TV INSPECTIONS OF SEWER LINE AT _____ LUMP SUM		
234.12	170	12 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		
234.15	10	15 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		
234.18	20	18 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
234.36	10	36 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		
238.10	24	10 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
238.12	10	12 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
238.16	32	16 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
238.24	30	24 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
238.36	25	36 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
258.	85	STONE FOR PIPE ENDS AT _____ PER SQUARE YARD		
280.	25	HOT MIX ASPHALT WATERWAY AT _____ PER SQUARE YARD		
285.	420	INFILTRATION TRENCH AT _____ PER FOOT		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
358.	7	GATE BOX ADJUSTED AT _____ EACH		
402.	1,400	DENSE GRADED CRUSHED STONE FOR SUB-BASE AT _____ PER CUBIC YARD		
415.3	2,300	PAVEMENT MICRO MILLING AT _____ PER SQUARE YARD		
431.1	65	HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE AT _____ PER CUBIC YARD		
440.	8,400	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL AT _____ PER POUND		
443.	18	WATER FOR ROADWAY DUST CONTROL AT _____ PER 1000 GALLONS		
450.22	350	SUPERPAVE SURFACE COURSE – 9.5 (SSC – 9.5) AT _____ PER TON		
450.31	180	SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC -12.5) AT _____ PER TON		
450.42	315	SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) AT _____ PER TON		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
452.	1,100	ASPHALT EMULSION FOR TACK COAT AT _____ PER GALLON		
470.	1	HOT MIX ASPHALT BERM AT _____ PER TON		
472.	25	TEMPORARY ASPHALT PATCHING AT _____ PER TON		
506.	2,800	GRANITE CURB TYPE VB - STRAIGHT AT _____ PER FOOT		
506.1	100	GRANITE CURB TYPE VB - CURVED AT _____ PER FOOT		
506.2	3	GRANITE TRANSITION TYPE VB - SPLAYED END AT _____ EACH		
509.	110	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT AT _____ PER FOOT		
509.1	55	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - CURVED AT _____ PER FOOT		
510.	40	GRANITE EDGING TYPE SA AT _____ PER FOOT		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
516.	2	GRANITE CURB CORNER TYPE A AT _____ EACH		
570.3	25	HOT MIX ASPHALT CURB TYPE 3 AT _____ PER FOOT		
594.	400	CURB REMOVED AND DISCARDED AT _____ PER FOOT		
620.12	78	GUARDRAIL, TL-2 (SINGLE FACED) AT _____ PER FOOT		
627.1	2	TRAILING ANCHORAGE AT _____ EACH		
627.82	2	GUARDRAIL TANGENT END TREATMENT, TL-2 AT _____ EACH		
630.2	55	HIGHWAY GUARD REMOVED AND DISCARDED AT _____ PER FOOT		
644.172	2,800	72 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) VINYL COATED (LINE POST OPTION) AT _____ PER FOOT		
655.	1,100	CEDAR RAIL FENCE AT _____ PER FOOT		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
657.	3,600	TEMPORARY FENCE AT _____ PER FOOT		
657.5	4,000	TEMPORARY FENCE REMOVED AND RESET AT _____ PER FOOT		
665.2	2,700	CHAIN LINK FENCE REMOVED AND DISCARDED AT _____ PER FOOT		
673.	1	ACCESS ROAD GATE AT _____ EACH		
697.1	18	SILT SACK AT _____ EACH		
697.2	340	FLOATING SILT FENCE AT _____ PER FOOT		
698.3	1,500	GEOTEXTILE FABRIC FOR SEPARATION AT _____ PER SQUARE YARD		
698.4	55	GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL AT _____ PER SQUARE YARD		
701.2	155	CEMENT CONCRETE PEDESTRIAN CURB RAMP AT _____ PER SQUARE YARD		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
701.3	110	CEMENT CONCRETE REINFORCED PAVEMENT AT _____ PER SQUARE YARD		
702.	1,275	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY AT _____ PER TON		
704.2	475	STONE DUST FOR SHOULDERS AT _____ PER TON		
706.9	42	TEXTURED DECORATIVE PAVEMENT AT _____ PER SQUARE YARD		
707.17	3	BENCH AT _____ EACH		
707.2	1	TRASH RECEPTACLE AT _____ EACH		
707.8	38	STEEL BOLLARD AT _____ EACH		
707.9	2	BICYCLE RACK AT _____ EACH		
722.2	1	SCHEDULE OF OPERATIONS (TYPE B) - FIXED PRICE $55,500 AT Fifty Five Thousand Five Hundred Dollars LUMP SUM	$55,500.00	$55,500.00

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
740.	29	ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) AT _____ PER MONTH		
748.	1	MOBILIZATION AT _____ LUMP SUM		
751.	1,050	LOAM FOR ROADSIDES AT _____ PER CUBIC YARD		
751.7	90	COMPOST BLANKET AT _____ PER CUBIC YARD		
755.35	1	INLAND WETLAND REPLICATION AREA AT _____ LUMP SUM		
755.45	540	WETLAND RESTORATION AT _____ PER SQUARE YARD		
755.75	40	WETLAND SPECIALIST AT _____ PER HOUR		
755.76	1	WETLANDS MONITORING REPORTS AT _____ LUMP SUM		
756.	1	NPDES STORMWATER POLLUTION PREVENTION PLAN AT _____ LUMP SUM		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
765.	7,500	SEEDING AT _____ PER SQUARE YARD		
765.451	10	NATIVE SEED - PART SHADE ROADSIDE MIX AT _____ PER POUND		
765.635	340	NATIVE SEEDING AND ESTABLISHMENT AT _____ PER SQUARE YARD		
767.121	9,750	SEDIMENT CONTROL BARRIER AT _____ PER FOOT		
767.6	2	AGED PINE BARK MULCH AT _____ PER CUBIC YARD		
767.91	560	TIMBER MATTING AT _____ PER SQUARE YARD		
769.	175	PAVEMENT MILLING MULCH UNDER GUARD RAIL AT _____ PER FOOT		
772.035	11	ARBORVITAE - EMERALD GREEN 4-5 FEET AT _____ EACH		
772.334	25	CEDAR - RED 3-4 FEET AT _____ EACH		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
774.239	2	SPRUCE - WHITE 4-5 FEET AT _____ EACH		
775.12	6	ASPEN - QUAKING 4-5 FEET AT _____ EACH		
776.543	2	MAPLE - RED - OCTOBER GLORY 2-2.5 INCH CALIPER AT _____ EACH		
778.18	7	BIRCH - GRAY 4-5 FEET AT _____ EACH		
783.043	1	SERVICEBERRY - AUTUMN BRILLIANCE 4-5 FEET AT _____ EACH		
794.329	11	SUMAC SHRUB - FRAGRANT 2-3/ #2 AT _____ EACH		
794.331	3	SUMAC SHRUB - FRAGRANT-GRO-LOW 2-3 FEET / #2 AT _____ EACH		
794.733	5	SUMMERSWEET -'HUMMINGBIRD' 18-24 INCH HT AT _____ EACH		
794.809	6	SWEETSPIRE - LITTLE HENRY - 12-18 INCH HT AT _____ EACH		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
796.031	14	BUTTERFLYWEED - #1 CONT AT _____ EACH		
796.433	14	CAREX - ICE DANCE -#1 CONT AT _____ EACH		
796.459	9	SWITCH GRASS - SHENANDOAH - #2 CONT AT _____ EACH		
796.753	84	DAY LILY - HAPPY RETURNS - #1 CONT AT _____ EACH		
796.757	46	DAY LILY - ROSY RETURNS - #1 CONT AT _____ EACH		
796.775	340	LIVE STAKES AT _____ EACH		
797.2	3	INFORMATIONAL SIGN AT _____ EACH		
811.36	2	ELECTRIC MANHOLE ADJUSTED AT _____ EACH		
811.60	1	JUNCTION BOX 12 X 8 X 6 INCHES AT _____ EACH		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
815.13	2	RECTANGULAR RAPID FLASHING BEACON SYSTEM (SOLAR) AT _____ EACH		
820.11	1	HIGHWAY LIGHTING - UNDERPASS AT _____ LUMP SUM		
832.	165	WARNING-REGULATORY AND ROUTE MARKER - ALUMINUM PANEL (TYPE A) AT _____ PER SQUARE FOOT		
832.91	4	EAST COAST GREENWAY STANDARD ROUTE SIGN AT _____ EACH		
832.92	4	EAST COAST GREENWAY ARROW SIGN AT _____ EACH		
847.1	50	SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL AT _____ EACH		
851.1	38	TRAFFIC CONES FOR TRAFFIC MANAGEMENT AT _____ PER DAY		
851.11	1,400	TEMPORARY PEDESTRIAN BARRICADE AT _____ PER FOOT		
851.12	4	TEMPORARY PEDESTRIAN CURB RAMP AT _____ EACH		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
852.	400	SAFETY SIGNING FOR TRAFFIC MANAGEMENT AT _____ PER SQUARE FOOT		
853.1	10	PORTABLE BREAKAWAY BARRICADE TYPE III AT _____ EACH		
854.016	10,500	TEMPORARY PAVING MARKINGS - 6 INCH (PAINTED) AT _____ PER FOOT		
854.036	1,680	TEMPORARY PAVING MARKINGS - 6 INCH (TAPE) AT _____ PER FOOT		
854.1	405	PAVEMENT MARKING REMOVAL AT _____ PER SQUARE FOOT		
856.	250	ARROW BOARD AT _____ PER DAY		
856.12	300	PORTABLE CHANGEABLE MESSAGE SIGN AT _____ PER DAY		
859.	2,300	REFLECTORIZED DRUM AT _____ PER DAY		
864.04	100	PAVEMENT ARROWS AND LEGENDS REFLECTORIZED WHITE (THERMOPLASTIC) AT _____ PER SQUARE FOOT		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
866.106	2,050	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		
866.112	1,440	12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		
867.106	4,800	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
867.112	50	12 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
874.	2	STREET NAME SIGN AT _____ EACH		
874.2	13	TRAFFIC SIGN REMOVED AND RESET AT _____ EACH		
874.4	10	TRAFFIC SIGN REMOVED AND STACKED AT _____ EACH		
901.	20	4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE AT _____ PER CUBIC YARD		
901.3	32	4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE FOR POST FOUNDATION AT _____ PER CUBIC YARD		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
910.	150	STEEL REINFORCEMENT FOR STRUCTURES AT _____ PER POUND		
916.01	1	PRECAST CONCRETE CULVERT NO. 1 (8 FT SPAN X 4 FT RISE) AT _____ EACH		
916.02	1	PRECAST CONCRETE CULVERT NO. 2 (8 FT SPAN X 4 FT RISE) AT _____ EACH		
943.2	3,700	HELICAL PILE AND BRACKET ASSEMBLY AT _____ PER FOOT		
948.6	80	PRE-DRILLING FOR PILE OBSTRUCTIONS AT _____ PER FOOT		
948.7	3	HELICAL PILE VERIFICATION LOAD TEST AT _____ EACH		
983.	2,860	DUMPED RIPRAP AT _____ PER TON		
983.1	145	RIPRAP AT _____ PER TON		
983.6	1,400	NATURAL STREAMBED MATERIAL AT _____ PER SQUARE YARD		

Project # 609211	Contract # 132091			
Location : PEABODY				
Description : Independence Greenway Extension				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
986.	32	MODIFIED ROCKFILL AT _____ PER TON		
991.1	1	CONTROL OF WATER - STRUCTURE NO. P-03-020 (CAK) AT _____ LUMP SUM		
991.2	1	CONTROL OF WATER - STRUCTURE NO. 2 (CULVERT NO. 1) AT _____ LUMP SUM		
991.3	1	CONTROL OF WATER - STRUCTURE NO. 3 (CULVERT NO. 2) AT _____ LUMP SUM		
995.01	1	BRIDGE STRUCTURE, BRIDGE NO. P-03-020 (CAK) AT _____ LUMP SUM		
Total Qty:	124,843			

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT B00853

SCHEDULE OF PARTICIPATION
BY DISADVANTAGED BUSINESS ENTERPRISES (DBEs)

PRIME BIDDER: _____

DATE OF BID OPENING: _____ MassDOT PROJECT NO.: 609211

FEDERAL AID PROJECT NUMBER: TAP/CMQ-0034(027)X

PROJECT LOCATION: PEABODY

Name Address and Phone Number of DBE	Name of Activity	NAICS Code(s)	(a) DBE Contractor Activity Amount *Construction Work*	(b) DBE Other Business Amount *Services, Supplies, Material*	(c) Total amount eligible for credit
Total Bid Amount	TOTALS:		$		$
	DBE Percentage of Total bid:		%		%

A copy of the DBE's most recent certification and an original affidavit must be attached to this document.

Is a Joint Check Approval being submitted for any of the above? ☐ Yes X No
Will any of the contractors listed above be using a third party to deliver materials or perform any portion of work?
☐ Yes X No
(i.e. manufacturing)

SIGNATURE:_____ DATE_____

NAME AND TITLE (*PRINT*):_____

EMAIL ADDRESS: _____TEL NO.:_____

Rev'd 5/8/13

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT B00854

DBE Letter of Intent

(To be completed by the DBE – Page 1 of 2)

The DBE firm will also include the latest MassUCP letter with this Letter of Intent.

To: _____ (Prime Bidder)

From: _____ (DBE Firm)

Federal Aid Project No.: TAP/CMQ-0034(027)X Bid Opening or Due Date: _____

Project Name: _____ Project Location: PEABODY

I, _____, authorized signatory of the above-reference DBE firm hereby declare:

(Print Name)

(a) My company is currently certified as a Disadvantaged Business Enterprise (DBE) by the Massachusetts Supplier Diversity Office (SDO), as a (check all that apply):

☐ CONTRACTOR ☐ REGULAR DEALER ☐ OTHER
☐ MANUFACTURER ☐ TRUCKING OPERATIONS ☐ PROFESSIONAL SERVICES

[Additional guidance is available at Title 49, Code of Federal Regulations, Part 26.55 (49 CFR Part 26.55)]

(b) My firm has the ability to manage, supervise and perform the activity described on page 3 of this Letter of Intent. If you are awarded the contract, my company intends to enter into a contract with your firm to perform the items of work or other activity described on the following sheet for the prices indicated.

(c) There have been no changes affecting the ownership, control or independence of my company since my last certification review on _____. If any such change is planned or occurs prior to my company's completion of this proposed work, I will give prior written notification to your firm and to the Office of Diversity and Civil Rights (ODCR)(MBTA/MassDOT) and SDO.

(d) I have read the MassDOT proposal for the Project, and acknowledge that my company will comply with that document and the requirements of 49 CFR Part 26.

(e) For the purpose of obtaining subcontractor approval from the MassDOT, my firm will provide to you:

a. ***The following construction work:***
   i. a complete list of contact information for proposed Superintendent, i.e., address, phone number and e-mail address, and;
   ii. a list of projects completed in the last 10 years. I shall also include, for each project: the name and telephone number of a contact person for the contracting authority, person, or organization; project title / location (City/State), dollar value of the work; a description of the work; and the date project completed .

b. The following professional services work:
   i. resume, stating the qualifications and experience of person responsible for project oversight and contact information, i.e., address, phone number and e-mail address.
   ii. proposed team and organization,
   iii. resumes of key personnel;
   iv. example projects

c. The following services, materials or supplies:
   i. a written agreement and invoices for the materials or supplies, and any other documents evidencing the terms of providing such items to be sent to the Office of Diversity and Civil Rights Government Compliance Unit designee;
   ii. information concerning brokers fees and commissions for providing services or materials.

DBE Firm Authorized Signature _____ Date _____

DBE Letter of Intent (Continued)

(To be completed by the DBE – Page 2 of 2)

Prime Bidder: _____

DBE Firm: _____

Federal Aid Project No.: TAP/CMQ-0034(027)X Bid Opening or Due Date: _____

Project Name: _____ Project Location: PEABODY

Item number if applicable	NAICS Code	Description of Activity with notations such as Services, or Brokerage, Labor Only, Material Only, or Complete	Quantity	Unit Price	Amount
			TOTAL AMOUNT:		

Please give full explanations, attach additional sheets if necessary.

I HEREBY VERIFY THAT _____

(DBE Firm)

WILL SOLELY PERFORM THE WORK, OR PROVIDE THE SERVICES OR MATERIALS, AS DESCRIBED ABOVE.

DBE Authorized Signature: _____

_____

Name (Print): _____

Title: _____

Email Address: _____

Phone Number: _____ Fax Number: _____

END OF DOCUMENT

DOCUMENT B00855

DBE JOINT CHECK ARRANGEMENT APPROVAL FORM

(to be submitted by Prime Contractor)

Contract No: 132091 **Project No.** 609211 **Federal Aid No.:** TAP/CMQ-0034(027)X

Location: PEABODY **Bid Opening Date:** _____

Project Description: Independence Greenway Extension

We have received the attached request for the use of a joint check arrangement from _____ _____ , a DBE on the above- referenced Contract and _____ _____, a Material Supplier/Vendor for the subject Contract. The DBE has complied with the requirements of 49 CFR Part 26.55(c)(1). In particular, the DBE has:

- a written agreement with the material supplier/vendor;
- applied for credit with the subject material supplier and has supplied the vendor's response;
- shown that it will place all orders to the subject material supplier/vendor;
- made and retains all decision-making responsibilities concerning the materials; and
- provided a Joint Check Agreement that is acceptable to MassDOT;

As the Contractor for the Project, we agree to issue joint checks (made payable to the Material Supplier/Vendor and the DBE) for payment of sums due pursuant to invoices from the Supplier/Vendor and DBE.

Contractor:

_____ _____
Company Name Signature
Duly Authorized

_____
Printed Name

_____ _____
Date Title

SubContractor:

_____ _____
Company Name Signature –
Duly Authorized

_____
Printed Name

_____ _____
Date Title

*** END OF DOCUMENT ***

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT B00856

JOINT VENTURE AFFIDAVIT

(All Firms)

- All Information Requested By This Schedule Must Be Answered. Additional Sheets May Be Attached.
- If, there is any change in the information submitted, the Joint Venture parties must inform MassDOT Pre-Qualifications Office (and, if one of the companies is a DBE, the Director of Contract Compliance, Office of Civil Rights) *prior* to such change, in writing, either directly or through the Prime Contractor if the Joint Venture is a subcontractor.
- If the Joint Venture Entity will be the bidder on a prime Contract, it must bid and submit all required documents (insurance, worker's compensation, bonds, etc.) in the name of the Joint Venture Entity.

I. Name of Joint Venture: _____

Type of Entity if applicable (Corp., LLC):_____Filing State _____

Address of joint venture: _____

_____

Phone No(s) for JV Entity: _____E-mail:_____

Contact Person(s)_____

Tax ID/EIN of Joint Venture: _____Vendor Code:_____

II. Identify each firm or party to the Joint Venture:

Name of Firm: _____

Address: _____

Phone : _____E-mail:_____

Contact person(s) _____

Name of Firm: _____

Address: _____

Phone: _____E-mail:_____

Contact Person(s)_____

III. Describe the role(s) of the each party to the Joint Venture:

_____

_____

IV. Attach a copy of the Joint Venture Agreement. The proposed Joint Venture Agreement should include specific details including, but not limited to: (1) the contributions of capital and equipment; (2) work items to be performed by each company's forces, (3) work items to be performed under the supervision of any DBE Venturer; (4) the commitment of management, supervisory and operative personnel employed by the DBE to be dedicated to the performance of the Project; and (5) warranty, guaranty, and indemnification clauses.

V. Attach any applicable Corporate or LLC Votes, Authorizations, etc.

VI. Ownership of the Joint Venture:

A. What is the percentage(s) of each company's ownership in the Joint Venture?

ownership percentage(s): _____

ownership percentage(s): _____

B. Specify percentages for each of the following (provide narrative descriptions and other detail as applicable):

1. Sharing of profit and loss: _____
2. Capital contributions:

(a) Dollar amounts of initial contribution: _____

(b) Dollar amounts of anticipated on-going contributions: _____

(c) Contributions of equipment (specify types, quality and quantities of equipment to be provided by each firm): _____

_____

4. Other applicable ownership interests, including ownership options or other agreements, which restrict or limit ownership and/or control:

_____

_____

5. Provide copies of all other written agreements between firms concerning bidding and operation of this Project or projects or contracts.

6. Identify all current contracts and contracts completed during the past two (2) years by either of the Joint Venture partners to this Joint Venture:

_____

_____

VII. Control of and Participation in the Joint Venture. Identify by name and firm those individuals who are, or will be, responsible for and have the authority to engage in the following management functions and policy decisions. (Indicate any limitations to their authority such as dollar limits and co-signatory requirements.):

A. Joint Venture check signing:

_____

_____

B. Authority to enter Contracts on behalf of the Joint Venture:

_____

_____

C. Signing, co-signing and/or collateralizing loans:

_____

_____

D. Acquisition of lines of credit:

E. Acquisition and indemnification of payment and performance bonds:

F. Negotiating and signing labor agreements:

G. Management of contract performance. *(Identify by name and firm only)*:

1. Supervision of field operations:
2. Major purchases:
3. Estimating:
4. Engineering:

VIII. Financial Controls of Joint Venture:

A. Which firm and/or individual will be responsible for keeping the books of account?

B. Identify the "Managing Partner," if any, and describe the means and measure of their compensation:

C. What authority does each firm have to commit or obligate the other to insurance and bonding companies, financing institutions, suppliers, subcontractors, and/or other parties participating in the performance of this Contract or the work of this Project?

IX. Personnel of Joint Venture: State the approximate number of personnel (by trade) needed to perform the Joint Venture's work under this Contract. Indicate whether they will be employees of the majority firm, DBE firm, or the Joint Venture.

	Firm 1 (number)	Firm 2 (number)	Joint Venture (number)
Trade			
Professional			
Administrative/Clerical			
Unskilled Labor			

Will any personnel proposed for this Project be employees of the Joint Venture?: _____

If so, who: _____

A. Are any proposed Joint Venture employees currently employed by either firm?

Employed by Firm 1: _____Employed by firm 2 _____

B. Identify by name and firm the individual who will be responsible for Joint Venture hiring: ____

_____

X. Additional Information. Please state any material facts and additional information pertinent to the control and structure of this Joint Venture.

_____

_____

XI. AFFIDAVIT OF JOINT VENTURE PARTIES. The undersigned affirm that the foregoing statements and attached documents are correct and include all material information necessary to identify and explain the terms and operations of our Joint Venture and the intended participation of each firm in the undertaking. Further, the undersigned covenant and agree to provide to MassDOT current, complete and accurate information regarding actual Joint Venture work, payments, and any proposed changes to any provisions of the Joint Venture, or the nature, character of each party to the Joint Venture. We understand that any material misrepresentation will be grounds for terminating any Contract awarded and for initiating action under Federal or State laws concerning false statements.

Firm 1	Firm 2
Signature Duly Authorized	Signature Duly Authorized
Printed Name and Title	Printed Name and Title
Date	Date

*** END OF DOCUMENT ***