GEOTECHNICAL ENGINEERING REPORT

CONNECTICUT DEPARTMENT OF TRANSPORTATION

REPLACEMENT OF BRIDGE NO. 02698
ROUTE 149 OVER DYKAS BROOK
EAST HADDAM, CONNECTICUT

State Project No. 0040-0148
GM2 Project No. 40386.02

November 13, 2023

Prepared for:
Connecticut Department of Transportation

Prepared by:
GM2 Associates, Inc.

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November 13, 2023

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Replacement of Bridge No. 02698
Route 149 over Dykas Brook
East Haddam, Connecticut

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Dear Ms. Ritacco,

GM2 Associates, Inc. (GM2) is pleased to submit our Geotechnical Engineering Report for the subject project. This report presents a description of our services, a summary of field explorations and laboratory testing, descriptions of site and subsurface conditions, and geotechnical recommendations for design and construction of the proposed project.

We appreciate the opportunity to be of service to you. If you have questions concerning this report or require additional information, please contact us at 978-488-9191.

Respectfully submitted,
GM2 Associates, Inc.

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1.0 INTRODUCTION

GM2 Associates, Inc. (GM2) is pleased to submit our geotechnical report for the proposed replacement of Bridge No. 02698 carrying Route 149 (aka Haddam Moodus Road) over Dykas Brook in East Haddam, Connecticut. The site location relative to surrounding physical features is shown in ***Figure 1 – Locus Plan***.

This report presents a description of our services, a summary of field explorations and laboratory testing, descriptions of site and subsurface conditions, and geotechnical recommendations for design and construction of the proposed bridge replacement. Our understanding of the existing and proposed conditions is based on the following:

- Routine Inspection Report prepared by CTDOT (Team 5), dated December 1, 2020.
- Rehabilitation Study Report (RSR) prepared by GM2 for the Connecticut Department of Transportation (CTDOT), dated May 18, 2022.
- Preliminary Design Drawings dated May 23, 2023.
- Preliminary Design Report – 30% Submittal prepared by Prime AE Group, dated May 30, 2023.

The recommendations presented in this report are based on our understanding of the project as described herein and our interpretation of the subsurface conditions encountered at discrete exploration locations. Project details including, but not limited to, the proposed structure type, configuration, grading, related site improvements, and proposed construction approach had not been finalized at the time of this report. The recommendations provided herein should therefore be considered preliminary and we should be contacted to review and modify our recommendations as necessary as the design is finalized. Additional investigations, laboratory testing, analyses, and recommendations may be necessary during final design. Our current understanding of the proposed conditions is described in Section 1.3. Our recommendations are subject to the limitations described in Section 5.0 of this report.

1.1 Survey and Datum

Existing site topography is based on a survey plan prepared by GM2. Surface elevation contours are shown in ***Figure 2 – Exploration Location Plan***. Elevations are in feet and reference the North American Vertical Datum of 1988 (NAVD88). The stationing and offsets shown on the boring logs reference the roadway centerline stationing and right/left offsets when looking in the direction of increasing station numbers.

1.2 Site Description and Existing Conditions

The existing single span bridge carries vehicular traffic in a generally north-south direction over Dykas Brook, which flows generally east to west. The structure was originally built in 1905 and was rehabilitated in 1957 with a pre-cast concrete slab that has a span of 6'-10" and an out-to-out width of 30'-4". The roadway across the bridge has a width of 27 feet. A concrete curb, guardrails, and steel railings are present on both sides of the roadway at the bridge. Existing roadway grades in the vicinity of the bridge range from about Elevation (El.) 107.0 to 109.0. Utilities include overhead electric and communication lines west of the bridge. The presence of underground utilities at the bridge is unknown. See ***Photo 1*** in ***Appendix A***.

The bridge substructure consists of stone masonry abutments with concrete gunite facing with that appear to be founded directly on bedrock, which forms the streambed in the area under the bridge. Abutment heights range from approximately 10 feet at the east side of the bridge to about 15 feet on the west side of the bridge. Stone masonry wing walls, also covered with concrete gunite facing, are present at each end of both abutments. The wingwalls are generally oriented perpendicular to the abutment alignment. See ***Photos 2 through 4***.

The streambed gradient is moderately steep beneath the bridge. A small concrete dam, approximately 3 feet tall, is located about 9 feet upstream of the bridge. See ***Photo 5***.

1.3 Proposed Conditions

According to the RSR report, the existing structure is in poor condition with significant cracking and spalling in many areas of the superstructure, abutments, and wingwalls. Rehabilitation of the existing structure was dismissed as an alternative due to age, construction type, and condition. Additionally, the highway classification (Rural – Major Collector) requires widening the roadway cross-section across the bridge to accommodate sidewalks. Lower portions of the existing abutments may be left in place to preserve the existing characteristics and geomorphology of the stream.

Two layout alternatives were proposed in the RSR report for bridge replacement; one that widens the structure to the west (Alternative 1) and the other that widens the structure to the east (Alternative 2). The Preliminary Design Report (PDR) identifies Alternative 1 as the selected alternative. The new superstructure will be constructed of prestressed concrete slab units and have a span of 20 feet. The proposed abutments will be a reinforced concrete pier cap/bridge seat supported by drilled micropiles. New wingwalls along the downstream (west) side of the bridge will be constructed of soldier piles socketed into bedrock with 8-foot-long pre-cast concrete lagging between soldier piles. The east side wingwalls will be supported by shallow spread footings bearing on bedrock. The RSR and PDR reports did not include preliminary structural loads. Preliminary structural drawings associated with the PDR are in ***Appendix F***.

2.0 SUBSURFACE CONDITIONS

2.1 Geologic Setting

Based on the Surficial Materials Map of Connecticut available from the United States Geological Survey (USGS), the site is mapped in an area of thin till less than 10 to 15 feet thick overlying bedrock. Bedrock in the site vicinity is mapped as Hebron Gneiss.

2.2 Subsurface Explorations

Subsurface conditions were explored by advancing six borings (B-1 through B-6) at the approximate locations shown in ***Figure 2 – Exploration Location Plan.*** The borings were completed by New England Boring Contractors, Inc. of Glastonbury, Connecticut between June 22 and June 28, 2023 using a truck mounted drill rig. GM2 staff monitored drilling activities in the field and prepared logs for each exploration. Various sampling and drilling methods were used as described in the following sections. Samples of streambed materials were not collected due to the bedrock stream channel.

A summary of the locations and depths of the borings drilled at the site is provided in the following table.

Boring ID	Abutment	Total Depth, ft.	Depth into Bedrock, ft.
B-1	South	25.0	17.0
B-2	South	8.1 (abandoned)	
B-2A	South	30.0	22.0
B-3	South	26.5	22.0
B-4	North	27.0	21.0
B-5	North	30.0	21.5
B-6(OW)	North	30.0	19.0

The borings were advanced to depths noted above using drive-and-wash and rock coring drilling methods. When drilling through soils, standard penetration tests (SPTs) were completed at 2 to 5 feet intervals by driving a 24 in. long by 1-3/8 in. inside diameter (2 in. outside diameter) split spoon sampler with blows from a 140 lb. winch-operated hammer falling 30 in. per blow. Hammer blows per 6 inches of sampler penetration (for up to 24 inches) were recorded. The blow counts for the middle 12 inches are combined and designated as the SPT blow count, which is correlated to soil consistencies and engineering soil properties.

The borings were advanced to refusal on bedrock prior to coring except for B-2, which was abandoned at 8.1 feet due to a boulder that prevented casing installation. The rig was moved approximately 2 feet south and B-2A was advanced to refusal on bedrock at 8.0 ft. Refusal is defined as more than 100

hammer blows for less than 6 inches of sampler penetration, or no discernable advancement of the drill bit over a period of approximately 5 minutes. NX sized coring equipment was used for all bedrock cores. Core depths into bedrock are noted in the above table.

Subsurface conditions encountered in the borings are described in Section 2.3 and in the boring logs included in ***Appendix B***. Photographs of rock cores as included in ***Appendix C***. A groundwater observation well was installed in B-6. A monitoring well installation report is included in ***Appendix D***.

2.3 Subsurface Profile

2.3.1 General

Subsurface conditions encountered in the borings were generally consistent with the mapped surficial geology and site observations. The conditions encountered in the borings are described below, in general order of occurrence with depth. Depths provided herein are relative to the pavement or ground surface at the respective boring locations.

Subsurface conditions described herein are on a limited number of borings. Variations may occur and should be expected outside of and between boring locations. The strata boundaries shown in our boring logs are based on our interpretations and the actual transition may be gradual. Refer to the boring logs included in ***Appendix B*** for detailed descriptions of the soil and rock samples collected.

Surficial Materials- All borings were completed in existing pavement areas and encountered approximately 6 inches of asphalt concrete (AC) pavement at the ground surface.

Fill- Fill was encountered below the pavement in all borings and extended to depths ranging from 4.5 to 8.5 feet below ground surface. The fill generally consisted of very loose to dense, fine SAND with some silt and little gravel and GRAVEL and SAND with little silt. Cobbles and boulders were present within the fill in some of the borings based on the observed drilling behavior. Boring B-2 was terminated at a depth of 8.1 feet due to a boulder encountered at 4 ft. that prevented casing installation.

Glacial Till- Glacial till was encountered below the fill in B-1 and B-6(OW). The till consisted of dense, fine SAND with some silt and trace gravel in B-1 and very dense, fine to medium SAND with little gravel and silt in B-6(OW). The glacial till extended to the top of bedrock at 8.0 ft. in B-1 and 11.0 ft. in B-6(OW).

Bedrock- Bedrock was encountered in all borings at depths ranging from 5.5 ft. to 11.0 ft. Coring was completed in all borings except B-2. Rock core run lengths, depths, recovery, and Rock Quality Designation (RQD) values for the rock cores are summarized in the following table.

Boring ID	Core Number	Depth, ft.	Elevation, ft.	Recovery, in.	RQD, %
B-1	C-1	10 to 15	98.5 to 93.5	54	30
	C-2	15 to 20	93.5 to 88.5	53	70
	C-3	20 to 25	88.5 to 83.5	60	15
B-2A	C-1	10 to 15	98 to 93	57	57
	C-2	15 to 20	93 to 88	57	80
	C-3	20 to 25	88 to 83	58	57
	C-4	25 to 30	83 to 78	60	100
B-3	C-1	6.5 to 11.5	101.5 to 96.5	52	0
	C-2	11.5 to 16.5	96.5 to 91.5	60	70
	C-3	16.5 to 21.5	91.5 to 86.5	60	78
	C-4	21.5 to 26.5	86.5 to 81.5	59	90
B-4	C-1	7 to 12	101.3 to 96.3	60	60
	C-2	12 to 17	96.3 to 91.3	57	57
	C-3	17 to 22	91.3 to 86.3	55	65
	C-4	22 to 27	86.3 to 81.3	59	98
B-5	C-1	10 to 15	97.8 to 92.8	59	8
	C-2	15 to 20	92.8 to 87.8	57	43
	C-3	20 to 25	87.8 to 82.8	60	95
	C-4	25 to 30	82.8 to 77.8	60	90
B-6 (OW)	C-1	12 to 15	95.3 to 92.3	10	0
	C-2	15 to 20	92.3 to 87.3	46	37
	C-3	20 to 25	87.3 to 82.3	59	46
	C-4	25 to 30	82.3 to 77.3	60	93

The rock core samples are generally described as medium hard to hard, slightly to very slightly weathered, slightly to extremely fractured, blue-gray GNEISS with very close to moderately close joints. More detailed descriptions for each core are included in the boring logs. A 6- to 8-foot thick zone of poor quality, fracture bedrock (RQD < ~50%) was encountered overlying more intact bedrock in B-1, B-3, B-5, and B-6(OW). Photographs of each core are included in ***Appendix C***.

2.3.2 Groundwater

Groundwater was not observed during drilling in the borings due to the introduction of water into the boreholes for drilling and coring. A monitoring well was installed in B-6 and groundwater and subsequent measurements are summarized in the following table. A monitoring well installation report is included in ***Appendix D***.

Date	Depth to Groundwater, ft.
	B-6(OW)
6/27/23	8.8
6/28/23	9.2
8/17/23	9.2

Groundwater is expected to be within a few feet of the bedrock surface and be influenced by water levels in Dykas Brook. Groundwater levels will also fluctuate with season, variations in precipitation, construction in the area, and other factors. Perched groundwater conditions could exist close to the ground surface, especially during and after extended periods of wet weather.

2.4 Laboratory Testing

Select samples obtained from the explorations were submitted to Terracon Consultants, Inc. for grain size analysis (ASTM D422) and unconfined compressive strength of rock. Laboratory test results are summarized in the tables below and included in ***Appendix E***.

Boring	Sample ID	Depth	Moisture Content (%)	Percent Gravel	Percent Sand	Precent Fines*
B-3	S-1 & S-2	1 to 5 ft.	3.4	46.3	39.2	14.5
B-5	S-2 & S-3	3 to 7 ft.	9.5	25.6	58.7	15.7
B-6	S-3 & S-4	5 to 9 ft.	15.1	19.9	62.4	17.7

** - Percent passing the U.S. No. 200 sieve.*

Unconfined Compressive Strength Test Results – Rock*		
Boring	B-2A	B-4
Core ID	C-1	C-2
Depth	10 to 15 ft.	12 to 17 ft.
Density, pcf	171.0	173.2
Unconfined Compressive Strength, psi	23,035	21,725
Elastic Modulus, ksi	1,638	1,640
Poisson's Ratio, υ	0.124	0.117

** - See Appendix E for additional test information and results.*

2.5 Geotechnical Design Parameters

Recommended design parameters for the soil encountered in our explorations, as applicable for the project, are summarized in the following table.

Soil Type	Unit Weight, γ (pcf)	Drained Friction Angle, ϕ (°)	Effective Cohesion, c (psf)
Existing Fill	120	34	0
Glacial Till	125	38	0

2.6 Seismic Considerations

The recommended seismic design parameters for the site have been evaluated in accordance with the AASHTO LRFD Bridge Design Specifications, 9th Edition. Based on SPT blow count data from the borings, the subsurface profile (from the ground surface down) of this site is representative of Site Class C. Site Class B could be appropriate, but would need to be confirmed via in-situ shear wave velocity testing. We recommend the following seismic design parameters for the site.

Seismic Parameter	AASHTO Reference	Value
Peak Ground Acceleration, PGA	Figure 3.10.2.1-1	0.060g
Short-period Spectral Acceleration, S_s	Figure 3.10.2.1-2	0.125g
Long-period Spectral Acceleration, S_1	Figure 3.10.2.1-3	0.034g
Site Factor for Short-period, F_a	Table 3.10.3.2-2	1.2
Site Coefficient for Long-period, F_v	Table 3.10.3.2-3	1.7
Short period acceleration coefficient, S_{DS}	Equation 3.10.4.2-3	0.150g
1-sec period acceleration coefficient, S_{D1}	Equation 3.10.4.2-6	0.058g
Seismic Zone	Table 3.10.6.1	1

Based on the soil types and consistencies encountered in our explorations and shallow bedrock, the risk of structurally damaging ground deformations due to liquefaction is low at this site.

3.0 GEOTECHNICAL RECOMMENDATIONS

3.1 General

Based on our project understanding, the subsurface conditions encountered in the borings, and our geotechnical engineering analyses, support of the proposed structure on a combination of drilled micropiles, rock-socketed soldier piles, and shallow spread foundations is feasible subject to the recommendations herein. Primary geotechnical considerations for the proposed structure include existing fill, boulders in the fill and native glacial till, shallow bedrock, and the potential for differential settlement due to variable bearing conditions (i.e., soil and bedrock).

Shallow foundations should bear directly on rock or on native, undisturbed, dense (or very dense) glacial till soils. The existing non-engineered fill is not suitable for support of shallow foundations, slabs, or other rigid site improvements that could be adversely affected by differential settlement caused by variations in the composition and consistency of the fill. Existing fill should be completely removed from within the zone-of-influence (ZOI) beneath foundation elements, slabs, etc. The ZOI extends horizontally away from the bottom outside edges of footings, slabs, and other site improvements a distance of 2 feet, then down and away at a 1H:1V (horizontal:vertical) slope to the intersection with undisturbed native soil or bedrock. Scour should be considered, where applicable, for shallow foundations not supported directly on bedrock. The structure should be designed to accommodate differential settlement between portions of the structure supported on bedrock (and deep foundations) and portions supported on soil.

Drilled micropiles supporting the new bridge abutments and soldier pile walls supporting the roadway should extend to adequate depths in competent bedrock. The rock socket diameters discussed in the RSR are likely feasible, but other diameters may be more practical or economical depending on the anticipated structural loads. Additional geotechnical analyses will be required during design as structural loads are developed. Drilled micropile and solider pile installation will encounter difficult conditions associated with cobbles, boulders, existing structures, and weathered/fractured bedrock.

Geotechnical recommendations for design of the proposed structure are provided in the following sections. Considerations and recommendations for site preparation, excavation, dewatering, fill materials and compaction, and foundation construction are provided in Section 4.0.

3.2 Shallow Foundations

New wing walls can be supported on conventional spread footings bearing either directly on bedrock or on native, undisturbed glacial till consisting of dense to very dense SAND with variable amounts of silt and gravel. Footings may also be supported on new Structural Fill overlying these materials. We recommend the following parameters for spread footing foundation design based on soil bearing

conditions. Foundations supported on weathered bedrock (RQD < 50%) and/or more than 24 inches of Structural Fill should be designed using the parameters for glacial till as noted below.

Description	Spread Footing Design Parameters	
Bearing Material	Bedrock[1]	Glacial Till, Weathered Bedrock, & New Structural Fill
Nominal Bearing Resistance, q_n (ksf) – Strength Limit (AASHTO 10.6.3.1)	36	20
Bearing Resistance Factor, φ_b - Strength Limit (AASHTO 10.5.5.2.2-1)	0.45	0.45
Presumptive Bearing Resistance, q_n (ksf) – Service Limit (AASHTO 10.6.2.6)	16	8
Drained Friction Angle, ϕ_f (AASHTO 10.4.6.2.4)	38°	38°
Sliding Resistance, tanδ (FHWA-SA-02-05 Table 5-15)	0.55	0.45
Shear Resistance Factor for Sliding, $\varphi\tau$ - Strength Limit (AASHTO 10.5.5.2.2-1)	0.80	0.80
Passive Resistance Factor for Sliding, φ_{ep} - Strength Limit (AASHTO 10.5.5.2.2-1)	0.50	0.50
Minimum Footing Embedment below Finished Grade for Frost Protection (inches)[2]	42[(3)]	42
Estimated Total Settlement (inch)[4]	<1	<1
Estimated Differential Settlement (inch)[4]	<0.5	<0.5

1 – Footings supported directly on sound bedrock and up to 24 inches of Structural Fill overlying sound bedrock.
2 - Additional embedment may be required for scour resistance.
3 - Footings bearing directly on intact, sound rock may have less embedment.
4 – Preliminary estimates only. Settlement estimates should be confirmed during final design using anticipated structural loads.

3.3 Soldier Piles

Soldier piles/drilled shafts socketed into bedrock can be used to support the roadway embankment. Resistance in the existing fill should be ignored and a minimum center-to-center spacing of 4 shaft diameters is recommended. We recommend that tip resistance be ignored due to the amount of shaft displacement (typically about 0.4-inch) required to mobilize base resistance and the need to thoroughly clean and visually inspect the shaft bases prior to concrete placement. The following table includes recommended parameters for design of rock socketed soldier piles. The design parameters

for glacial till should be used for weathered bedrock (RQD < 50%), where present. No use of permanent casing in the bearing strata is assumed.

Description	Soldier Pile Design Parameters	
Material	Glacial Till/ Weathered Bedrock	Bedrock
Nominal Unit Side Resistance, q_s (ksf) (AASHTO 10.8.3.5)	2.5	25*
Side Resistance Factor – Compressive, φ_{qs} (AASHTO Table 10.5.5.2.4-1)	0.55	0.55
Side Resistance Factor – Uplift, φ_{up} (AASHTO Table 10.5.5.2.4-1)	0.45	0.40

** - limited by concrete compressive strength of 4,000 psi.*

Total settlement associated with the above design parameters is anticipated to be less than 1-inch. Settlement and differential settlement should be evaluated during final design once the design and structural loads are developed.

3.4 Drilled Micropiles

Drilled mircopiles (DMP) should be designed to derive their axial support by side resistance within weathered bedrock and bedrock. End-bearing resistance should be ignored. Based on the RQDs observed in the borings, the upper 5 ft. of bedrock should be considered weathered rock for design purposes (RQD < 50%). The following table includes recommended parameters for design of Type A (gravity grouted) drilled micropiles. Additional recommendations can be provided for other DMP types (i.e., use of pressure grouting) if required.

Description	DMP Design Parameters	
Material	Weathered Bedrock*	Bedrock
Nominal Grout-to-Ground Bond Resistance, q_s (ksf) (AASHTO Table C10.9.3.5.2-1)	4.0	25.0
Grout-to-Ground Resistance Factor – Compressive, φ_{qs} (AASHTO Table 10.5.5.2.5-1)	0.55	
Grout-to-Ground Resistance Factor – Uplift, φ_{up} (AASHTO Table 10.5.5.2.5-1)	0.55	

** - Upper 5 ft. of bedrock.*

The values presented in the above table are geotechnical pile resistances only. The structural capacity depends on the DMP section and should be evaluated separately in accordance with the CTDOT LRFD Bridge Manual and with appropriate resistance factors. Center-to-center DMP spacing should not be less than 30 inches or 3 pile diameters, whichever is greater.

Final design of the DMP bond length(s) and strata should be determined by a specialty drilled micropile contractor engaged by the general site contractor, who is experienced in design, construction, and testing DMPs of similar load and similar subsurface conditions anticipated for this project. DMP capacities should be confirmed based on the results of verification load tests as described later in this report, and in accordance with the latest edition of the CTDOT LRFD Bridge Manual.

3.5 Resistance to Lateral Loads

Lateral loads can be resisted by individual soldier piles, micropiles, and passive earth pressures against pile caps, if planned. Lateral resistance against pile caps can be calculated as recommended below in Section 3.6.

The lateral load capacity of individual soldier piles and micropiles should be analyzed by the Structural Engineer based on the applicable load combinations. Recommended soil parameters are provided in the following table for use in the program LPILE or a similar computer analysis program. The lateral deflection analysis should include the effects of group interaction and proximity to sloping ground, where applicable.

Strata Name	Lateral Response Model (P-Y curve)	Effective Unit Weight, g' (pcf)	Friction Angles, *f* (degrees)	Reaction Modulus, k (pci)
Glacial Till/Weathered Rock	Sand (Reese)	62.6	38	120

Lateral resistance in bedrock can be analyzed using the Vuggy Limestone lateral response model, a unit weight of 170 lbs/ft^3, and an unconfined compressive strength (q_u) of 20,000 lbs/in^2. Analyses should consider rock mass quality and fracturing.

3.6 Lateral Earth Pressures

Sliding stability for proposed cast-in-place concrete structures should be evaluated at the Strength Limit state using a resistance factor (φ) of 0.80 per AASHTO Table 10.5.5.2.2.-1. The design lateral pressures should consider appropriate loading conditions and load combinations as required by AASHTO including earth pressures, hydrostatic, traffic, wind, seismic, and other loads. The following table provides lateral earth pressures for design of new structure assuming backfill with Structural Fill.

Parameter	Structural Fill
Angle of Internal Friction, ϕ	36°
Total Unit Weight, γ (pounds per cubic foot)	125
Buoyant Unit Weight, γ' (pounds per cubic foot)	62.6
At-Rest Earth Pressure Coefficient, K_0	0.41
Active Earth Pressure Coefficient, K_A	0.23
Seismic Active Earth Pressure Coefficient, K_{AE}	0.27
Interface Friction Angle (between backfill and back of abutment)	24°

At-rest earth pressures should be used for structures restrained from lateral movement. Active earth pressures may be used for structures free to rotate. Wall rotation associated with development of active pressures is expected to be approximately 1 percent of the wall height. Passive pressures should be ignored when evaluating abutment sliding and overturning.

All retaining structures should include drainage and be backfilled with free-draining backfill materials to prevent buildup of hydrostatic pressures. If drainage cannot be provided, the structures should be designed to resist hydrostatic pressures.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Site Preparation

Site preparation should include removal of existing pavement, curbing, vegetation, topsoil, tree roots greater than 1-inch in diameter (as well as concentrations of smaller roots), existing structures, and surface debris within the limits of the proposed construction. Loose and disturbed soils, existing fill, and soils containing organics should be removed to expose undisturbed glacial till or bedrock, and replaced with Structural Fill below the zone of influence of new foundations and structural elements. The zone-of-influence is defined as a plane extending horizontally from the edge of the footing (or other structural element) a distance of 2 feet, and then downward at 1H:1V slopes. Existing granular fill may be suitable to remain below proposed pavements provided the exposed subgrade is evaluated by the Geotechnical Engineer during construction.

4.2 Excavation Considerations

4.2.1 Temporary Excavation Support

Excavations will be required for site preparation and construction of new structures. Temporary excavation support will be required for excavation depths greater than 4 feet and where groundwater seepage is present. Temporary excavation support should also be anticipated if the final design requires excavations within the zone-of-influence beneath existing footings, structures, utilities, site features, or property lines.

The selection, design, and construction of excavation support systems should be the responsibility of the Contractor. The shoring system should be designed and stamped by a professional engineer licensed in the State of Connecticut to support lateral earth pressures, construction surcharge loads, unbalanced hydrostatic pressures, and surcharges from adjacent structures and utilities, if present. At a minimum, a lateral temporary construction surcharge of 100 psf should be applied uniformly over the height of the wall. All excavations should be made in accordance with applicable OSHA safety regulations. Recommended soil strength parameters for design of excavation support systems are provided in the following table.

Parameter	Values for:	
	Existing Fill	Glacial Till
Angle of Internal Friction, ϕ	34°	38°
Unit Weight, γ (pounds per cubic foot)	120	125
Buoyant Unit Weight, γ' (pounds per cubic foot)	57.6	62.6
At-Rest Earth Pressure Coefficient, K_o	0.44	0.38
Active Earth Pressure Coefficient, K_a	0.25	0.22
Passive Earth Pressure Coefficient, K_p	3.5	4.20

Shoring systems restrained from lateral movement should be designed using at-rest lateral earth pressures. Shoring systems which can be allowed to deflect 1 to 2 percent of the exposed wall height may be designed assuming active earth pressure conditions.

4.2.2 Water Control

Static groundwater elevation is expected to be approximately equal with the brook level at the time of construction. Perched groundwater above the glacial till and bedrock surfaces should also be anticipated. Groundwater and surface water should be controlled to complete excavations, subgrade preparation, and foundation construction in dry conditions and to maintain the integrity of existing soil deposits and bearing surfaces. Temporary grading during construction should be performed so that pooling or ponding of water does not occur within the construction area.

Temporary cofferdams will be required for work adjacent to and within the river channel, such as during construction of new abutments and wingwall sections. Steel sheet pile cofferdams are not feasible due to the presence of bedrock, cobbles, boulders, and very dense glacial soils. Therefore, we recommend use of a temporary gravity dam, such as a bladder dam or sand bags, to divert river water around the work zone.

Dewatering systems and cofferdams should be selected and designed by the Contractor and capable of adapting to variable flows and conditions. Flow rates for dewatering are likely to vary depending on location, soil type, and the season during which the excavation occurs. Water control systems should be capable of maintaining groundwater at least 24 inches below the bottom of excavations and should be designed and operated to prevent pumping of soil, loss of fines, and adverse effects to existing structures. If possible, pumped water should be recharged on site.

4.3 Subgrade Preparation and Protection

Exposed subgrades should be proof compacted and observed by the Geotechnical Engineer prior to placement of backfill and construction of footings, slabs, and pavements. Unsuitable or disturbed soils,

or soils exhibiting excessive rutting or pumping will require over-excavation and backfilling with compacted Structural Fill.

Silty soils, such as the native glacial deposits at the site, are highly susceptible to softening and disturbance by construction activity during wet or freezing weather. Construction traffic should not operate directly on subgrades. Subgrade protection is the responsibility of the contractor and special precautions and protective measures appropriate for the weather and traffic conditions during construction should be used during earthwork and foundation construction to preserve the integrity of subgrades.

A few inches of angular crushed stone can be placed and compacted at the base of footing excavations to protect subgrades from disturbance due to foot traffic during construction and wet weather conditions. If construction occurs during freezing conditions, insulating blankets, heaters, or other suitable measures should be employed to prevent subgrades from freezing until the foundations are backfilled sufficiently to prevent frost from reaching the footing subgrades and penetrating beneath foundation elements.

4.4 Fill Materials and Compaction

Structural Fill should be used as backfill behind abutments and wingwalls, below footings and approach slabs, and within 3 feet of finished grades in pavement areas. Gradation recommendations for backfill materials are provided in **Table 1**. Recommended lift thicknesses and compaction methods are provided in **Table 2**. Fill compaction criteria is provided in **Table 3**. Fill should not be constructed over frozen subgrades.

Crushed Stone may be used as Structural Fill, in drainage applications, and for subgrade stabilization. Where used, Crushed Stone should be separated from subgrade soils with non-woven geosynthetic. A woven geosynthetic may be used for stabilizing the subgrade depending on the condition of the exposed subgrade and groundwater conditions encountered during the work. Recommended geotextile fabric properties are included in **Table 4**.

4.5 Slopes

Soil slopes should be excavated with a smooth excavator bucket with the surface repaired if disturbed. Surface runoff should be routed so that it does not run down the face of the slopes. Erosion control is critical to maintaining slopes and should be in place immediately after construction of all slopes. No outfalls or stormwater discharge points should be located on or above slopes. All slopes and excavations should be constructed in accordance with applicable OSHA and local safety standards.

Equipment should not be allowed to induce vibration or infiltrate water above the slopes and no surcharges should be located within 15 feet of slope crests. Temporary slopes should be expected to

ravel somewhat, depending on weather conditions, soil conditions, seepage, and duration of exposure. Soft or loose fill soils and the presence of seepage may require flatter slopes, erosion control measures, drainage elements, and/or temporary excavation support.

Permanent cut and fill slopes up to 12 feet high should be formed at 2H:1V or flatter, however shallower (3H:1V) slopes are recommended for ease of maintenance and mowing and increase erosion resistance. The faces of fill slopes should be overbuilt and cut back into compacted materials with a smooth excavator bucket. If steeper fill slopes are desired, we should be consulted to evaluate use of grid reinforcement, rock blankets, or rock fill buttresses.

The presence of slow seepage may require drainage in the form of a blanket of Crushed Stone or a suitably revegetated reinforced erosion control blanket such as North American Green SC150 or equivalent. Faster seepage, or the presence of soft or loose sandy soils or layers may require improved erosion control measures, subsurface drainage elements, and/or flatter slopes.

4.6 Soldier Pile Construction

Soldier piles/drilled shafts should be constructed by an experienced specialty contractor using appropriate equipment and methods. Excavation of the shafts will require casing and drilling fluid to prevent caving of the sidewalls, destabilization of the shaft bottom, and loss of ground.

Drilled shaft construction should be observed by the Geotechnical Engineer on a full-time basis to document encountered subsurface conditions, shaft diameter and depth, shaft cleanout and bottom cleanliness, placement or reinforcement steel and concrete, and general conformance with contract documents.

4.7 Drilled Micropile Construction

Cobbles, boulders, and other subsurface obstructions may present difficult drilling conditions and should be anticipated during DMP construction. A load test should be performed during construction to confirm design pile capacities in accordance with the CTDOT LRFD Bridge Manual. Verification testing should be conducted on a sacrificial DMP that is not used in the final structure. Additional verification tests should be performed for DMPs with bonded zone within dissimilar strata, if applicable. Proof load tests should be performed on a minimum of one pile per substructure, or five percent of the total number of piles, whichever is greater. Load tests and installation of production DMPs should be observed and documented by a representative of the Geotechnical Engineer.

5.0 LIMITATIONS

5.1 Observation of Construction

Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. The actual subsurface conditions encountered during construction may vary from those encountered in the subsurface investigations and may require revisions to the recommendations provided in this report. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated. In addition, sufficient monitoring of the contractor's activities is a key part of determining the work is completed in accordance with construction drawings and specifications. DMP and soldier pile construction should include full-time monitoring by the Geotechnical Engineer.

5.2 Variations of Subsurface Conditions and Use of Report

GM2 prepared this report for use by CTDOT and members of the design and construction team for the subject project and site, only. The data and report can be used for estimating purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Soil borings indicate conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect subsurface conditions that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, reevaluation will be necessary.

Design details were not finalized at the time this report was prepared. If changes are made in site grades, configuration, design loads, or type of construction for the proposed structure, our recommendations may not be applicable. We should be retained to review our recommendations and provide a written evaluation or modification prior to finalizing the design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices at the time this report was prepared. No warranty or other conditions, expressed or implied, are given.

FIGURES

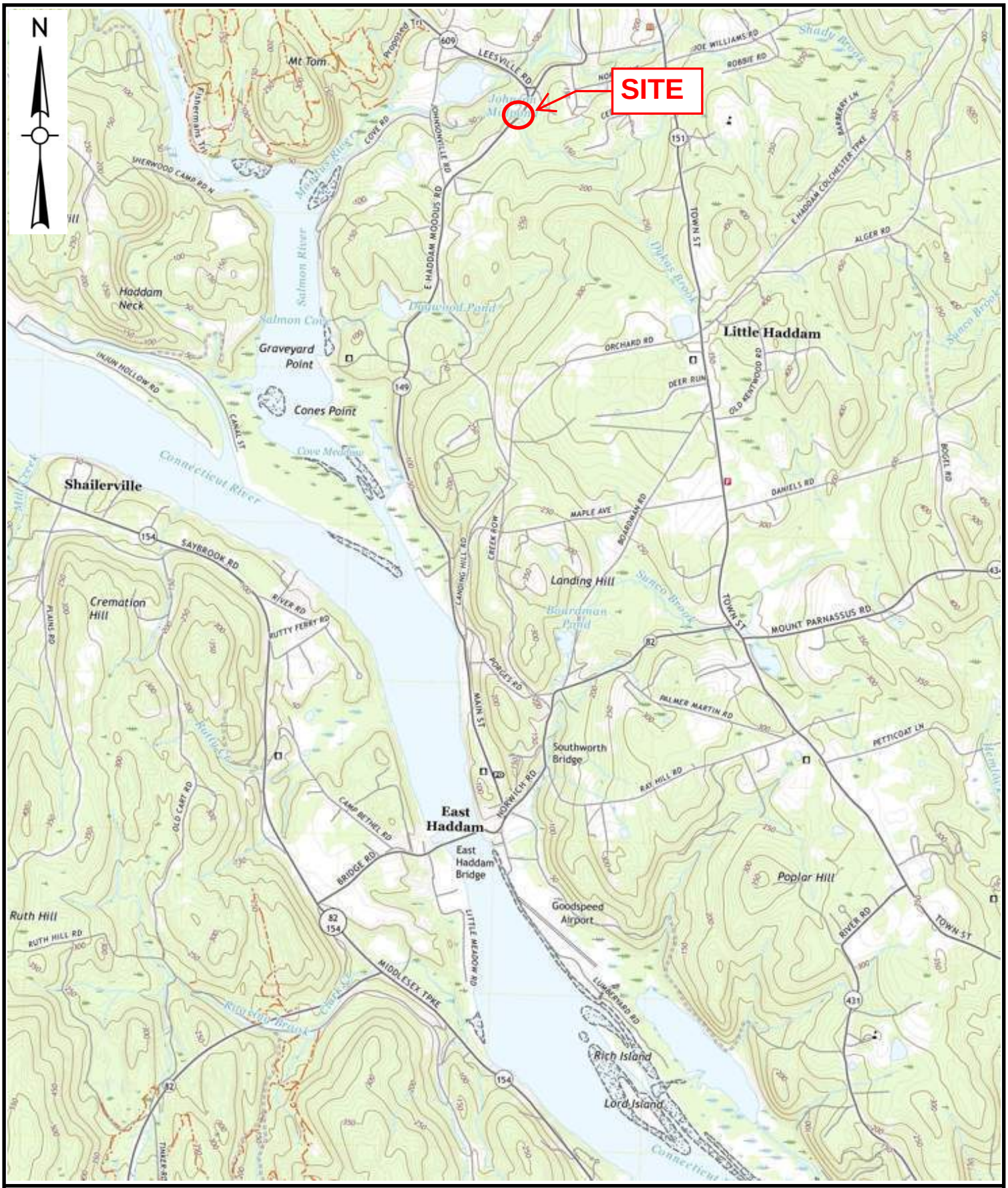
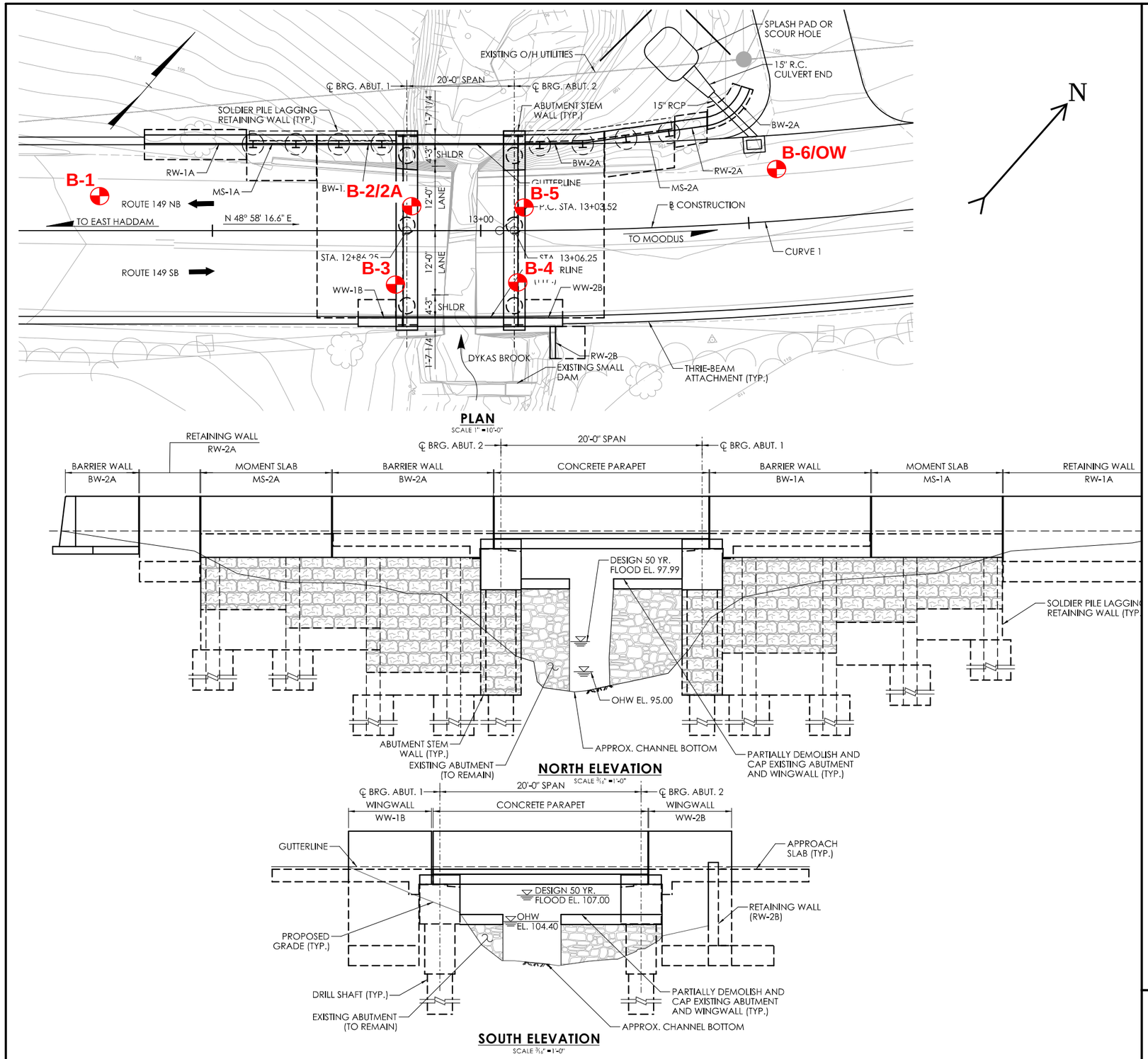


FIGURE 1 - LOCUS PLAN

Bridge #02698 - Route 149 over Dykas Brook
East Haddam, CT



PLAN
SCALE 1" = 10'-0"

NORTH ELEVATION
SCALE 3/16" = 1'-0"

SOUTH ELEVATION
SCALE 3/16" = 1'-0"

NOTES:

1. Plan based on proposed conditions plan for Alternative 1, prepared by GM2 Associates, Inc.
2. Exploration locations shown are approximate.
3. Borings were completed by New England Boring Contractors of Glastonbury, CT.
4. All borings were observed by GM2 Associates Engineering staff.
5. Observation well installed in B-6.

LEGEND:

B-1 — Designation and approximate location of borings.

FIGURE 2 - EXPLORATION LOCATION PLAN

BRIDGE #02698 - ROUTE 149 OVER DYKAS BROOK EAST HADDAM, CT

DESIGNER/DRAFTER: PS CHECKED BY: RS

SIGNATURE/ BLOCK:

GM2 ASSOCIATES, INC.
115 GLASTONBURY BLVD.
GLASTONBURY, CT 06033

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0040-0148
PROJECT DESCRIPTION: ALTERNATIVE 1
TOWN(S): EAST HADDAM
DRAWING TITLE: GENERAL PLAN, ALTERNATIVE 1

LASTED SAVED BY: PShrestha **FILE NAME:** M:\CLE_Bridge_Program\Assignment_1\Bridge 02698 - Rte 149 over Brook - East Haddam\CAD\Structure_Bridge\MSto_Sheet_files\SB_OBM_2D_02698_General Plan (Alt_1).dgn
PLOTTED DATE: 5/16/2022

TABLES

Replacement of Bridge No. 02698
Route 149 over Dykas Brook
East Haddam, Connecticut

TABLE 1
Gradation Criteria and Recommended Use for Structural Fill and Backfill Materials

Fill Type[1]	CTDOT Classification	Gradation Criteria			Recommended Use
		U.S. Sieve and No.	Percent Finer by Weight		
			Minimum	Maximum	
Structural Fill[2]	Granular Fill (M.02.01) Granular Base (M.02.03)	3½-inch	100	-	- Within building areas and below foundations. - Pavement base course. - Slab-on-grade base course - Retaining wall backfill - All other locations and elevations.
		1½-inch	55	100	
		1/4 -inch	25	60	
		No. 10	15	45	
		No. 40	5	25	
		No. 100	0	10	
		No. 200	0	5	
Crushed Stone[3]	1-½ in. Crushed Stone (M.01.02, No.4)	2-inch	100	-	- Structural Fill[3]. - Drainage applications including below slabs and behind retaining walls. - Subgrade stabilization.
		1½-inch	90	100	
		1-inch	20	55	
		¾-inch	0	15	
		3/8-inch	0	5	
	¾-in. Crushed Stone (M.01.02, No.6)	1-inch	100	-	
		¾-inch	90	100	
		½-inch	20	55	
		3/8-inch	0	15	
		No. 4	0	5	
Common Fill[4]	N/A	6-inch[4]	100	-	- Non-structural areas. - Below a depth of 2 ft. in pavement areas.
		No. 200	0	20	

1. All fill should consist of approved materials free of organic matter, debris, and other deleterious materials. Frozen material should not be used. Fill should not be placed on frozen subgrades.
2. Use of on-site materials as Structural should be evaluated on a case-by-case basis by the Geotechnical Engineer.
3. Crushed Stone used for drainage applications should be washed with less than 2 percent passing the No. 200 Sieve. When used as Structural Fill, drainage applications, or when the layer thickness exceeds 9 inches, the Crushed Stone should be fully encased within a non-woven filter fabric.
4. On-site materials may be used as Common Fill if adequately moisture conditioned and compacted to required densities. Maximum particle size should be less than 2/3 the loose lift thickness.

TABLE 2
Recommended Lift Thickness and Compaction Methods for Granular Fill Materials

Compaction Equipment	Minimum Static Weight (lbs.)	Minimum Dynamic Force (lbf.)	Maximum Uncompacted Lift Thickness (inches)[1]		Minimum Number of Passes[1]	
			Structures and Pavement Areas	Other Areas	Structures and Pavement Areas	Other Areas
Small Vibratory Plate or Jumping Jack Rammer	< 700	-	4	6	6	4
Large Vibratory Plate	> 700	-	6	8	6	4
Light Vibratory Roller	3,000	10,000	10	12	6	4
Medium to Heavy Vibratory Roller	10,000	20,000	12	16	6	6

1. The maximum uncompacted lift thickness and minimum number of passes may need to be adjusted to achieve compaction requirements.
2. Maximum fill material particle size should not exceed two-thirds (2/3) the uncompacted lift thickness.

TABLE 3
Fill Compaction Criteria

Fill Type	Location	Percent Maximum Dry Density[1,2]
Structural Fill	Below foundations, structures, pavement areas, and all other structural features.	95
	Pavement base and sub-base materials	95
	All other structural areas (e.g., foundation backfill, deadmen, thrust blocks, etc.).	95
	Retaining wall and embedded structure backfill	92 (90 percent within 3 feet of walls)
	Trench Backfill[3]	92 (95 percent within 2 feet of finished grades)
Crushed Stone	Below foundations, slabs, and where used as Structural Fill	Compaction observed and documented by the Geotechnical Engineer.
	Drainage and stabilization applications, non-structural areas	Dense and 'well keyed' (See Table 2 for recommendations)
Common Fill	Non-structural areas, landscape areas, below a depth of 2 feet in pavement areas, trench backfill in non-structural areas.	92

1. As determined by ASTM D 1557 at ±3 percent of optimum moisture content.
2. In addition to density testing, fill compaction in areas accessible to a fully loaded 10-wheel dump truck or equipment of similar size and weight should be evaluated by a proof roll observed by the Geotechnical Engineer.
3. Construction of hard surfaces, such as pavement, should not occur within 2 weeks of backfilling.

Replacement of Bridge No. 02698
Route 149 over Dykas Brook
East Haddam, Connecticut

TABLE 4
Recommended Geotextile Fabric Properties

Fabric Type	Property	Test Method	Unit	Minimum Value
Non-Woven[1]	Weight	ASTM D5261	oz/yd^2	6.5
	Thickness	ASTM D5199	mils	65
	Grab Tensile Strength	ASTM D4632	lbs	160
	Grab Tensile Elongation	ASTM D4632	percent	50
	Trapezoid Tear Strength	ASTM D4533	lbs	60
	CBR Puncture Strength	ASTM D6241	lbs	410
	Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve	70
	Permittivity	ASTM D4491	Sec^{-1}	1.5
Woven[2]	Weight	ASTM D5261	oz/yd^2	6.2
	Thickness	ASTM D5199	mils	15
	Grab Tensile Strength	ASTM D4632	lbs	250
	Grab Tensile Elongation	ASTM D4632	percent	15
	Trapezoid Tear Strength	ASTM D4533	lbs	60
	CBR Puncture Strength	ASTM D6241	lbs	950
	Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve	70
	Permittivity	ASTM D4491	Sec^{-1}	0.28

1. Non-woven filter fabric should be used in drainage applications, encasement of crushed stone, and where transmission of water through the geotextile is required. Mirafi 160N or equivalent will satisfy the above minimum properties for a non-woven fabric.
2. Woven fabric should be used for stabilization applications. Mirafi FW700 or equivalent will satisfy the above minimum properties for a woven fabric.
3. Edges of geotextile fabrics should overlap a minimum of two feet.
4. Geotextile fabrics shall be inert to organic chemicals commonly encountered in the soil.

APPENDIX A

Site Photographs

Appendix A - Site Photographs

Photo 1 – Route 149 looking south over Bridge No. 02698.

Photo 2 – Close up view of west side wing walls and abutments.

Photo 3 – View of west side wing walls and abutments from downstream. Note bedrock controlled streambed.

Photo 4 – East (upstream) side of bridge and abutments. Note small dam present upstream.

Photo 5 – Steep gradient bedrock streambed beneath the bridge.

APPENDIX B

Boring Logs

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-1
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	12+29/7 L
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740613
Start Date:	6-28-23	Route No.:	Rt 149	Easting:	1079332.1
Finish Date:	6-28-23	Bridge No.:	02698	Surface Elevation:	109.1

Project Description: Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook

Casing Size/Type: 3" ID	Sampler Type/Size: 2" OD	Core Barrel Type: NX
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations:

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
	S-1	12 28 11 11	24	18		FILL	Dense, gray-brown, fine SAND, some silt, little gravel; dry.	
	S-2	8 14 17 17	24	18			Dense, gray-brown, fine SAND, some silt, little gravel; dry.	105
5	S-3	14 14 36 50	20	14		GLACIAL TILL	Dense, yellow-brown, fine SAND, some silt, trace gravel; moist.	
						BEDROCK		100
10	C-1		60	54	30		Medium hard, slight to severely weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	
15	C-2		60	53	70		Hard, fresh to slightly weathered, moderately fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, tight sub-horizontal primary joints parallel to foliation. Several tight to healed sub-vertical joints.	95
20	C-3		60	60	15		Hard, slightly to very slightly weathered, extremely to moderately fractured, medium grained, blue-gray, GNEISS, thin sub-horizontal foliation, close, tight, sub-horizontal primary joints parallel to foliation. Several open sub-vertical joints.	90
25							END OF BORING 25ft	85
30								80

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 8ft Rock: 17ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 3 No. of Core Runs: 3		SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-2
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	12+87/5 L
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740654.9
Start Date:	6-23-23	Route No.:	Rt 149	Easting:	1079386.8
Finish Date:	6-23-23	Bridge No.:	02698	Surface Elevation:	108.1
Project Description:	Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook				
Casing Size/Type:	3" ID	Sampler Type/Size:	2" OD	Core Barrel Type:	
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:					

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
	S-1	18 12 8 5	24	16		FILL	Medium dense, brown-gray, fine SAND, some silt, little gravel; dry.	105
	S-2	2 2 15 16	24	8			Medium dense, brown-gray, fine SAND, some silt, little gravel; dry.	
5	S-3	35 12 10 10	24	6			Medium dense, brown-gray, fine SAND, some silt, little gravel; moist.	
	S-4	5 7 50	13	8			Medium dense, mottled brown, fine SAND, some silt, little gravel; wet.	100
10							END OF BORING 8.1ft	
								95
15								
								90
20								
								85
25								
								80
30								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 8.1ft Rock: ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: ---		SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-2A
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	12+87/5 L
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740654
Start Date:	6-23-23	Route No.:	Rt 149	Easting:	1079385.8
Finish Date:	6-23-23	Bridge No.:	02698	Surface Elevation:	108.1
Project Description:	Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook				
Casing Size/Type:	3" ID	Sampler Type/Size:	2" OD	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:					

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
						FILL	See B-2 log for soil descriptions.	
5								105
						BEDROCK		100
10	C-1		60	57	57		Medium hard to hard, very slightly weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	95
15	C-2		60	57	80		Medium hard to hard, very slightly weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	90
20	C-3		60	58	57		Medium hard to hard, very slightly weathered, slightly to moderately fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, open to tight sub-horizontal primary joints parallel to foliation.	85
25	C-4		60	60	100		Hard to very hard, fresh, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	80
30							END OF BORING 30ft	

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 8ft Rock: 22ft No. of Soil Samples: --- No. of Core Runs: 4	NOTES:	Sheet 1 of 1 SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-3
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	12+85/10 R
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740642
Start Date:	6-22-23	Route No.:	Rt 149	Easting:	1079398.2
Finish Date:	6-22-23	Bridge No.:	02698	Surface Elevation:	108.2

Project Description: Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook

Casing Size/Type: 3" ID	Sampler Type/Size: 2" OD	Core Barrel Type: NX
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations:

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
	S-1	9 6 6 4	24	16		FILL	Medium dense, brown, GRAVEL and SAND, little silt; dry.	
	S-2	5 2 1 3	24	14			Very loose, brown, GRAVEL and SAND, little silt; dry.	105
5	S-3	6 50	8	6			Medium dense, brown, fine SAND, some silt, little gravel; moist.	
						BEDROCK		
	C-1		60	52	0		Medium hard to hard, slightly to very slightly weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	100
10								
	C-2		60	60	70		Moderately hard to hard, slightly weathered to fresh, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	95
15								
	C-3		60	60	78		Hard, fresh, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	90
20								
	C-4		60	59	90		Hard, fresh, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	85
25								
							END OF BORING 26.5ft	80
30								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 5.5ft Rock: 21.5ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 3 No. of Core Runs: 4		SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-4
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	13+07/10 R
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740658.7
Start Date:	6-22-23	Route No.:	Rt 149	Easting:	1079416.1
Finish Date:	6-22-23	Bridge No.:	02698	Surface Elevation:	108.1
Project Description:	Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook				
Casing Size/Type:	3" ID	Sampler Type/Size:	2" OD	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:					

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
	S-1	13 9 10 9	24	18		FILL	Medium dense, red-brown, fine SAND, some silt, little gravel; dry.	105
	S-2	9 10 10 11	24	4			Medium dense, red-brown, fine SAND, some silt, little gravel; dry.	
5	S-3	6 7 50	16	8			Medium dense, brown, fine SAND, some silt, little gravel; moist.	
						BEDROCK		
	C-1		60	60	60		Moderately hard to hard, moderately weathered to fresh, extremely to moderately fractured, medium grained, blue-gray, GNEISS, thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints, several minor vertical joints.	100
10								
	C-2		60	57	57		Hard, fresh, extremely to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, very close to moderately close, open to tight sub-horizontal primary joints, several minor sub-vertical joints and fractures.	95
15								
	C-3		60	55	65		Hard, fresh, extremely to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, very close to moderately close, open to tight sub-horizontal primary joints, several minor sub-vertical joints and fractures.	90
20								
	C-4		60	59	98		Hard, fresh, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints, several minor vertical fractures.	85
25								
							END OF BORING 27ft	80
30								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 6ft Rock: 21ft No. of Soil Samples: 3 No. of Core Runs: 4	NOTES:	Sheet 1 of 1 SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-5
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	13+08/4 L
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740670.6
Start Date:	6-26-23	Route No.:	Rt 149	Easting:	1079404.8
Finish Date:	6-26-23	Bridge No.:	02698	Surface Elevation:	107.8

Project Description: Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook

Casing Size/Type: 3" ID	Sampler Type/Size: 2" OD	Core Barrel Type: NX
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations:

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
						FILL		
	S-1	30 23 15 10	24	14			Dense, red-brown, fine SAND, some gravel, little silt; dry.	105
	S-2	4 4 25 15	24	12			Dense, red-brown, fine SAND, some gravel, little silt; moist.	
5	S-3	43 7 7 5	24	14			Dense, red-brown, fine SAND, some gravel, little silt; moist.	
	S-4	4 3 4 60	24	14			Loose, yellow brown to dark brown, fine SILT and SAND, trace gravel; moist.	100
						BEDROCK		
10	C-1		60	59	8		Moderately hard, very slightly to moderately weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	95
15	C-2		60	57	43		Hard, very slightly weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, open to tight sub-horizontal primary joints parallel to foliation.	90
20	C-3		60	60	95		Hard, very slightly weathered, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	85
25	C-4		60	60	90		Hard, very slightly weathered, moderately to slightly fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to moderately close, tight sub-horizontal primary joints parallel to foliation.	80
30							END OF BORING 30ft	

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 8.7ft Rock: 21.3ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: 4		SM-001-M REV. 1/02

Driller:	Mike St. John	**Connecticut DOT Boring Report**		Hole No.:	B-6(OW)
Inspector:	G. Jacobsen	Town:	East Haddam, CT	Stat./Offset:	13+55/10 L
Engineer:	C. Palmer	Project No.:	40386.02	Northing:	740705.6
Start Date:	6-27-23	Route No.:	Rt 149	Easting:	1079435
Finish Date:	6-27-23	Bridge No.:	02698	Surface Elevation:	107.6

Project Description: Replacement of Bridge 02698 carrying Rt. 149 over Dykas Brook

Casing Size/Type: 3" ID	Sampler Type/Size: 2" OD	Core Barrel Type: NX
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations:

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						ASPHALT	ASPHALT CONCRETE PAVEMENT (6 inches)	
	S-1	5 10 7 8	24	14		FILL	Medium dense, gray, fine to medium SAND and SILT, little gravel; dry.	105
	S-2	9 12 10 22	24	14			Medium dense, yellow brown, fine SAND, some silt, little gravel; dry.	
5	S-3	16 22 28 31	24	14		GLACIAL TILL	Very dense, brown, fine to medium SAND, little gravel, little silt; moist.	
	S-4	35 26 34 50	20	18			Very dense, brown, fine to medium SAND, little gravel, little silt; moist.	100
10	S-5	19 35 70	14	12			Very dense, brown, fine to medium SAND and SILT, little gravel; moist.	
						BEDROCK		95
	C-1		36	10	0		Very soft, completely weathered, extremely fractured, medium grained, blue-gray, GNEISS.	
15	C-2		60	46	37		Moderately hard, moderately weathered, moderately to extremely fractured, medium grained, blue-gray, GNEISS, thin sub-horizontal foliation, close to very close, open sub-horizontal primary joints.	90
20	C-3		60	59	46		Hard, fresh, moderately to extremely fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, tight to open sub-horizontal primary joints parallel to foliation.	85
25	C-4		60	60	93		Hard, fresh, moderately fractured, medium grained, blue-gray, GNEISS, very thin sub-horizontal foliation, close to very close, tight to open sub-horizontal primary joints parallel to foliation. Several sub-vertical secondary cracks.	80
30							END OF BORING 30ft	

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

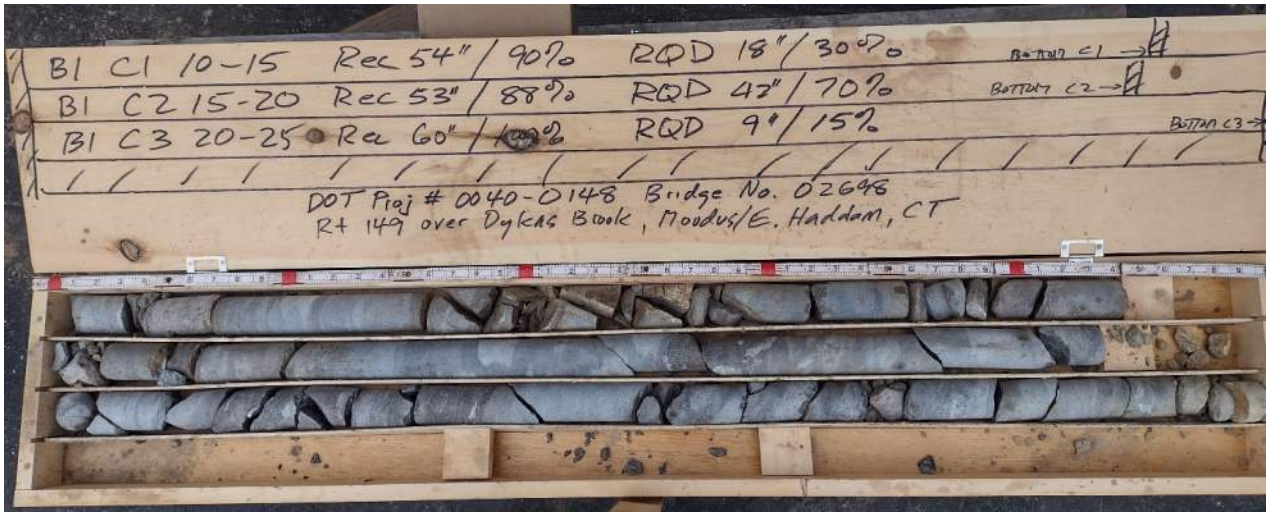
Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 11ft Rock: 19ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 5 No. of Core Runs: 4		SM-001-M REV. 1/02

APPENDIX C

Rock Core Photographs

APPENDIX D – ROCK CORE PHOTOS
Bridge No. 02698 - East Haddam, CT



Boring B-1: Cores C-1 through C-3

Boring B-2A: Cores C-1 through C-4

Boring B-3: Cores C-1 through C-4

Boring B-4: Cores C-1 through C-4

Boring B-5: Cores C-1 through C-4

Boring B-6: Cores C-1 through C-4

Appendix D

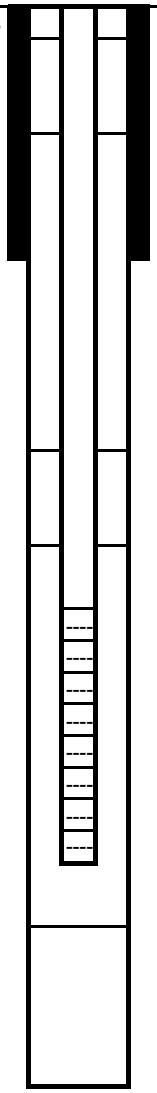
Monitoring Well Installation Report

GROUNDWATER MONITORING WELL INSTALLATION REPORT

PROJECT NAME/NO.	Bridge No. 02698 Replacement			**MONITORING WELL NO.**	
LOCATION	Route 149 over Dykas Brook, East Haddam, CT			**B-6(OW)**	
CLIENT	Connecticut Department of Transportation (CTDOT)			ELEVATION OF	
CONTRACTOR	New England Boring Co	DRILLER	Mike St. John	ROAD BOX RIM (ft.)	107.3±
OBSERVED BY	G. Jacobsen	DATE	6/27/23	DEPTH TO GROUNDWATER FROM	
CHECKED BY	C. Palmer	DATE	7/13/23	ROAD BOX RIM	8.8 ft.

GROUND ELEVATION

GENERAL SOIL CONDITIONS (NOT TO SCALE)



<---------	FLUSH-MOUNTED ROAD BOX	(GROUND SURFACE)
	THICKNESS OF SURFACE SEAL(S)	0.6 ft.
<---------	TYPE OF SURFACE SEAL(S)	CONCRETE
	TYPE OF SURFACE CASING	ROAD BOX
<---------	ID OF SURFACE CASING	8"
<---------	DEPTH BOTTOM OF CASING	0.7 ft.
	ID OF RISER PIPE	2"
<---------	TYPE OF RISER PIPE	Solid Sch. 40 PVC
<---------	TYPE OF BACKFILL AROUND RISER PIPE	
	DEPTH TOP OF SEAL	1 ft.
<---------	TYPE OF SEAL	Portland Cement
	DEPTH BOTTOM OF SEAL/TOP OF SAND COLUMN	5 ft.
<---------	DEPTH TOP OF SCREEN	15 ft.
	TYPE OF SCREEN	Slotted Sch. 40 PVC
<---------	SIZE OPENINGS	0.01
	ID OF SCREEN	2"
<---------	TYPE OF BACKFILL AROUND SCREEN	Filter Sand
<---------	DEPTH BOTTOM OF SCREEN	30.0 ft.
<---------	DEPTH BOTTOM OF SAND COLUMN	30.0 ft.
<---------	TYPE OF BACKFILL BELOW SCREEN	None.
<---------	DIAMETER OF BOREHOLE	3 1/8 in.
<---------	DEPTH BOTTOM OF BOREHOLE	30.0 ft.

NOTES:

MONITORING WELL NO.
B-6(OW)

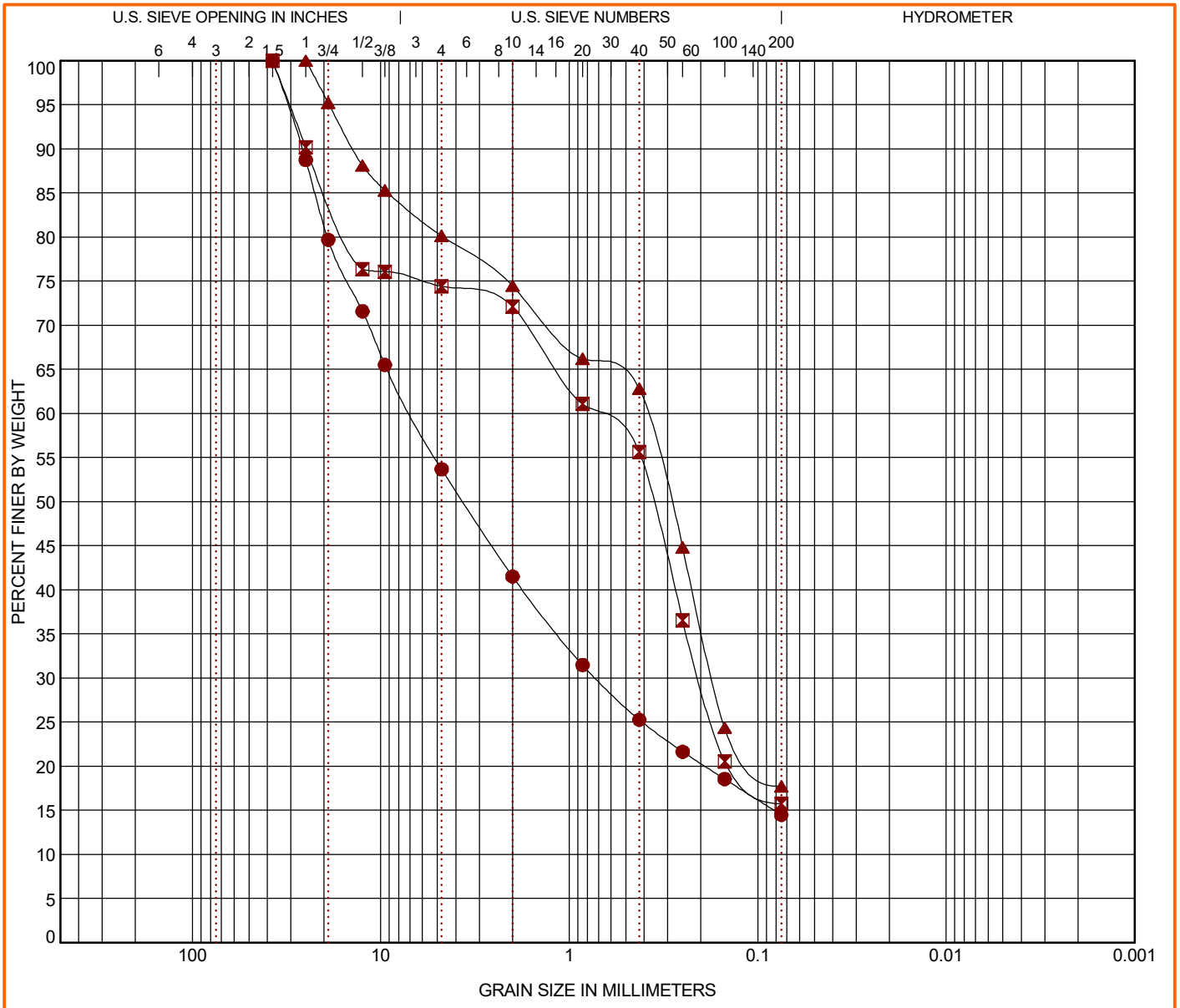
GM2

APPENDIX E

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	1 - 5	SILTY GRAVEL with SAND (GM)	3.4					
⊠	B-5	3 - 7	SILTY SAND with GRAVEL (SM)	9.5					
▲	B-6	5 - 9	SILTY SAND with GRAVEL (SM)	15.1					

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	3 - 5	37.5	6.88	0.72		0.0	46.3	39.2		14.5	
⊠	B-5	3 - 7	37.5	0.74	0.203		0.0	25.6	58.7		15.7	
▲	B-6	5 - 9	25	0.391	0.173		0.0	19.9	62.4		17.7	

PROJECT: GM2 2023 Lab Services

SITE: Route 149 over Dykas Brook - East Haddam, CT (CTDOT)
, Connecticut

Terracon
77 Sundial Ave, Ste 401W
Manchester, NH

PROJECT NUMBER: J1221027

CLIENT: GM2 Associates, Inc.
197 Loudon Road, Concord, NH 03301

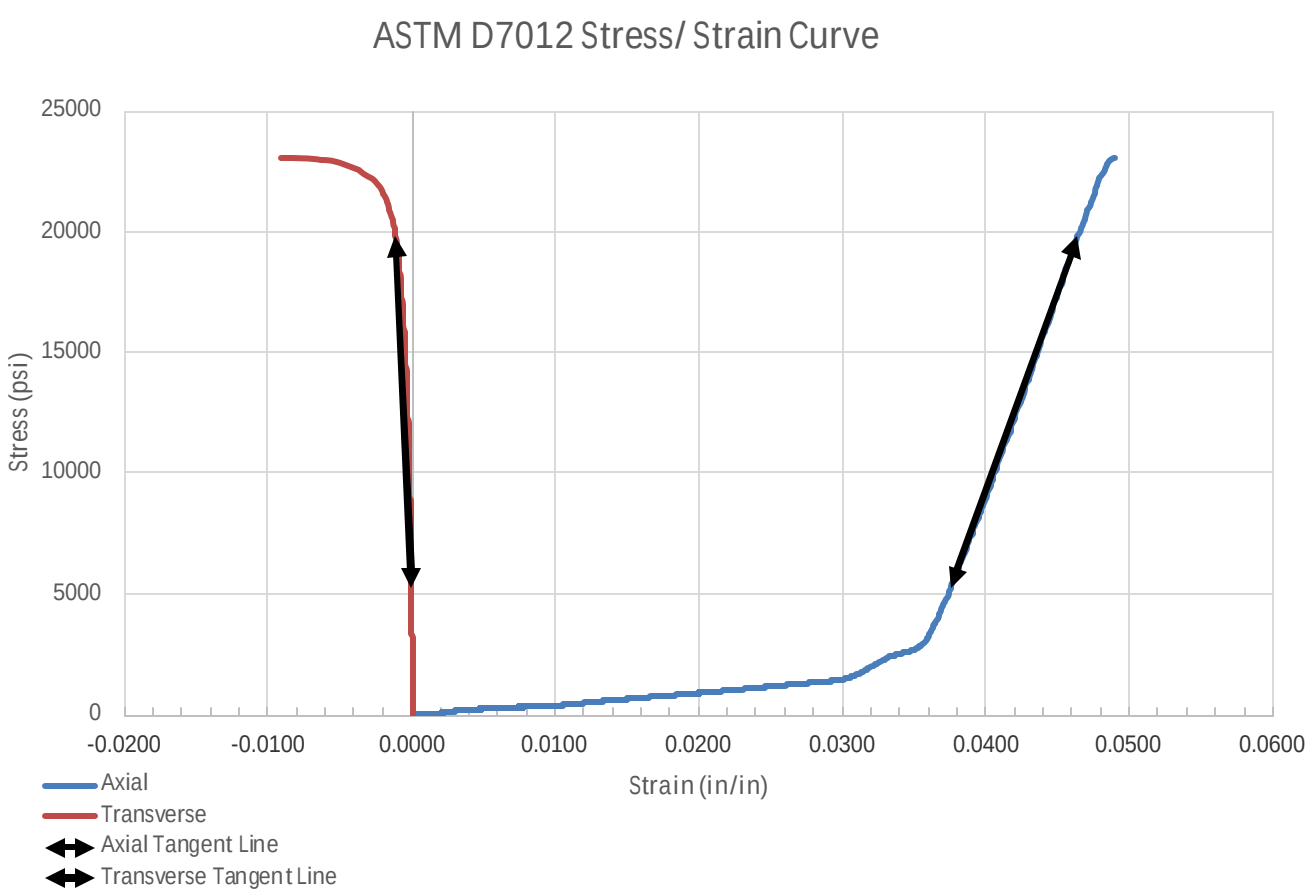
Client

GM2 Associates, Inc.
197 Loudon Rd Ste 310
Concord, NH 03301-8015

Project

GM2 2023 Lab Services
197 Loudon Road
Concord, NH

Project No. J1221027



SAMPLE LOCATION

Site:	GM2 2023 Lab Services		
Rock Type:	Biotite Schist		
Boring:	B-2A	Depth (feet):	10.0-15.0

SPECIMEN INFORMATION

Sample No.:	C-1	Mass (g):	606.05
Length (in.):	4.37	Diameter (in.):	1.98
L/D Ratio:	2.2	Density (pcf):	170.95

TEST RESULTS

Failure Load (lbs):	71213
Failure Strain (%):	5.19
Unconfined Compressive Strength (psi):	23,035
Elastic Modulus, E, (ksi):	1638
Poisson's Ratio, υ:	0.124
Time of Failure (min):	02:49
Rate of Loading (psi/sec):	136.625

Client	Project
GM2 Associates, Inc. 197 Loudon Rd Ste 310 Concord, NH 03301-8015	GM2 2023 Lab Services 197 Loudon Road Concord, NH Project No. J1221027

ASTM D4543 Test Results:

Parameter	Data
Side Straightness:	0.0945
Perpendicularity Deviation:	
Diameter 1a:	0.0464
Diameter 1b:	0.0607
Diameter 2a:	0.0469
Diameter 2b:	0.0207
Max Deviation from Flatness:	0.0610
Parallelism Deviation:	
Diameter a:	0.05
Diameter b:	2.65

Equipment:	TICCS ID:
Calipers:	W-44049
Scale:	B-71466
Dial Indicator:	C-70608
Compression (spherically seated):	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:
Notes:

Per ASTM D4543, this specimen has not met the requirements for straightness, by exceeding 0.02 inches.
Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250º.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

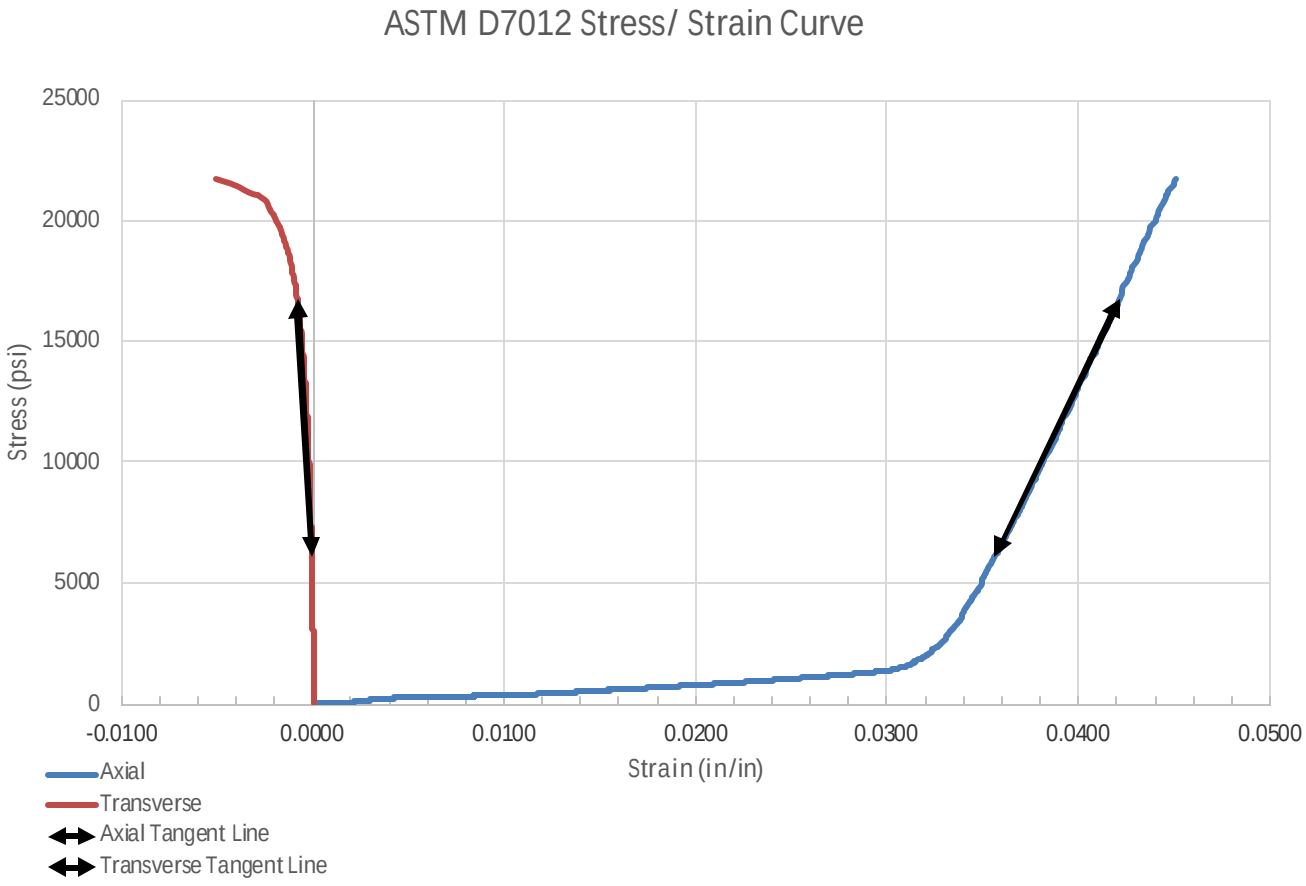
Client

GM2 Associates, Inc.
197 Loudon Rd Ste 310
Concord, NH 03301-8015

Project

GM2 2023 Lab Services
197 Loudon Road
Concord, NH

Project No. J1221027



SAMPLE LOCATION

Site:	GM2 2023 Lab Services		
Rock Type:	Biotite Schist		
Boring:	B-4	Depth (feet):	12.0-17.0

SPECIMEN INFORMATION

Sample No.:	C-2	Mass (g):	607.39
Length (in.):	4.32	Diameter (in.):	1.98
L/D Ratio:	2.2	Density (pcf):	173.24

TEST RESULTS

Failure Load (lbs):	67297
Failure Strain (%):	4.86
Unconfined Compressive Strength (psi):	21,725
Elastic Modulus, E, (ksi):	1640
Poisson's Ratio, υ:	0.117
Time of Failure (min):	02:52
Rate of Loading (psi/sec):	126.306

Client	Project
GM2 Associates, Inc. 197 Loudon Rd Ste 310 Concord, NH 03301-8015	GM2 2023 Lab Services 197 Loudon Road Concord, NH Project No. J1221027

ASTM D4543 Test Results:

Parameter	Data
Side Straightness:	0.0650
Perpendicularity Deviation:	
Diameter 1a:	0.0456
Diameter 1b:	0.0504
Diameter 2a:	0.0154
Diameter 2b:	0.0363
Max Deviation from Flatness:	0.0254
Parallelism Deviation:	
Diameter a:	2.02
Diameter b:	5.04

Equipment:	TICCS ID:
Calipers:	W-44049
Scale:	B-71466
Dial Indicator:	C-70608
Compression (spherically seated):	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:
Notes:

Per ASTM D4543, this specimen has not met the requirements for straightness, by exceeding 0.02 inches.
Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250º.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

APPENDIX F

Preliminary Design Drawings

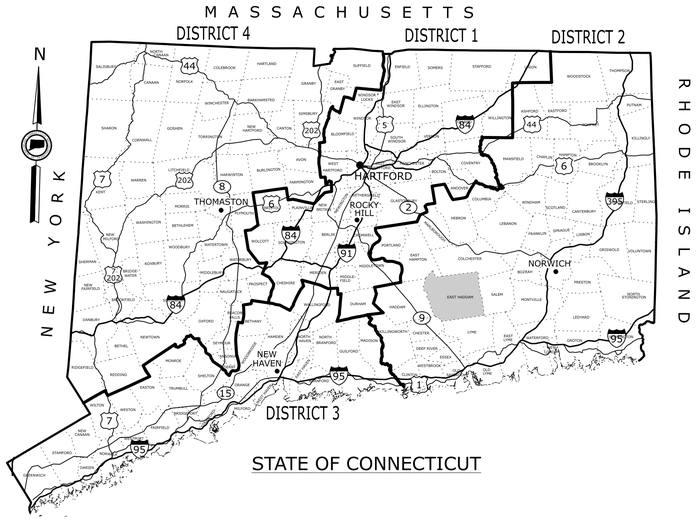
CONNECTICUT DEPARTMENT OF TRANSPORTATION

Plans For

REPLACEMENT OF BRIDGE NO. 02698
ROUTE 149 OVER DYKAS BROOK

Town of

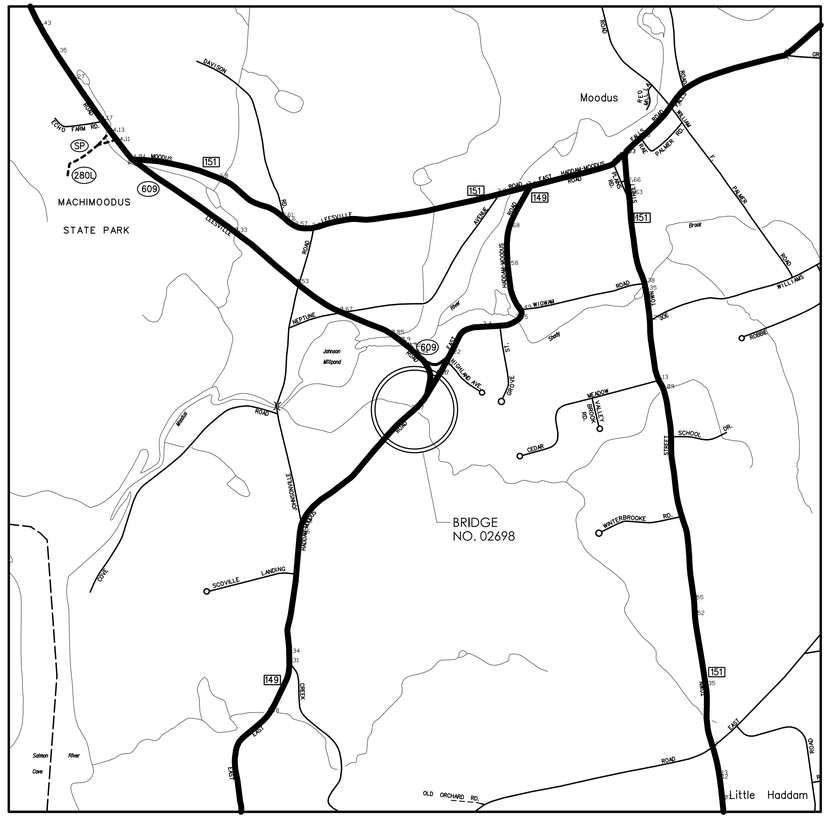
EAST HADDAM



STATE OF CONNECTICUT

ROAD	MAINTENANCE RESPONSIBILITY	LENGTH
Route 149	STATE	6.833 FEET

F.A.P. #	MAINTENANCE RESPONSIBILITY	PROJECT #
-	STATE	0040-0148



GENERAL NOTES:

1. FEDERAL AID PROJECT NO.
2. CONSTRUCTION SPECIFICATIONS:
   Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 818, dated 2020; Supplemental Specifications, dated January 2023; and Special Provisions
3. 400 FOOT GRID BASED ON CONNECTICUT COORDINATE SYSTEM N.A.D. 1927 N.A.D. 1983
4. VERTICAL DATUM BASED ON NGVD OF 1929 NAVD 1988
5. TRAFFIC INFORMATION
   ADT: 2,900 (2018)
   DESIGN SPEED: 40 MPH
   ROADWAY CLASSIFICATION: RURAL - MAJOR COLLECTOR
6. Surveyed By:

DISCLAIMER:

IT IS THE RESPONSIBILITY OF EACH BIDDER AND ALL OTHER INTERESTED PARTIES TO OBTAIN ALL BIDDING RELATED INFORMATION AND DOCUMENTS FROM OFFICIAL SOURCES WITHIN THE DEPARTMENT.

PERSONS AND/OR ENTITIES WHICH REPRODUCE AND/OR MAKE SUCH INFORMATION AVAILABLE BY ANY MEANS ARE NOT AUTHORIZED BY THE DEPARTMENT TO DO SO AND MAY BE LIABLE FOR CLAIMS RESULTING FROM THE DISSEMINATION OF UNOFFICIAL, INCOMPLETE AND/OR INACCURATE INFORMATION.

LIST OF SUBSETS

*THE INITIAL SUBSET SHEET COUNT DOES NOT INCLUDE ADDENDUM AND CHANGE ORDERS

SUBSET NO.	SUBSET TITLE	*SUBSET SHEET COUNT
#01	GENERAL	2
#02	REVISIONS	1
#03	HIGHWAY	13
#04	STRUCTURE	10
#05	TRAFFIC	4

LIST OF DRAWINGS
SUBSET 01 - GENERAL

DRAWING TITLE	DRAWING NO.
TITLE SHEET	G-1
DETAILED ESTIMATE SHEET	G-2

STANDARD CONVENTIONS

North Arrow W/No. Coor.
Grid Arrow
Edge Of Road
Concrete Pavement
Dirt Road
B.C.I.C.
Granite Curb
Guide Rail
Concrete Median Barrier
Bit. Walk
Conc. Sidewalk
Railroad Tracks
Limit Of Marsh
Stone Wall
Ledge Outcrop
Inland Wetland Limits
STATE LINE
Power Line
Swamp
Building
Transmission Tower
Chain Link Fence
Rustic Fence
Pipe Fence
Board Fence
Property Line
Lot Line
Easement Line
Water Edge
Stream
Ditch
TOWN LINE
Highway Line
Street Line
Riprap
Hedge Row
Tree Line
Shrub
Evergreen Tree
Deciduous Tree
Retaining Wall

THE DESIGN APPEARS TO CONFORM TO APPLICABLE CRITERIA. APPROVAL IS NOT TO BE CONSTRUED TO MEAN THAT ALL ASPECTS OF THE DESIGN HAVE BEEN PERSONALLY CHECKED BY THE UNDERSIGNED.

DESIGNED BY:
PRIME AE GROUP, INC.

PRELIMINARY DESIGN REVIEW

Plans For
REPLACEMENT OF BRIDGE NO. 02698
ROUTE 149 OVER DYKAS BROOK

Town
EAST HADDAM

STATE PROJECT NO.
0040-0148

DRAWING NO.
G-1

SHEET NO.
01.01

SUBSET 4 - STRUCTURE
INDEX OF DRAWINGS

DRAWING NUMBER	DRAWING TITLE	DRAWING NUMBER	DRAWING TITLE
INX-01	INDEX OF DRAWINGS	S-08	WINGWALL 1A & 2A PLAN AND ELEVATION
S-01	GENERAL PLAN, ELEVATION, AND TYPICAL SECTION	S-09	WINGWALL 1B & 2B PLAN AND ELEVATION
S-02	GENERAL NOTES AND PROFILE		
S-03	CONSTRUCTION PLAN		
S-04	ABUTMENT 1 PLAN AND ELEVATION		
S-05	ABUTMENT 2 PLAN AND ELEVATION		
S-06	FRAMING PLAN AND DECK UNIT DATA		
S-07	DECK PLAN AND SECTION		

REV. | DATE | REVISION DESCRIPTION

DESIGNER/DRAFTER: NPR/MAN CHECKED BY: BWC

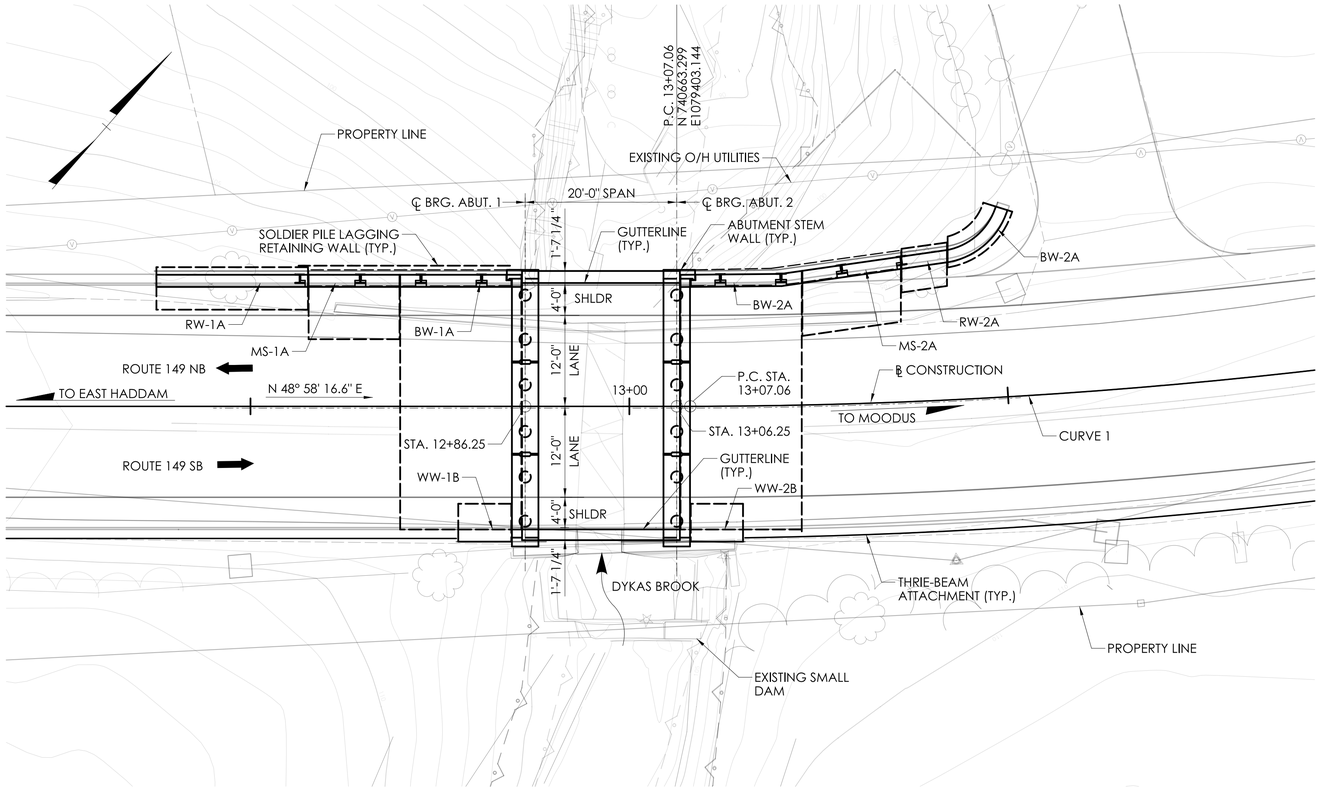
SIGNATURE/
BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0040-0148-Pri
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO.02698 CARRY ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: INDEX OF DRAWINGS

DRAWING NO. INX-01
SHEET NO.

LASTED SAVED BY: duhane.clarke **FILE NAME:** I:\001 - Projects\CTDOT\CT_Projects\0040_0148\Bridge\Contract_Plans\RSR\SB_PN 0040_0148__Index of Drawings.dgn
PLOTTED DATE: 5/23/2023

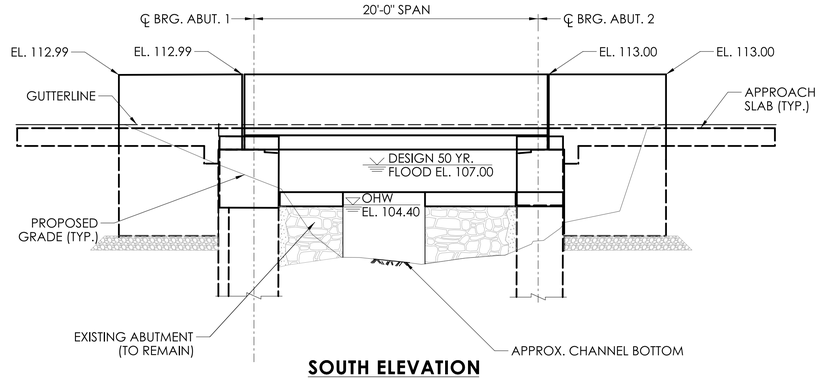


PLAN
SCALE 1" =10'-0"

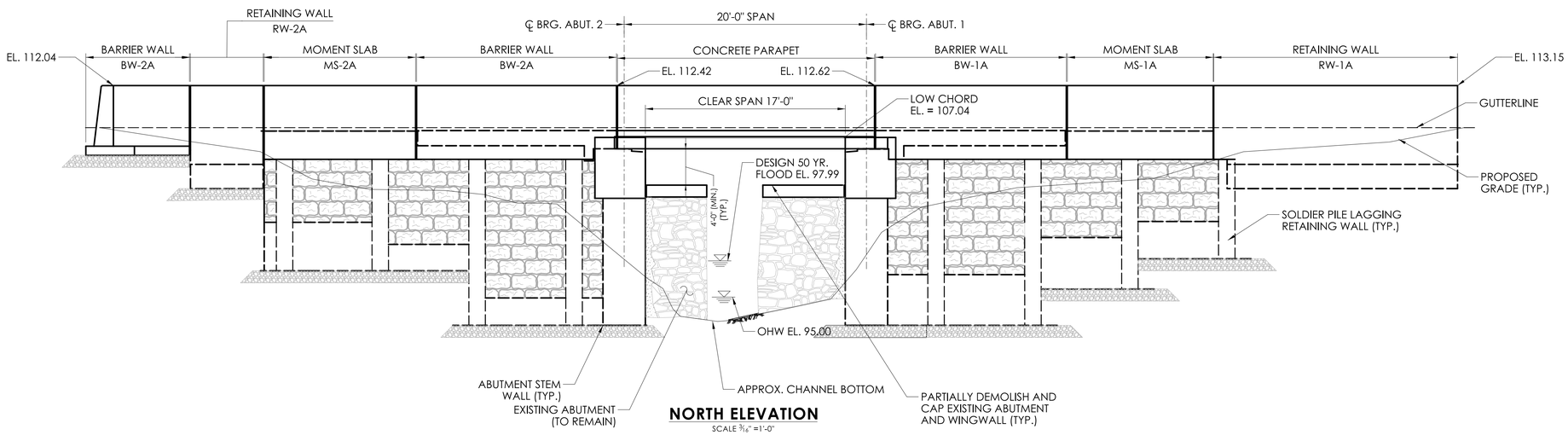
CURVE 1 DATA
Δ = 20° 05' 48.1"
R = 750.00 FT.
T = 132.898 FT.
L = 263.065 FT.

NOTE:

1. OHW DECREASES RAPIDLY THROUGH PROJECT AREA DUE TO CHANNEL SLOPE. ELEVATIONS PROVIDED ARE IMMEDIATELY UPSTREAM OF THE SMALL DAM AND IMMEDIATELY DOWNSTREAM OF THE BRIDGE.



SOUTH ELEVATION
SCALE 3/16" =1'-0"



NORTH ELEVATION
SCALE 3/16" =1'-0"

REV.	DATE	REVISION DESCRIPTION

DESIGNER/DRAFTER: BWC/DCLARKE CHECKED BY: BWC

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0040-0148
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 02698 CARRY ROUTE 149 (EAST HADDAM MOODUS ROAD) OBER BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: GENERAL PLAN, ELEVATION AND TYPICAL SECTION

DRAWING NO. S-01
SHEET NO.

LASTED SAVED BY: Manandhart **FILE NAME:** C:\Users\richardeh\State of Connecticut\DOT CTDOT_DDE - CONNECT_WIP\CT_Configuration\Organization\Cell\CTDOT_Borders_Contract.cel
PLOTTED DATE: 5/31/2023

GENERAL NOTES

1. SPECIFICATIONS: CONNECTICUT DEPARTMENT OF TRANSPORTATION FORM 818 (2020), SUPPLEMENTAL SPECIFICATION DATED JANUARY 2023, AND SPECIAL PROVISIONS.
2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, NINTH EDITION (2020), AS SUPPLEMENTED BY THE CONNECTICUT DEPARTMENT OF TRANSPORTATION BRIDGE DESIGN MANUAL (2003), INCLUDING REVISIONS UP TO 01/2020.
3. MATERIAL STRENGTHS:

   CONCRETE:
   CLASS PCC03340 . . . . . f'c = 3,000 PSI
   CLASS PCC04460 . . . . . f'c = 4,000 PSI
   CLASS PCC04462 . . . . . f'c = 4,000 PSI

   THE CONCRETE STRENGTH, f'c, USED IN THE DESIGN OF THE CONCRETE COMPONENTS IS NOTED ABOVE. THE COMPRESSIVE STRENGTH OF THE CONCRETE IN THE CONSTRUCTED COMPONENTS SHALL CONFORM TO THE REQUIREMENTS OF 6.01 - CONCRETE FOR STRUCTURES, AND M.03 - PORTLAND CEMENT CONCRETE.

   REINFORCEMENT:
   (ASTM A615 GRADE 60) . . . . . fy = 60,000 PSI
4. PRESTRESSED CONCRETE: REFER TO PRESTRESSED CONCRETE NOTES.
5. LIVE LOAD: HL-93, LEGAL AND PERMIT VEHICLES.
6. FUTURE PAVING ALLOWANCE: NONE.
7. BITUMINOUS CONCRETE OVERLAY: THIS SHALL CONSIST OF TWO LAYERS, 2" HMA S0.50 TRAFFIC LEVEL 2 ON 1" HMA S0.25 TRAFFIC LEVEL 2.
8. UTILITIES: THE FOLLOWING UTILITIES ARE LOCATED WITHIN THE PROJECT LIMITS AND SHALL BE PROTECTED DURING CONSTRUCTION:

   THE CONTRACTOR SHALL COORDINATE ALL WORK RELATED TO UTILITY RELOCATION WITH THE RESPECTIVE UTILITY COMPANIES.
9. FOUNDATION PRESSURES: THE VARIOUS GROUP LOADINGS NOTED ON THE SUBSTRUCTURE PLAN SHEETS REFER TO THE GROUP LOADS AS GIVEN IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.
10. DIMENSIONS: WHEN DECIMAL DIMENSIONS ARE GIVEN TO LESS THAN THREE DECIMAL PLACES, THE OMITTED DIGITS SHALL BE ASSUMED TO BE ZEROS. ALL ELEVATIONS ARE GIVEN IN FEET.
11. EXISTING DIMENSIONS: DIMENSIONS OF THE EXISTING STRUCTURE SHOWN ON THESE PLANS ARE FOR GENERAL REFERENCE ONLY. THEY HAVE BEEN TAKEN FROM THE ORIGINAL DESIGN DRAWINGS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL TAKE ALL FIELD MEASUREMENTS NECESSARY TO ASSURE PROPER FIT OF THE FINISHED WORK AND SHALL ASSUME FULL RESPONSIBILITY FOR THEIR ACCURACY. WHEN SHOP DRAWINGS BASED ON FIELD MEASUREMENTS ARE SUBMITTED FOR REVIEW, THE FIELD MEASUREMENTS SHALL ALSO BE SUBMITTED FOR REFERENCE BY THE REVIEWER.

CONCRETE NOTES

1. REMAIN IN PLACE FORMS: THE USE OF REMAIN IN PLACE FORMS ON THIS STRUCTURE IS NOT ALLOWED.
2. COMPOSITE CONSTRUCTION: NO TEMPORARY INTERMEDIATE SUPPORTS SHALL BE USED PRIOR TO AND DURING THE PLACING AND SETTING OF THE CONCRETE DECK SLAB. CONSTRUCTION LOADS AND DEAD LOADS WILL BE PERMITTED WHEN DIRECTED BY THE ENGINEER BUT ONLY WHEN THE SLAB CONCRETE HAS REACHED A STRENGTH OF f'c = 3500PSI. LIVE LOADS (TRAFFIC) WILL BE PERMITTED ON THE STRUCTURE AFTER THE CONCRETE HAS REACHED A STRENGTH OF f'c = 4000PSI.
3. THE FOLLOWING PAY ITEMS AND CONCRETE CLASSES ARE REQUIRED FOR CAST-IN-PLACE BRIDGE COMPONENTS:

ITEM	BRIDGE COMPONENTS	PCC CLASS
BRIDGE DECK CONCRETE	BRIDGE DECK	PCC04462
	CONCRETE CURBS	
ABUTMENT AND WALL CONCRETE	ABUTMENT AND WINGWALL STEMS, CHEEKWALLS	PCC03340
APPROACH SLAB CONCRETE	APPROACH SLABS, SLEEPER SLABS	PCC04460
BARRIER WALL CONCRETE	BARRIER WALLS	PCC04460

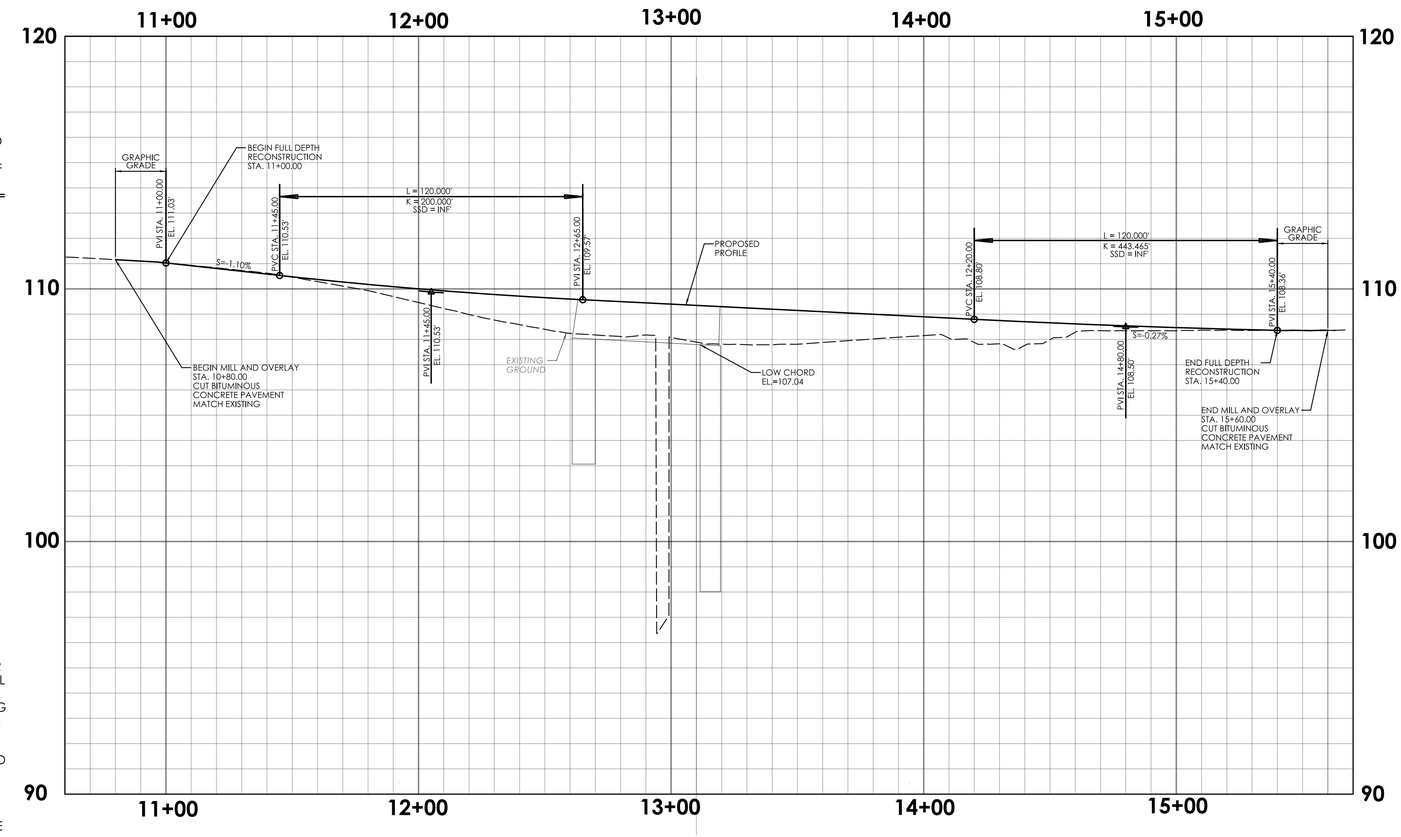
4. JOINT SEAL: SEE SPECIAL PROVISIONS.
5. EXPOSED EDGES: EXPOSED EDGES OF CONCRETE SHALL BE BEVELED 1" x 1" UNLESS DIMENSIONED OTHERWISE.
6. CONCRETE COVER: ALL REINFORCEMENT SHALL HAVE TWO INCHES COVER UNLESS DIMENSIONED OTHERWISE.
7. REINFORCEMENT: ALL REINFORCEMENT SHALL BE GALVANIZED AFTER FABRICATION UNLESS NOTED OTHERWISE. ALL REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF ASTM A767, CLASS 1, INCLUDING SUPPLEMENTAL REQUIREMENTS. THE COST OF FURNISHING AND PLACING THIS REINFORCEMENT SHALL BE INCLUDED IN THE ITEM "DEFORMED STEEL BARS - GALVANIZED."
8. PREFORMED EXPANSION JOINT FILLER: THE COST OF FURNISHING AND INSTALLING PREFORMED EXPANSION JOINT FILLER IS PAID FOR AS "1" PREFORMED EXPANSION JOINT FILLER FOR BRIDGES" OR "1/2" PREFORMED EXPANSION JOINT FILLER FOR BRIDGES."
9. CONSTRUCTION JOINTS: CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.

CONCRETE DISTRIBUTION		
SUPERSTRUCTURE	C.Y.	_
SUBSTRUCTURE	C.Y.	_
FOOTINGS	C.Y.	_
TOTAL	C.Y.	_

TRANSPORTATION DIMENSIONS AND WEIGHTS				
MEMBER	SHIPPING LENGTH	SHIPPING HEIGHT	SHIPPING WIDTH	SHIPPING WEIGHT
B1, B4.B5-B9	21.75 ft	1 ft	4 ft	12,724 lbs
B5	21.75 ft	1 ft	3 ft	9,723 lbs

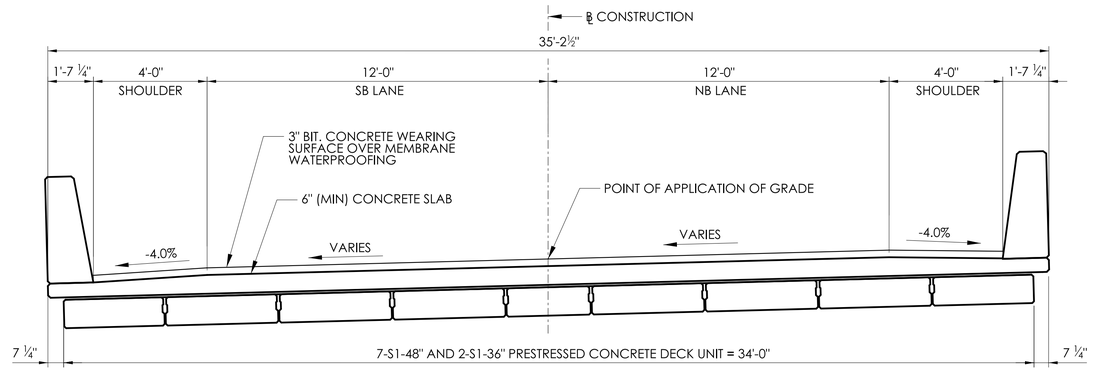
INSPECTION OF FIELD WELDS		
METHODS	UNIT	QUANTITY
ULTRASONIC	INCH	0
MAGNETIC PARTICLE	FEET	0

NOTICE TO BRIDGE INSPECTORS	
The Department's Bridge Safety procedures require this bridge to be inspected for, but not limited to, all appropriate components indicated in the governing manuals for bridge inspection. Attention must be given to inspecting the following special components and details. (The listing for components for specific attention shall not be construed to reduce the importance of inspection of any other component of the structure.) The frequency of inspection of this structure shall be in accordance with the governing manuals for bridge inspection, unless otherwise directed by the Manager of Bridge Safety and Evaluation.	
Component or Detail	Structure Sheet Reference
None	



PROFILE

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'



TYPICAL SECTION

SCALE: 1/4" = 1'-0"

REV. | DATE | REVISION DESCRIPTION

DESIGNER/DRAFTER: NPR/MAN CHECKED BY: BWC

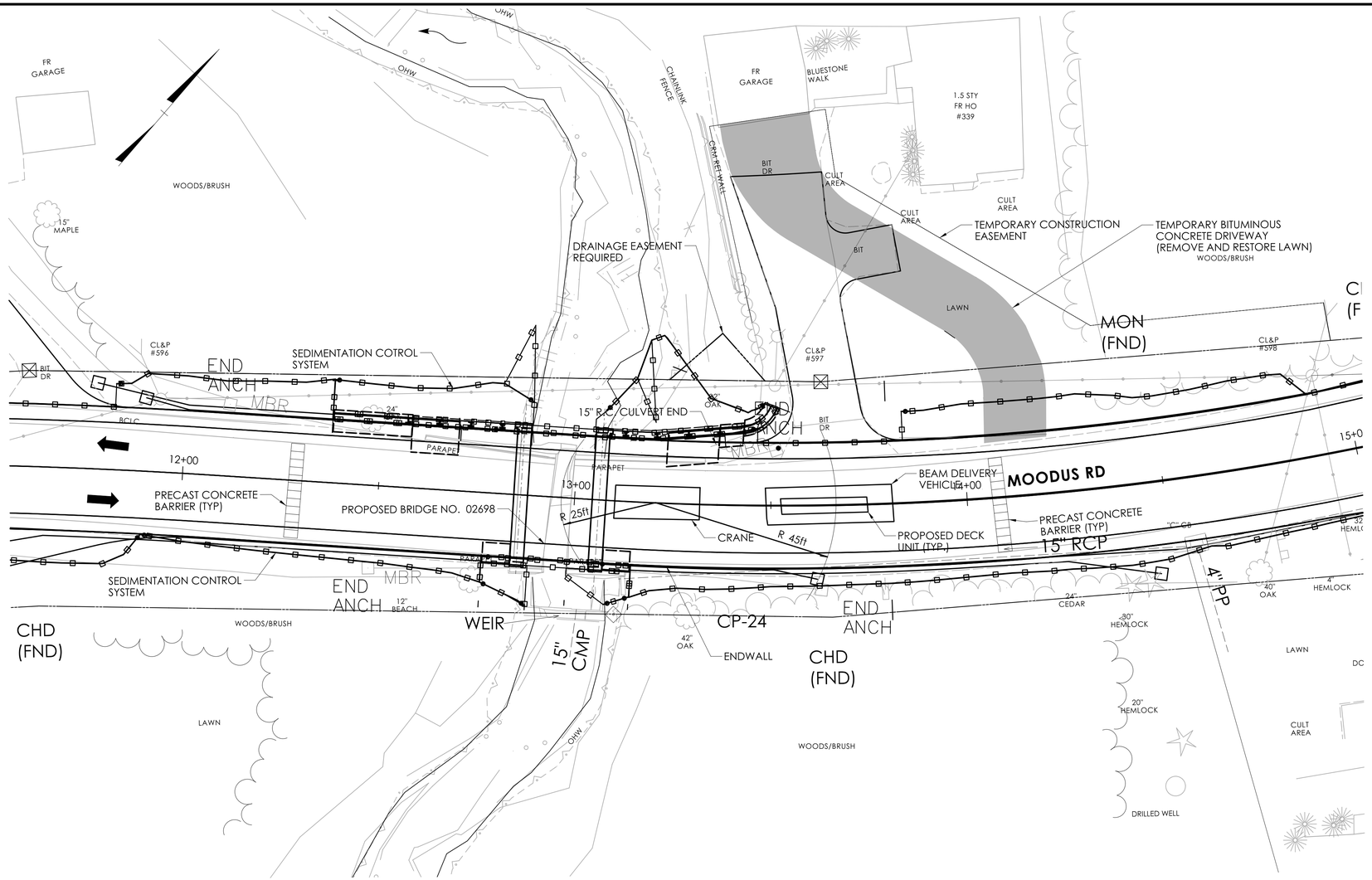
SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0040-0148-Pri
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 02698 CARRYING ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: GENERAL NOTES/VERTICAL ALIGNMENT

DRAWING NO. S-02
SHEET NO.

LASTED SAVED BY: msouliere FILE NAME: C:\Users\msouliere\Documents\CT_Projects\0040_0148\Bridge\Contract_Plans\RSR\RSR\SB_PN 0040_0148_General Notes.dgn
PLOTTED DATE: 5/31/2023

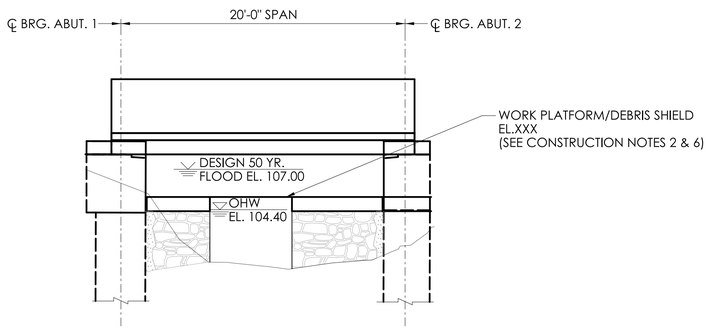


PLAN
SCALE 1" = 1/16'-0"

LEGEND

- RIGHT-OF-WAY LINE/PROPERTY LINE
- PROPOSED CONSTRUCTION EASEMENT LINE
- PROPOSED DEFINED EASEMENT LINE
- SEDIMENTATION CONTROL SYSTEM

TEMPORARY HYDRAULIC DATA	
AVERAGE DAILY FLOW (CFS)	-
AVERAGE SPRING FLOW (CFS)	-
TEMPORARY DESIGN FREQUENCY	2-YEAR STORM
2-YEAR FREQUENCY DISCHARGE (CFS)	-
2-YEAR WATER SURFACE ELEVATION UPSTREAM (FT)	-
2-YEAR WATER SURFACE ELEVATION DOWNSTREAM (FT)	-



SOUTH ELEVATION
SCALE 3/16" = 1'-0"

CONSTRUCTION NOTES

1. THE SUPERSTRUCTURE REMOVAL AND ERECTION PLANS SHOWN REPRESENT ONE SUGGESTED METHOD FOR REMOVAL OF THE EXISTING SUPERSTRUCTURE AND ERECTING THE PRESTRESSED DECK UNITS. THE INFORMATION GIVEN ON THESE DRAWINGS IS APPLICABLE TO THIS METHOD, BUT MAY NOT BE APPLICABLE TO OTHER METHODS OF ERECTION.
2. THE CONTRACTOR SHALL DEVELOP HIS OWN METHOD OF REMOVAL AND ERECTION. THE CONTRACTOR SHALL PREPARE AND SUBMIT WORKING DRAWINGS AND CALCULATIONS AS INDICATED IN THE SPECIAL PROVISIONS.
3. THE CONTRACTOR'S REMOVAL AND ERECTION PROCEDURES MUST BE COMPATIBLE WITH THE MAINTENANCE OF TRAFFIC PROVISIONS IN THE CONTRACT DOCUMENTS.
4. THROUGHOUT ALL STAGES OF THE WORK, THE CONTRACTOR SHALL TAKE THE PROPER PRECAUTIONS TO ENSURE THE STABILITY OF ALL STRUCTURAL ELEMENTS UNTIL THE TOTAL STRUCTURE IS IN BEING.
5. CONTRACTOR TO VERIFY WEIGHT OF ALL CRANE PICKS.
6. A DEBRIS SHIELD IS REQUIRED FOR ALL DEMO AND ERECTION OVER BROOK. SUBMIT STAMPED DESIGN OF DEBRIS SHIELD FOR REVIEW BY THE ENGINEER PRIOR TO COMMENCEMENT OF WORK. THE COST TO INSTALL, MAINTAIN, AND REMOVE THE DEBRIS SHIELD SHALL BE PAID UNDER "REMOVAL OF SUPERSTRUCTURE".
7. CONTRACTOR TO NOTE THAT WATER ACCESS IS NEITHER PROPOSED NOR REQUIRED. ALL WORK IS TO BE SHIELDED OVER THE WATER.
8. DRIVEWAY ACCESS SHALL BE MAINTAINED THROUGH PROJECT DURATION AS SHOWN ON THE PLANS.
9. ESTIMATED MAXIMUM PICK WEIGHT; DOES NOT INCLUDE RIGGING: 13.0 KIPS (DECK UNITS B2 TO B8)

SUGGESTED SEQUENCE OF CONSTRUCTION

1. TEMPORARILY RELOCATE UTILITY POLES AND OVERHEAD UTILITY LINES (BY OTHERS).
2. SET UP DETOUR AND TRAFFIC ITEMS.
3. INSTALL SEDIMENT CONTROL SYSTEM.
4. INSTALL DEBRIS SHIELD.
5. REMOVE EXISTING SUPERSTRUCTURE.
6. REMOVE EXISTING SUBSTRUCTURE TO LIMITS SHOWN.
7. INSTALL DRILLED MICROPILES AS SHOWN. PLACE PRECAST ABUTMENT SECTIONS.
8. INTALL SOLDIER PILES AS SHOWN ON THE PLANS. PLACE PRECAST LAGGING.
9. CONTRUCT CAST IN PLACE CONCRETE WINGWALLS 1B AND 2B.
8. INSTALL BEARINGS AND ERECT DECK UNITS B1 THROUGH B9. CAST CHEEKWALLS.
9. CONSTRUCT CONCRETE TOPPING SLAB.
10. CONSTRUCT PARAPETS.
11. REMOVE DEBRIS SHIELD.
13. CONSTRUCT REMAINING BARRIER WALL SECTIONS.
15. CONSTRUCT APPROACH SLABS AND SLEEPER SLABS.
17. INSTALL MEMBRANE WATERPROOFING OVER THE DECK AND APPROACH SLABS AND APPLY PENETRATING SEALER PROTECTIVE COMPOUND FOR THE CONCRETE CURBS.
18. MILL EXISTING ROADWAY AND RECONSTRUCT FULL DEPTH ROADWAY.
19. PLACE HMA.
20. PLACE PERMANENT PAVEMENT MARKINGS.
21. INSTALL GUIDE RAILS AND END ANCHORAGES.
22. PERFORM LANDSCAPING.
23. REMOVE TRAFFIC ITEMS AND DETOUR.
24. REMOVE EROSION AND SEDIMENTATION CONTROLS UPON PERMANENT STABILIZATION.

REVISION DESCRIPTION | DATE | REV.

DESIGNER/DRAFTER: BWC CHECKED BY: BWC

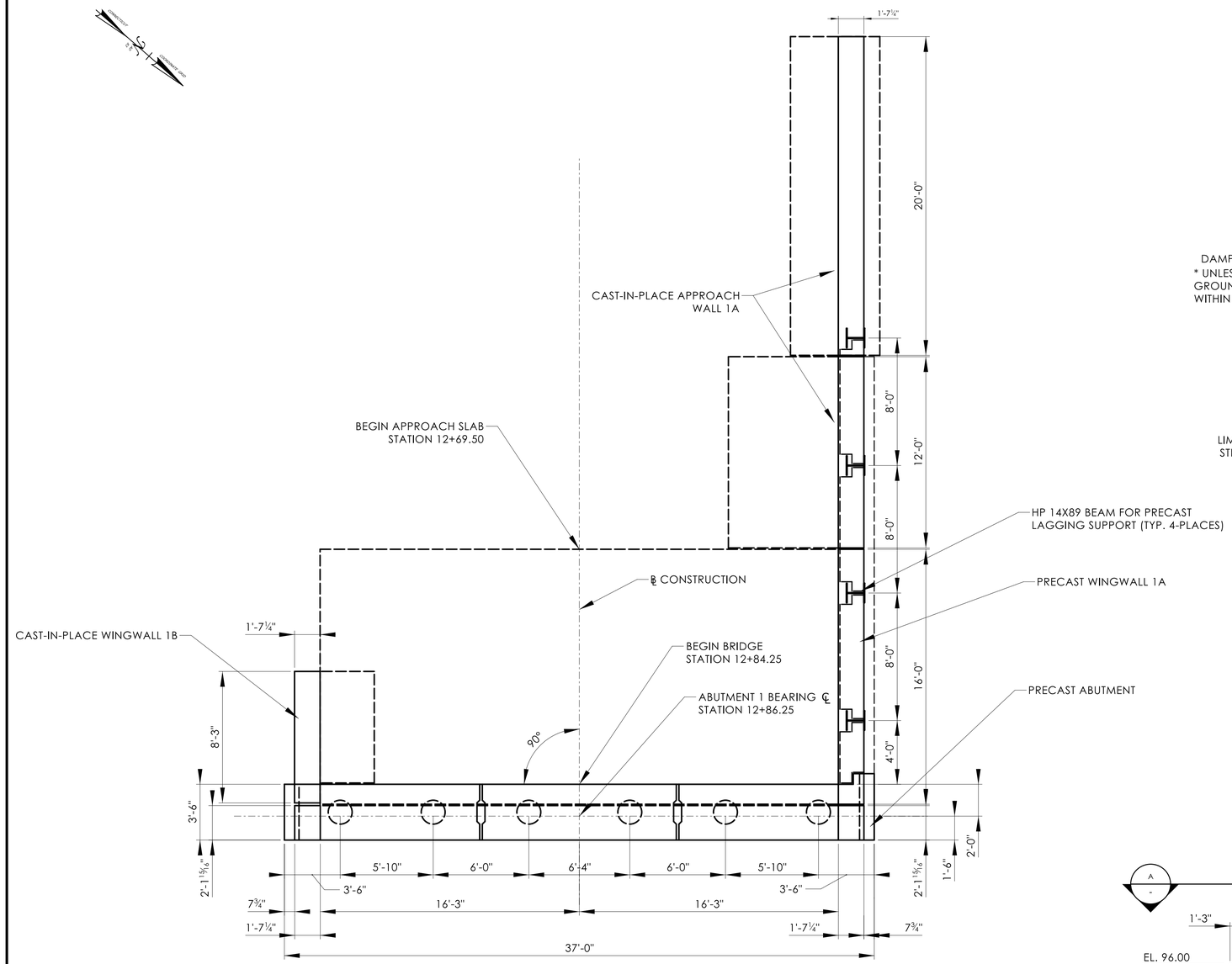
SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 0040-0148
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 02698 CARRY ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: CONSTRUCTION AND ELEVATION PLAN

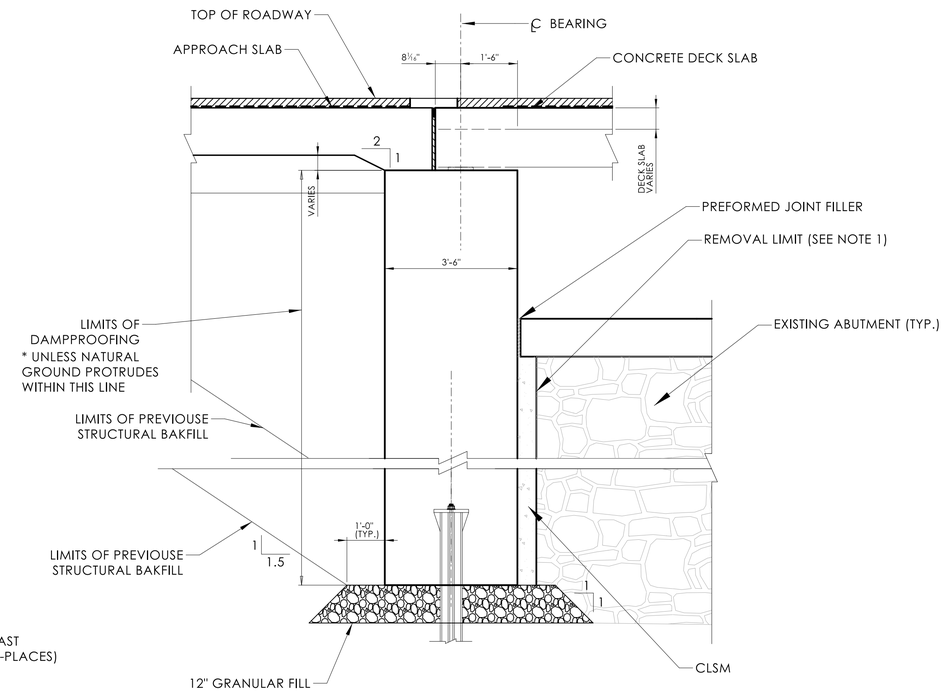
DRAWING NO. S-03
SHEET NO.

LASTED SAVED BY: msouliere **FILE NAME:** C:\Users\msouliere\Documents\CT_Projects\0040_0148\Bridge\Contract_Plans\RSR\RSR\SB_PN 0040_0148_Stage Construction.dgn
PLOTTED DATE: 5/31/2023



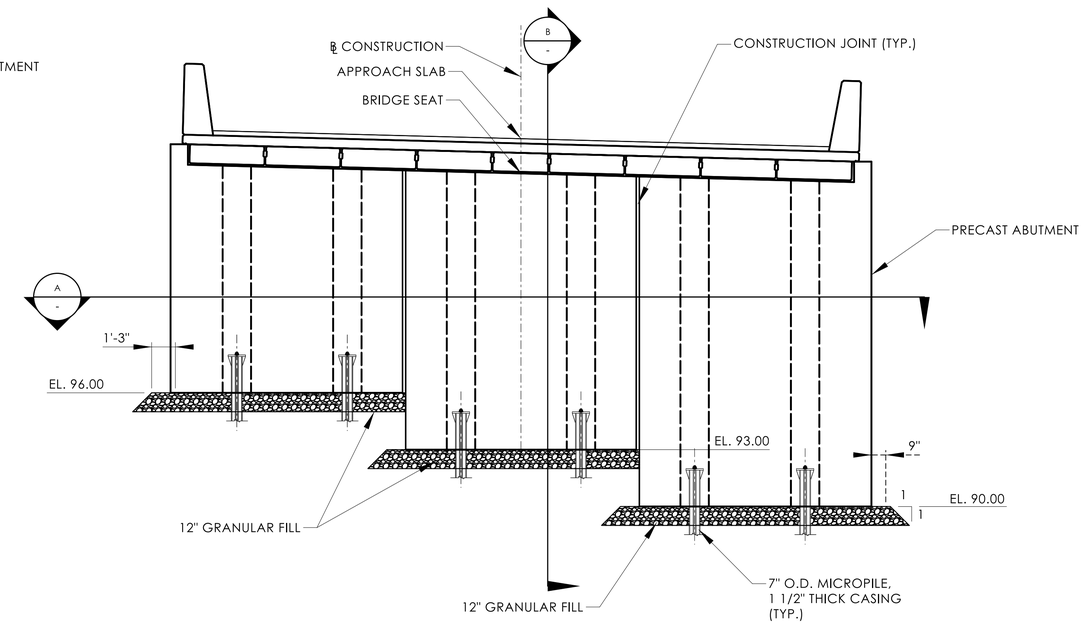
ABUTMENT #1 - PLAN - SECTION "A"

SCALE: 1/4"=1'-0"



TYPICAL ABUTMENT SECTION "B"

SCALE: 1/2"=1'-0"



ABUTMENT #1 - ELEVATION

SCALE: 1/4"=1'-0"

NOTES

1. EXISTING ABUTMENT STRUCTURE AND WINGWALL SHALL BE REMOVED AS SHOWN TO PROVIDE ADEQUATE SPACE FOR PLACEMENT OF PROPOSED ABUTMENT.

REV.	DATE	REVISION DESCRIPTION

DESIGNER/DRAFTER: BC/MS CHECKED BY:

SCALE AS NOTED

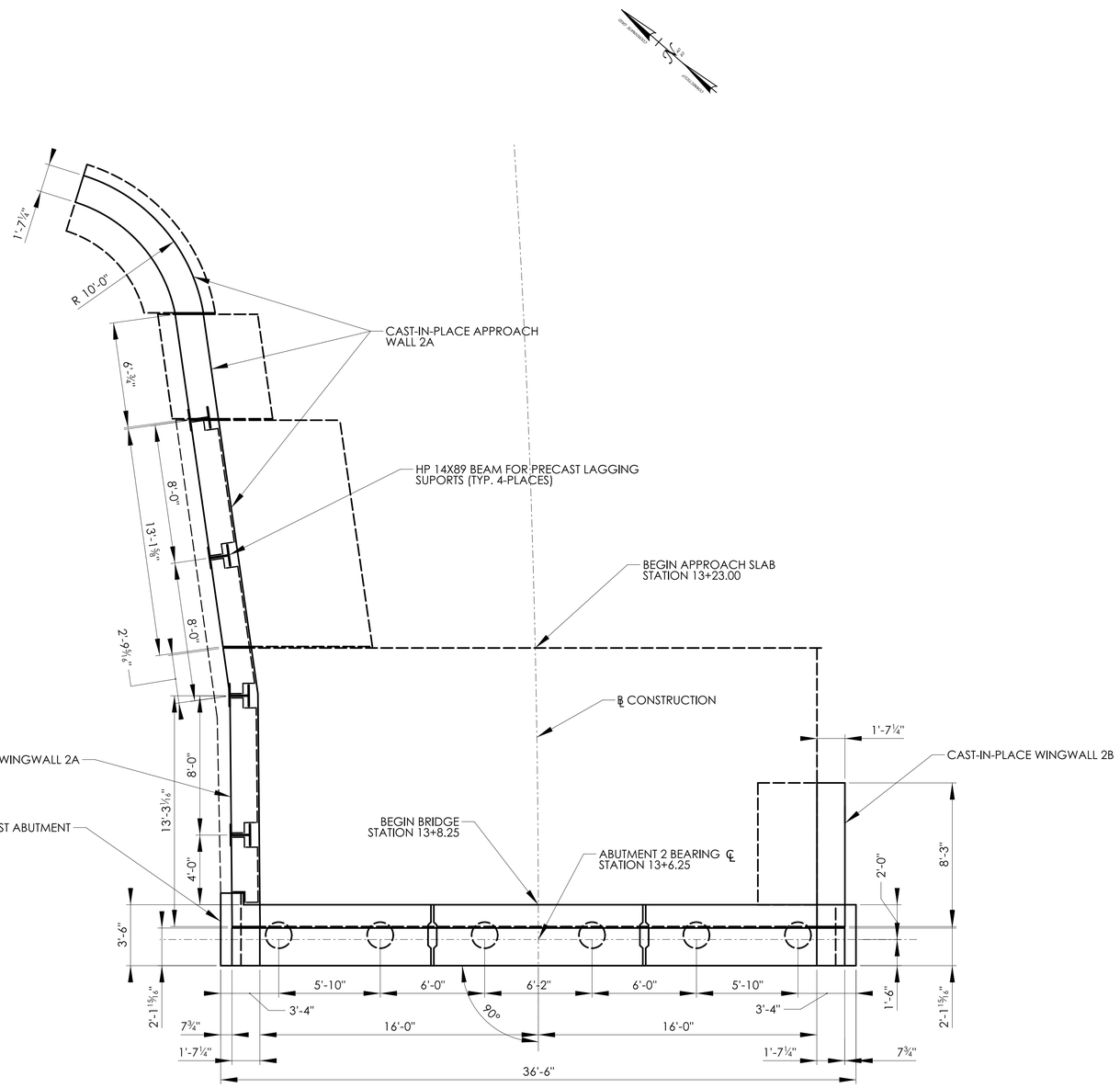
SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 040-0148
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 02698, ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER DYKAS BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: ABUTMENT - 1 PLAN AND ELEVATION

DRAWING NO. S-04
SHEET NO.

LASTED SAVED BY: msouliere **FILE NAME:** C:\Users\msouliere\Documents\CT_Projects\0040_0148\Bridge\Contract_Plans\SB_PN_040-0148_Br02698-ABUTMENT 01.dgn
PLOTTED DATE: 5/23/2023



ABUTMENT #2 - PLAN - SECTION "A"

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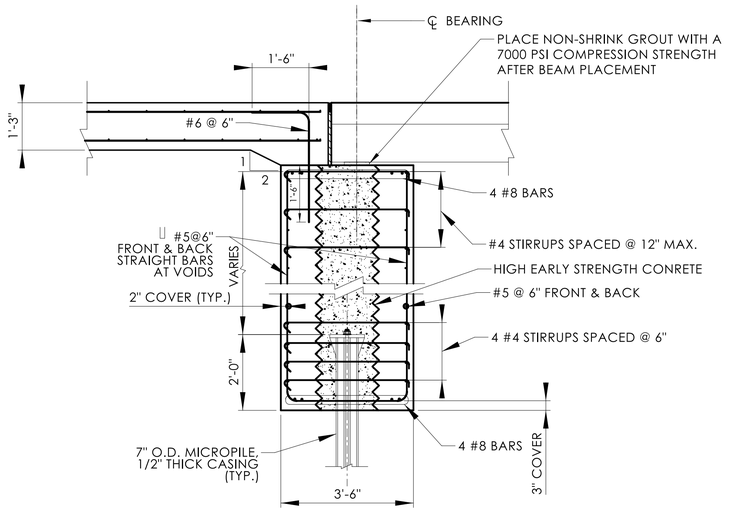
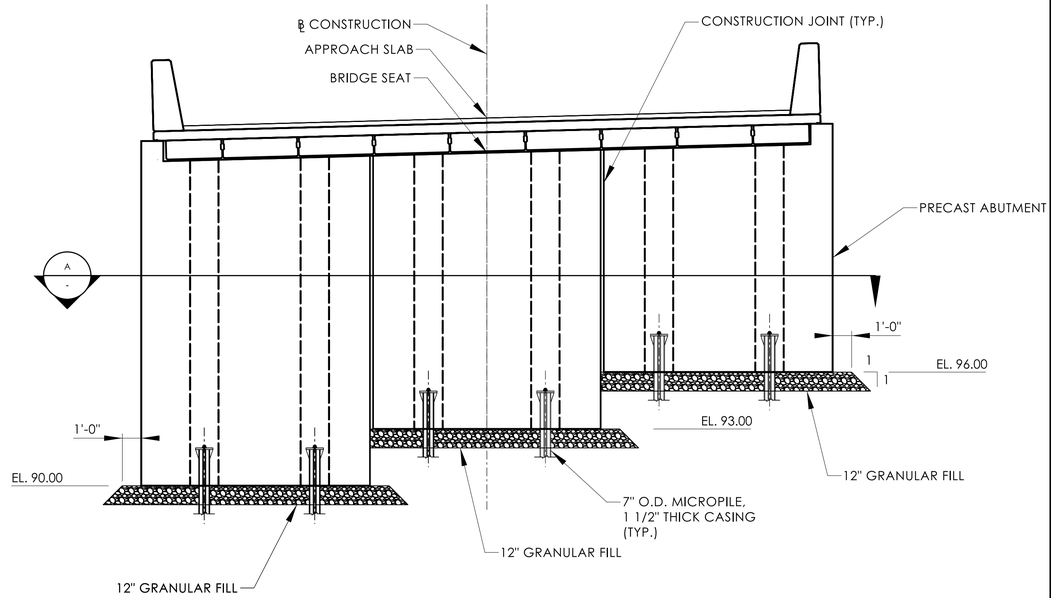


TYPICAL PILE CAP REINFORCEMENT DETAIL SECTION

SCALE: 1/2"=1'-0"



ABUTMENT #2 ELEVATION

SCALE: 1/4"=1'-0"

REV.	DATE	REVISION DESCRIPTION

DESIGNER/DRAFTER: BC/MS CHECKED BY:

SCALE AS NOTED

SIGNATURE/ BLOCK:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 040-0148
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO. 02698, ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER DYKAS BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: ABUTMENT 2 PLAN AND ELEVATION

DRAWING NO. S-05
SHEET NO.

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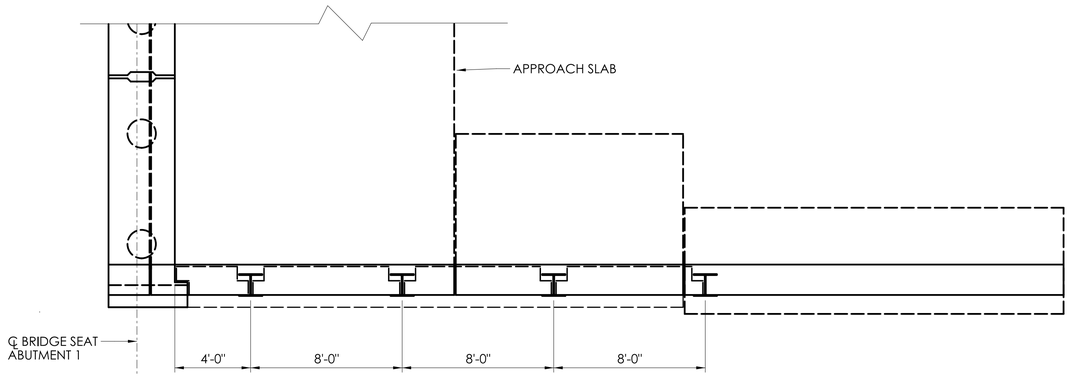
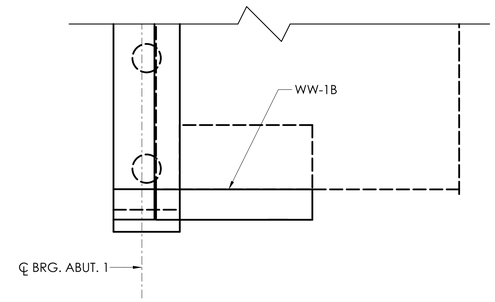
PLOTTED DATE: 5/23/2023



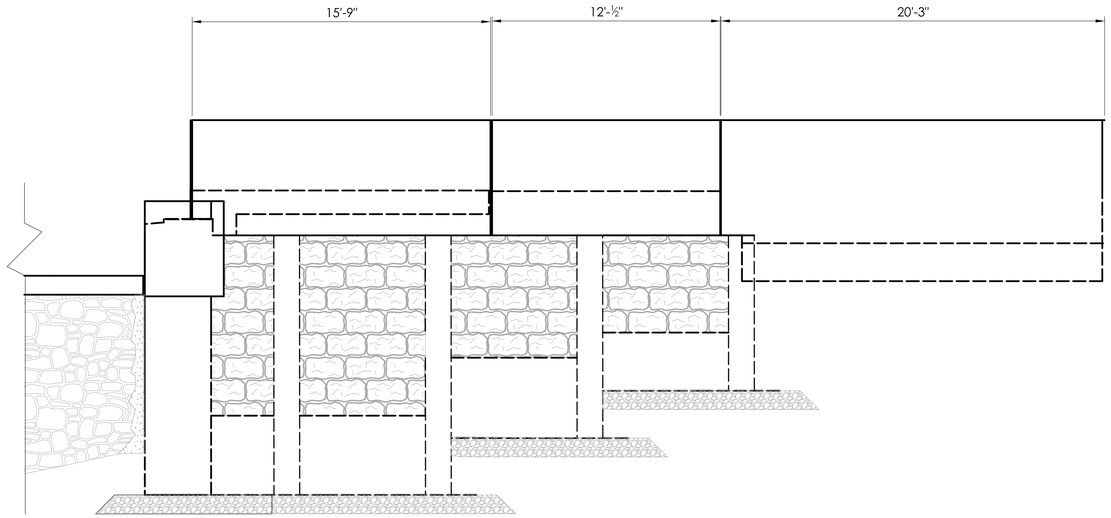
WINGWALL 1A PLAN

SCALE ¼" =1'-0"



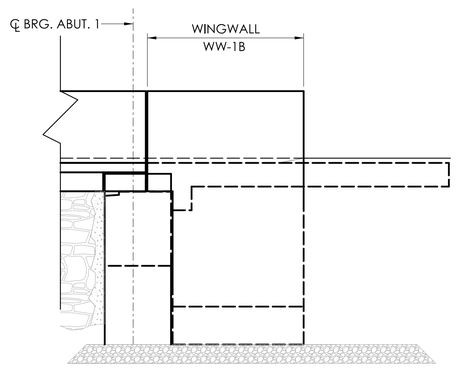
WINGWALL 1B PLAN

SCALE ¼" =1'-0"



WINGWALL 1A ELEVATION

SCALE ¼" =1'-0"



WINGWALL 1B ELEVATION

SCALE ¼" =1'-0"

REV.	DATE	REVISION DESCRIPTION

DESIGNER/DRAFTER: PS CHECKED BY: RS

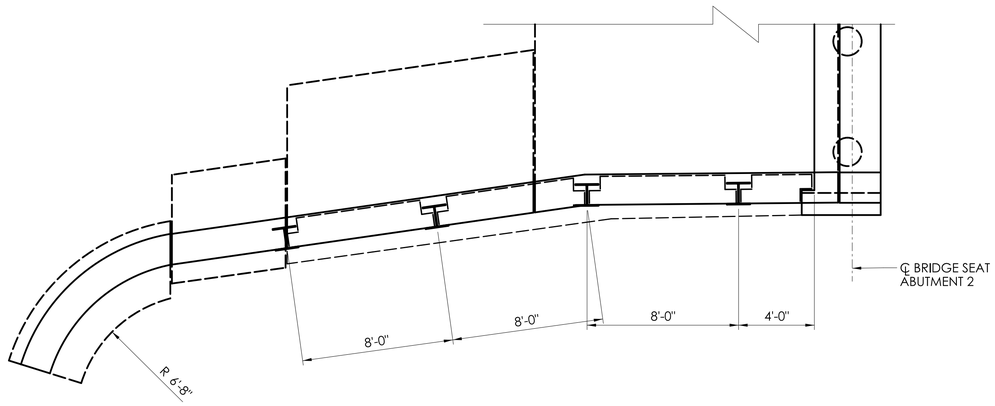
SIGNATURE/
BLOCK:

STATE OF CONNECTICUT
DEPARTMENT
OF
TRANSPORTATION

PROJECT NUMBER: 0040-0148-Pri
PROJECT DESCRIPTION: REPLACEMENT OF BRIDGE NO.02698 CARRYING ROUTE 149 (EAST HADDAM MOODUS ROAD) OVER BROOK
TOWN(S): EAST HADDAM
DRAWING TITLE: WINGWALL 1A AND 1B PLAN AND ELEVATION

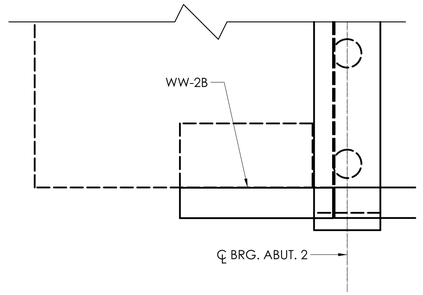
DRAWING NO. ####
SHEET NO.

LASTED SAVED BY: DClarke **FILE NAME:** XX
PLOTTED DATE: 5/23/2023



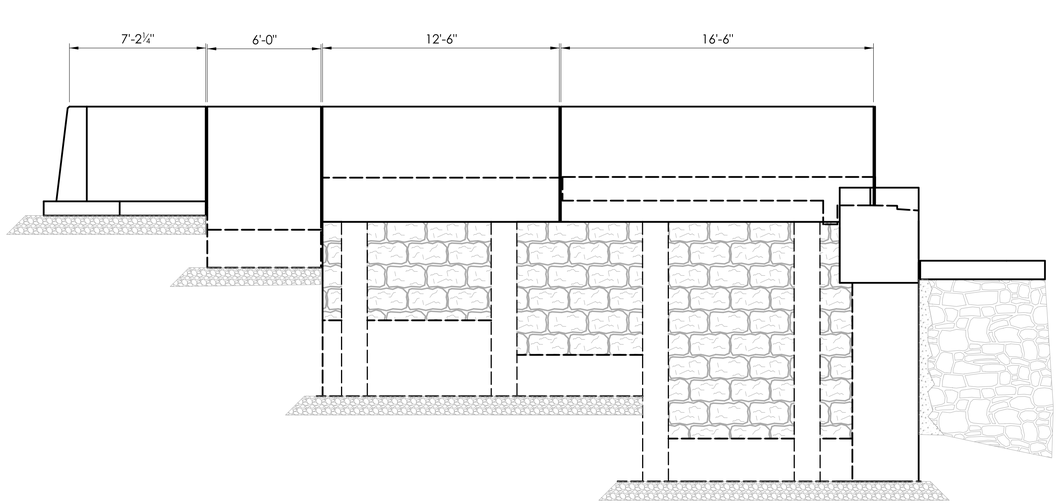
WINGWALL 2A PLAN

SCALE ¼" =1'-0"



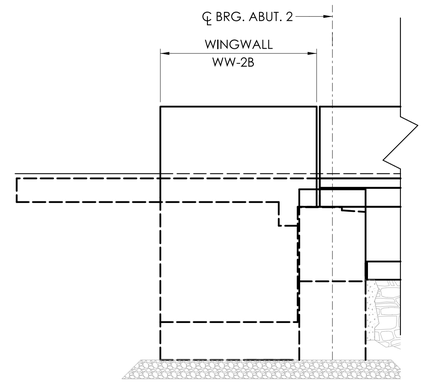
WINGWALL 2B PLAN

SCALE ¼" =1'-0"



WINGWALL 2A ELEVATION

SCALE ¼" =1'-0"



WINGWALL 2B ELEVATION

SCALE ¼" =1'-0"

REV.	DATE	REVISION DESCRIPTION

DESIGNER/DRAFTER: PS CHECKED BY: RS

SIGNATURE/
BLOCK:

STATE OF CONNECTICUT
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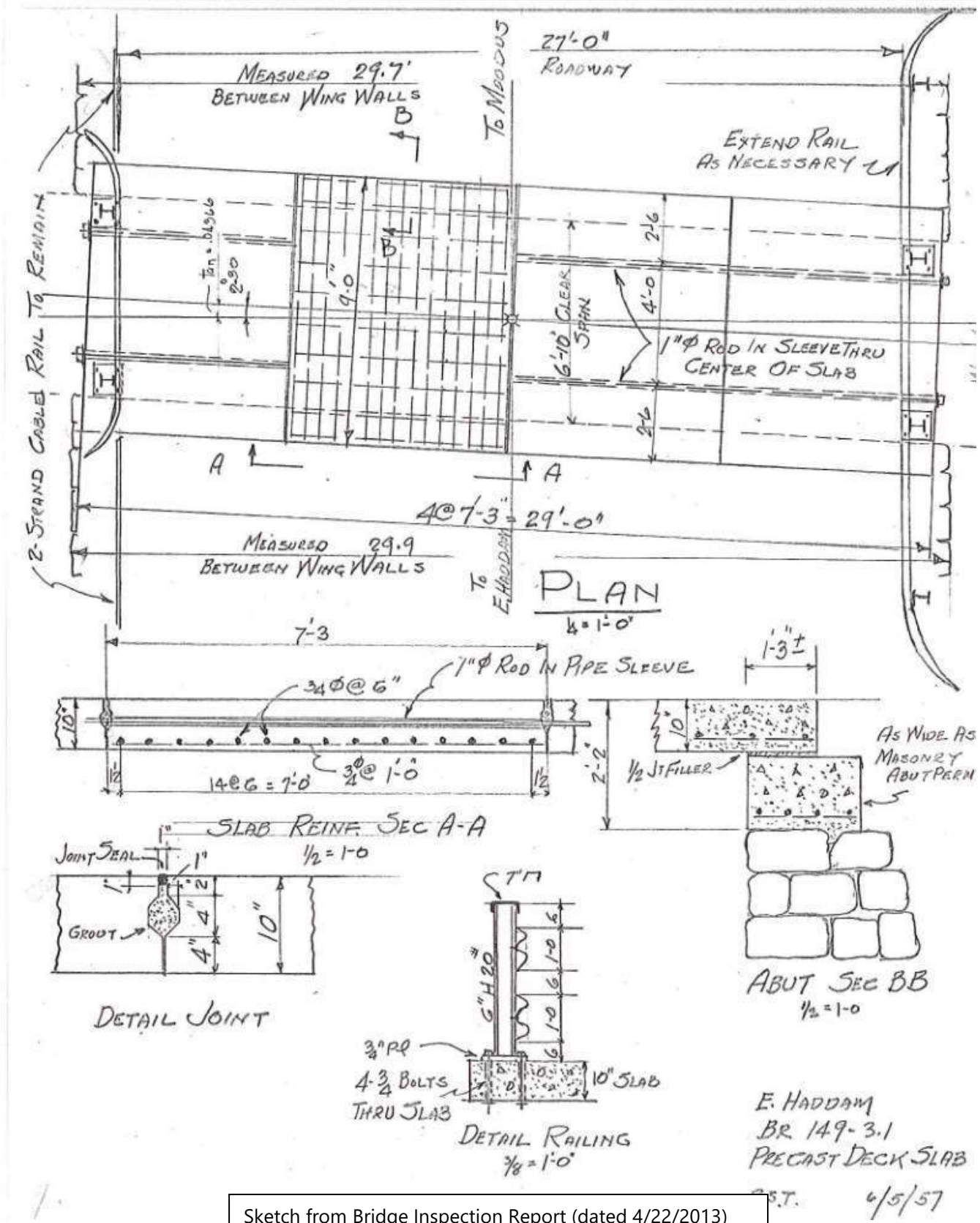
TOWN(S): EAST HADDAM
DRAWING TITLE: WINGWALL 2A AND 2B PLAN AND ELEVATION

DRAWING NO.
####
SHEET NO.

LASTED SAVED BY: DClarke **FILE NAME:** XX
PLOTTED DATE: 5/23/2023

6.7 Appendix G – Original Design Plans



Sketch from Bridge Inspection Report (dated 4/22/2013)