City of Worcester, MA
Addendum No. 3 to Contract Documents
for
Reconstruction of Federal Square (Carroll Plaza)
Contract No. M21-9

The following changes and additional information are hereby made part of the Contract Documents:

REPONSE TO QUESTIONS/CLARIFICATION

Question: On the new bid sheet Item #959.2021 describes #7 Wire Type and the spec identifies it as special purpose lighting and audio control.

RESPONSE: The item numbering in the special provisions was misnumbered from items 940.2021 to 974.2021. The special provisions have been revised to correct this errant numbering.

ATTACHMENTS
Attachment 1 – Revised Special Provisions.

City of Worcester
Purchasing Division
Room 201 – City Hall
Worcester, MA 01608

BETA Group, Inc.
701 George Washington Highway
Lincoln, RI 02865
(401) 333-2382

ATTACHMENT 1

Revised Specification Book

Reconstruction of Federal Square (Carroll Plaza)
Worcester, MA
Addendum No. 3
7/20/21

SPECIAL PROVISIONS
Federal Square (Carroll Plaza) Improvements
Contract No. M21-9
Worcester, Massachusetts

GENERAL REQUIREMENTS

SCOPE OF WORK

This project is for the construction of improvements to Federal Square (Carroll Plaza) at the intersection of Main Street, Southbridge Street and Federal Streets.

The work in the contract shall include, but is not limited to, excavation and backfill, milling and overlay of existing pavement, sidewalk construction, remove and reset existing curbing, installation of new curbing, crosswalks, wheelchair ramp construction, drainage work, furnishing and installation of granite hardscape, installation of streetscape elements including trees, signing, striping, site lighting, new street lighting, removal of existing street lighting, furnishing and installing plaza sculpture, furnishing and installing lighting and audio controls and all other incidentals included in the contract document. Items in this contract shall be paid for at the Contract Unit Price bid under each item, which price and payment shall constitute full compensation for furnishing all materials, labor, equipment, etc., required for the satisfactory completion and acceptance of the work.

BID ALTERNATE #1 is included to furnish and install exterior fountains associated with the plaza sculpture.

All work done under this contract shall be in conformance with the Plans, the 2020 MassDOT Standard Specifications for Highways and Bridges, the City of Worcester Department of Public Works and Parks Engineering Division Construction Management Section Standard Specifications and Details dated 02/01/2020 and all addenda, the 2017 MassDOT Construction Standard Details, the 2009 Manual on Uniform Traffic Control Devices for Streets and Highway (MUTCD) and the American Standard for Nursery Stock (ANSI Z-60.1-1986), as amended, and these Special Provisions.

WORK SCHEDULE

Work on this project is restricted to a normal eight-hour day, five-day week, with the Prime Contractor and all subcontractors working on the same shift, except as follows:

Pavement milling and resurfacing operations shall be performed at night between the hours of 8:00 PM and 6:00 AM. All costs associated with night work shall be considered incidental to the work and no additional payment shall be made.

No work shall be done on this contract on Saturdays, Sundays and Holidays without prior approval by the Engineer.

PRE-BID CONFERENCE

There is a pre-bid meeting for this contract on July 13,2021 at 10am. The Pre-bid meeting will be at the 1st floor conference room, DPW building, 20 East Worcester Street, Worcester, MA 01604.

ORDERING OF EQUIPMENT

The Contractor shall provide the City, within thirty (14) days of receipt of the contract, written evidence that:

1. He has ordered the shop drawings for the materials for which shop drawings are required on the subject contract;

The Contractor shall further provide the City written evidence within 30 days of receipt of the contract that these orders have been confirmed in writing by the manufacturer with delivery dates appropriate for timely completion of the project. These confirmations of orders will become part of the project records.

Failure to comply with any of the ordering requirements shall nullify a request for an extension of the project completion date as a consequence of late delivery of signal control devices or castings.

COORDINATION WITH HANOVER THEATER

The work under this contract is directly adjacent to the Hanover Theater and impacts access to and egress from the theater. The Theater sponsors events open to the public both during the day as well as at night. The Theater also conducts classes through its conservancy. In addition, the Theater conducts its normal business including its box office. The Contractor is responsible for ensuring that adequate and safe access is maintained to the Theater at all times and that sufficient and safe access is provided for larger crowds that will be attending scheduled events. The contractor shall coordinate with the Theater to obtain its schedule for events within the overall time frame for the project.

Access shall be maintained to the main entrance of the Theater as well as to the Conservancy entrance. Short term closure of this access, with the advanced permission of the City and the Theater, may be allowed to perform work directly in front of either access. Access to one entrance shall be maintained at all times. The Contractor shall coordinate with the City and the Theater for any closures and shall confirm all approved closures with the City and Theater in writing at least 48 hours prior to the closure.

Access to the Theater shall be maintained in a safe manner and shall include provisions for access by the disabled. The access shall be segregated from the work area by fencing or other suitable means approved by the City and the Theater to prevent access to the work area. For scheduled events, sufficient area shall be provided at the main entrance to allow queuing of patrons entering the Theater. An area of approximately 250 SF shall be provided in addition to the walkway.

Contacts for coordination with the Theater are:
Troy Seibels, President & CEO, Hanover Theater 508-471-1760
Troy@thehanovertheatre.org

Stephan Rolle, Assistant Chief Development Officer -City of Worcester 508-799-1400 ext 31434
RolleS@worcesterma.gov

WINTER SHUTDOWN

It is anticipated that the project will require a winter shutdown period. The expected dates for the winter shutdown are from December 15, 2021 to April 15, 2022. The Hanover Theater will be open for normal business including the operation of the conservancy as well as for events. The plaza shall be left in a clean, safe and operable condition throughout the winter shutdown. The Contractor shall coordinate with the City, the Theater and the Engineer to develop a plan for the shutdown to accommodate the Theater's operations. The Contractor shall submit the plan to the City, Theater and Engineer no later than three (3) weeks prior to the anticipated date of the start of the shutdown. The plan shall include, as a minimum, the areas to remain open for the winter, specific areas to be closed, location of any fence, barrier or other security measures and any other pertinent information deemed necessary to ensure a safe and functional space.

No equipment shall be stored on site during the shutdown. Any stockpiled material shall be removed from the site prior to the shutdown. Any obstructions that may impede safe use of the plaza by pedestrians, employees and patrons of the plaza shall be removed or protected.

The contractor will not be allowed to perform work during the shutdown without advanced written authorization from the City. The Contractor shall be available to address any safety or operational issues related to the construction that arise during the shutdown. Issues shall be addressed in a timely manner so as not to impact the use of the plaza.

The Contractor shall notify the City in writing three (3) weeks prior to the date of the anticipated start of construction following the shutdown.

The work required to prepare the site for winter shutdown and maintain the site during winter shutdown is considered incidental to the contract and no separate payment shall be made.

TRAVEL AND PROSECUTION OF WORK

Before starting any work under this Contract, the Contractor shall submit a Schedule of Operation as provided in Section 8.02 of the MassDOT Standard Specifications to the City of Worcester. This work schedule shall include a plan of construction procedures, scheduling details for completing all sidewalk work, lighting work, pavement milling and resurfacing, proposed detours, and the safety measures to be used during the prosecution of the work as set forth in Section 850 of the Standard Specifications for Highways and Bridges. Approval of the construction schedule by the City of Worcester is required prior to commencement of any construction activity.

The Contractor shall coordinate his work with the work to be done by the Public Utilities or other agencies, and he shall so schedule his operations as to cause the least interruption to the normal flow of traffic in existing roads.

Prior to commencement of work, the Contractor shall be responsible for obtaining all necessary local permits.

Attention is further directed to the following provisions unless otherwise directed by the Engineer:

1. Normal working hours for this project are from 7:00 AM to 5:00 PM, Monday through Friday.

2. Pavement milling and resurfacing operations shall be performed at night between the hours of 8:00 PM and 6:00 AM.

3. No work shall be done on this Contract on Saturdays, Sundays and Holidays, unless otherwise approved in writing by the City.

4. No detouring of traffic shall be allowed without permission of the City of Worcester.

5. The Contractor may be required to temporarily suspend operations when such are considered by the Engineer, to be a hazard to traffic.

Particular care shall be taken to establish and maintain methods and procedures, which will not create unnecessary or unusual hazards to public safety. All normal pedestrian and vehicular traffic on existing streets shall be maintained by proper scheduling of work. The convenience of the general public along and adjacent to the street shall be provided for in an adequate and satisfactory manner. Access shall be maintained to all buildings in use. The placement of necessary devices will be for daily work periods and shall be removed immediately after the conclusion of work operations. Signs having messages that are irrelevant to normal traffic conditions will be removed or properly covered at the end of each work period. Signs are to be kept clean at all times, and legends shall be distinctive and unmarred.

The Contractor shall provide, place and erect all necessary barricades and warning signs and maintain adequate lights and illumination therefore. He shall be held responsible for all damage to the work due to any failure of signs and barricades needed to protect the work from traffic, pedestrians or other causes.

The Contractor shall provide for the removal of all material spilled from his trucks on existing pavement over which it is hauled, or otherwise deposited thereon whenever, in the judgment of the Engineer, the accumulation is sufficient to cause the formation of mud or dust, or interfere with drainage or create a traffic hazard.

NOTICE TO OWNERS OF UTILITIES

(Supplementing Subsection 7.13 of the MassDOT Standard Specifications)

Written notice shall be given by the Contractor to all public service corporations or municipal and State officials owning or having charge of publicly or privately owned utilities of his intention to commence operations affecting such utilities at least one week in advance of the commencement of such operations. The Contractor shall, at the same time, file a copy of such notice with the Engineer.

Following is a list of Utility Companies and others who may be involved in this project:

City of Worcester
Department of Public Works
20 East Worcester Street

Mr. Mark Elbag, Jr., P.E.
(508) 799-1554

Worcester, MA 01604-3695

National Grid 939 Southbridge Street Worcester, MA 01610	Ms. Andrea Maris (508) 860-6052
Eversource Gas One Nstar Way, SE310 Westwood, MA 02090	Mr. Michal Cushera (781) 441-8709
Verizon 1166 Shawmut Drive New Bedford, MA 02746	Ms. Karen Nunes (508) 991-3522
Charter Communications 640-D Lincoln Street Worcester, MA 01605	Mr. Jeffery Mills (508) 853-1515
City of Worcester Fire Department Worcester, MA	Chief Michael J Lavoie (508) 799-1808
City of Worcester Police Department Worcester, MA 02670	Chief Steven Sargent (508) 799-8600
BETA Group, Inc. 6 Blackstone Valley Place Lincoln, RI 02865	William McGrath, P.E. Project Manager (401) 333-2382

The Contractor shall make his own investigation to assure that no damage to the existing structures, drainage lines, traffic signal conduits, and other utilities will occur as a result of his operations.

The Contractor shall notify "Mass. DIG SAFE" and procure a DIG SAFE number of each location 72 hours prior to disturbing ground in any way.

"DIG SAFE" call center: Telephone 1-800-344-7233

PROCEDURES FOR SHOP DRAWING SUBMITTALS

The following procedure shall be followed when making shop drawing submittals for this project:

1. The Prime Contractor shall submit three (3) sets of drawings directly to the Design Engineer, BETA Group, Inc. and one (1) set directly to the City of Worcester Department of Public Works and Parks for preliminary review.

2. The Design Engineer will send a written reply, returning two (2) sets to the Prime Contractor within ten working days of receipt of the drawings.

3. If the Design Engineer's reply indicates rejection or advises corrections or additions to the drawings, steps 1 and 2 are repeated until the Design Engineer indicates that approval will be given.

4. The Contractor shall then submit 8 sets of drawings to the Design Engineer for approval and distribution by the Design Engineer per the standard operating procedures of the City.

5. The Contractor shall take care that every separate document in each set of every submittal shall carry the following identifying information:

	Information Required	Example
a.	Community name of project	Worcester
b.	Contract No.	M21-9
c.	Identifying item number from proposal if applicable.	34
d.	Locations where material is proposed to be used, if applicable.	Carroll Plaza
e.	Name of submitting contractor	Doe Engineering
f.	Personal signature and title of an official of the Prime Contractor authorized to make shop drawing submittals	Joe Doe, Pres.
g.	Date of signature or submittal	
h.	Description of what is on drawing	
j.	A clear, signed Professional Engineer's stamp to be affixed per Specifications.	

The Contractor shall not receive payment for, nor will he be allowed to install any item or materials which require shop drawing approval unless and until he has received shop drawing approval for that item from the Design Engineer with an approval stamp placed thereon.

The following is a partial list of items and materials that require shop drawing approval. Along with each item may be listed certain information which shall be clearly marked on the shop drawing or submittal.

- Site Lighting
- Carroll Plaza Sculpture
- Special Purpose Lighting and Audio Control
- Fountain Components
- Stamped Asphalt Crosswalk/Median with Thermoplastic Marking System
- Granite Hardscape Materials
- Site Drainage

- Security Bollard Modules
- Hose Bib
- Temporary Fence
- Plantings
- Planting Soil Mix

Within 15 days after receipt of an approved shop drawing for any item, the Contractor shall provide the City written proof that he has ordered such approved materials and written confirmation of such order and delivery schedule from the manufacturer of the item. This delivery schedule shall be appropriate for timely completion of this project.

MATERIAL REMOVED AND STACKED

Materials directed to be removed and stacked which are the property of the City of Worcester, shall be removed, transported to and stacked in the DPW yard at 1065 Millbury Street (formerly 115 Ballard Street). All materials shall be neatly stacked as directed by the City of Worcester highway and/or water/sewer superintendents. In addition, all materials stacked shall be signed for by said superintendents.

Any materials damaged or lost during, or subsequent to, removal shall be replaced in kind by the Contractor without additional compensation.

All surplus materials resulting from excavation and not needed for use on the project, as determined by the Engineer, shall be disposed of by the Contractor outside and away from the limits of the project, subject to the regulations and requirements of local authorities governing the disposal of such materials at no additional compensation.

SAWCUTS

Sawcuts shall be made in existing pavement at the limits of full depth construction, limits of resurfaced pavement construction, locations where granite curbing is to be removed and reset, and as directed by the Engineer. At no time will feathering of pavement to meet existing conditions be permitted. All work associated with sawcutting at pavement limits shall be considered incidental to the project and the cost shall be included as part of the appropriate item.

PROTECTION OF UTILITIES AND PROPERTIES

(Supplementing Subsection 7.18 of the MassDOT Standard Specifications)

The Contractor's attention is directed to the location of underground utilities in the existing and proposed roadways and sidewalks.

The Contract Drawings indicate the approximate location in plan of existing overhead and subsurface utilities in the vicinity of the work.

Whatever measures are necessary to protect these lines during the work shall be included in the contract unit price for the various items involved.

The Contractor shall determine the exact location of all existing utilities before commencing work. He agrees to be fully responsible for any and all damages, which might be occasioned by his failure to exactly locate and preserve any and all underground utilities. The Contractor shall include in his bid a sufficient allowance to cover the cost of any exploratory excavations, which are needed to verify utility locations and to accomplish all of the required work.

In case of damage to utilities, the Contractor shall promptly notify the owner and shall, if requested, furnish manpower under the owner's direction in getting access to the utility. Pipes and other structures damaged by the operation of the Contractor may be repaired by the Owner, either the municipality or the utility company. The cost of such repairs shall be borne by the Contractor without compensation therefore.

The work to be done under this contract may necessitate changes in the properties of utility companies or the municipality herein before listed. Immediately after executing the contract, the Contractor shall confer with the owners of all utilities in order that relocations of mains or services may be made at times consistent with operations of this contract.

PUBLIC SAFETY AND CONVENIENCE

(Supplementing Subsection 7.09 of the MassDOT Standard Specifications)

The Contractor shall without additional compensation be required to provide safe and convenient access to all abutters during the prosecution of the work. Necessary access for fire apparatus and other emergency vehicles shall be maintained at all times. Trenches shall not be excavated in traveled ways until all materials and equipment required for such work are at the site and available for immediate use. When work is not in progress, trenches in areas subject to public travel shall be covered with beveled edged steel plates capable of safely sustaining a 36.5 ton truckload with impact without additional compensation. The work in each trench shall be practically continuous, with the placing of electrical conduit or pipe, backfilling and patching of the surface closely following each operation. Payment for steel plates will be included under the unit price bid per linear foot for each respective conduit or pipe item, regardless of the width of the trench.

Since the work on this project will be performed on a heavily traveled roadway, the Contractor shall take every measure necessary for the protection of personnel and property.

The Contractor shall provide and use all necessary warning devices, barricades, signs, special apparel, etc., in performance of the work, as set forth in Section 850 of the Massachusetts Standard Specification for Highways and Bridges.

The Contractor shall at all times, until written acceptance of the physical work by the Owner, be responsible for the protection of the work and shall take all precautions for preventing injuries to persons or damage to property on or about the project.

All automotive equipment, not protected by traffic control devices, that is working on a project, which is open to traffic, shall have on amber flashing or strobe warning light mounted on the cab roof or on the highest practical point of the machinery. These lights shall be in operation whenever the equipment is working on the highway and/or traveling in the work area at a speed of less than 25 mph.

Flashers must be visible to both oncoming and overtaking vehicular traffic and shall have a light source of 32 minimum candlepower and a flashing frequency of 50-60 times per minute.

All personnel who are working on the traveled way or breakdown lane shall wear approved safety vests.

All vehicles except passenger cars which are assigned to the project which operate at speeds of 25 mph or less shall have an official slow moving vehicle emblem displayed in accordance with the provisions of Section 7 of Chapter 90 of the General Laws as amended by Chapter 684 of the Acts of 1970.

PROTECTION OF EXISTING UTILITIES AND STRUCTURES

(Supplementing Subsection 7.13 of the MassDOT Standard Specifications)

Excavation and backfill operations shall be carried out in a manner that will prevent cave-in of excavation or the undermining, damage or disturbing of existing utilities and structures or of new work.

Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required, then refilled with new materials and compacted, and the surface restored to the required grade at no additional expense to the Owner.

Any damage due to excavation, backfilling or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage, shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Owner, shall be borne by the Contractor at no additional expense to the Owner.

Where existing subsurface utilities or other facilities adjacent to or crossing through the excavation require temporary support or protection, such temporary support or protection shall be satisfactorily provided by the Contractor, at no additional expense to the Owner. Support or protection of gas utility will be performed by the gas company and the Contractor will be responsible for payment of such work. All necessary measures shall be taken by the Contractor to prevent material movement or settlement of existing facilities or of work in progress.

The plans indicate the approximate location of existing overhead and subsurface utilities in the vicinity of the work and the bidders are advised to verify the information, as its accuracy and completeness are not guaranteed by the City.

PAVEMENT MARKINGS

The Contractor will be responsible for all pavement markings to be applied in accordance with the 2009 Manual on Uniform Traffic Control Devices (MUTCD) as shown on the plans and as directed by the Engineer. All permanent pavement markings shall be thermoplastic.

ARCHITECTURAL ACCESS BOARD TOLERANCES

The Contractor is hereby notified that he is ultimately responsible for constructing all project elements in strict compliance with the current ADA/AAB rules, regulations and standard.

All construction elements in the project associated with sidewalks, walkways, wheelchair ramps and curb cuts are controlled by 521CMR – Rules and Regulation of the Architectural Access Board (AAB).

The AAB Rules and Regulations specify maximum slopes and minimum dimensions required for construction acceptance. There is no tolerance allowed for slopes greater than the maximum slope, or dimensions less than the minimum dimensions.

Contractor shall establish grade elevations at all wheel chair ramp locations and shall set transition lengths according to the appropriate table in the Construction Standards.

All wheelchair ramp joints and transition sections which, define grade changes shall be formed, stacked and checked prior to placing cement concrete. All grade changes are to be made at joints.

DISPOSAL OF EXCAVATION MATERIAL

Surplus material obtained from any type of excavation, and not needed for further use as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the project location, subject to the regulations and requirements of local authorities governing the disposal of such materials, at no additional compensation.

MAINTENANCE OF TRAFFIC AND SAFETY CONTROLS FOR CONSTRUCTION OPERATIONS

Streets under construction shall be open to through traffic and provisions shall be made for access to all abutting land throughout the period of construction. The Contractor shall provide and maintain over or near all obstructions within the construction limits, sufficient temporary signing, barricades and drums to protect the general public from injury. All Temporary Traffic Safety controls for construction operations shall be in accordance with the contract plans and relevant provisions of the Manual on Uniform Traffic Control Devices (MUTCD) latest edition. This work shall be paid for under items within this contract. The removal and resetting of traffic and safely control devices shall receive no additional compensation.

REFLECTORIZED DRUMS

Reflectorized drums shall meet the criteria set forth in the latest edition of the MUTCD. Reflectorized sheeting shall consist of 4 strips of alternating fluorescent orange and white reflectorized sheeting, with orange at the top. Fluorescent orange and white reflectorized sheeting shall be 6 inches wide. The sheeting shall be at least 3 inches off the ground.

Reflective sheeting shall meet or exceed the requirements set forth in the following table:

REFLECTORIZED SHEETING
Minimum Coefficient of Reflection (Candelas per lux per square meter)
From an Observation Angle of 0.2º

	Entrance Angle = -4º	Entrance Angle = 30º
Fluorescent Orange	180	100
White	550	300

Steady or flashing lights shall be used on Reflectorized Drums only at the direction of the Engineer and will be considered incidental to the contract with no additional compensation.

INSPECTION OF WORK

The Contractor is advised that the City of Worcester Department of Public Works and Parks will be provided with a schedule of operations and will, at various times, be on-site to inspect procedures and give directions. For the purpose of observing work that affects their respective properties, inspectors for public agencies and utility companies shall be permitted access to the work, but all official orders and directives to the Contractor will be issued by the Resident Engineer appointed by the City. The Contractor shall be responsible for the cost of any and all electrical inspections.

PERMITS BY CONTRACTOR

The Contractor shall secure all necessary permits from the state, city or town authorities having jurisdiction, for digging of trenches in the streets or highways and all other building and construction operations requiring permits. This work is considered incidental to other items of work in the contact and no separate payment shall be made.

FAILURE TO COMPLETE WORK ON TIME

In case the Contractor fails to complete the Work satisfactorily on or before the date of completion fixed herein or as duly extended as hereinbefore provided, the Contractor agrees that the Owner shall deduct from the payments due the Contractor each month the sum of Two Hundred ($250.00) dollars for each calendar day of delay. If the payments due the Contractor are less than the amount of such liquidated damages, said damages shall be deducted from any other monies due or to become due the Contractor, and, in case such damages exceed the amount of all monies due or to become due the Contractor, the Contractor or his Surety shall pay the balance to the Owner.

CONSTRUCTION (STAKES) STAKINGS

The Contractor shall employ, at his own expense, a competent civil engineer registered within the State as a Professional Engineer or Land Surveyor. The Contractor shall require said engineer to establish all lines, elevations, stakes, reference marks, batter boards, etc., needed by the Contractor during the progress of the Work, and from time to time, to verify such marks by instrument or other appropriate means.

The Engineer shall be permitted at all times to check the lines, elevations, reference marks, stakes, batter boards, etc., set by the Contractor, who shall correct any errors in lines, elevations, stakes, reference marks, batter boards, etc. disclosed by such check. Such a check shall not be construed to be an approval of the Contractor's work and shall not relieve or diminish in any way the responsibility of the contractor for the accurate and satisfactory construction and completion of the entire Work.

The Contractor shall make, check, and be responsible for all measurements and dimensions necessary for the proper construction of and the prevention of misfittings in the Work.

SANITARY REGULATIONS

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such a manner as may be required.

B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or any adjacent property.

MAINTENANCE OF DRAINAGE SYSTEMS

It shall be the contractor's responsibility to maintain drainage functioning properly in the areas under construction prior to the time when the final system is put into use.

Where new pipe is to be connected into an existing structure, the existing structure shall be first cleaned of all mud, debris and other material.

The existing structure wall shall be carefully and neatly cut to provide the minimum size opening required for the insertion of the new pipe. The proposed pipe end shall be set or cut flush with the inside face of the existing structure wall and the remaining space around the pipe completely filled with cement grout for the full thickness of the structure.

Existing shaped inverts in manholes shall be reconstructed as necessary to provide a smooth and uniform flow channel from the new pipe through the existing structure.

All structures within the limits of the project shall be left in a clean and operable condition at the completion of the work.

SITE INVESTIGATION

The Contractor acknowledges that he has satisfied himself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint himself with available information will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor is further directed to make any and all questions known to the Engineer at the mandatory pre-bid Conference.

DISTURBANCE OF BOUNDS

The contractor shall replace all bounds disturbed by his operation, at his own expense, except as otherwise shown on the Drawings. The bounds shall be relocated by a land surveyor approved by the engineer and registered in the State of Massachusetts.

PRICE ADJUSTMENT – HOT MIX ASPHALT, DIESEL FUEL AND GASOLINE, PORTLAND CEMENT CONCRETE MIXES, STRUCTURAL STEEL AND REINFORCING STEEL

The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Hot Mix Asphalt, Diesel Fuel and, Gasoline, Portland Cement Concrete, and Structural Steel and Reinforcing Steel. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. The price adjustments will be made on a monthly basis. Calculation of price adjustments will be based on MassDOT Policy (See Appendix). The reference (base) price for comparison shall be the prices listed as updated January 5, 2021 at 9:15 AM on MassDOT's website for price adjustments.

The base price for liquid asphalt on this project is $542.50 per ton.

The base price for diesel fuel on this project is $2.307 per gallon and for gasoline $2.222 per gallon.

The base price for Portland cement on this project is $146.36 per ton.

GUARANTEE AFTER FINAL ACCEPTANCE

The Contractor shall diagnose (trouble-shoot) the lighting system, control systems and water components of the sculpture and, at his own expense replace any part of these systems found to be defective in workmanship, material or manner of functioning within six months from date of final acceptance of all the installations under this Contract.

Upon the date of acceptance of the project by the City, the Contractor shall turn over all guarantees and warranties to the City, as applicable.

FINAL CLEANUP

Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the condition of the site shall be approved by the Engineer.

The following Special Provisions modify/clarify sections of the City of Worcester Construction Standards dated February 1, 2020 and/or the 2020 MassDOT Standard Specifications for Highways and Bridges.

ITEM 113. TEST HOLE EXCAVATION AND BACKFILL EACH

The work to be performed under this item shall conform to the relevant provisions of Section 140 of the MassDOT Standard Specifications.

Test pits shall be performed at the direction of the Engineer and shall be used to identify existing utilities or other potential subsurface obstructions. The Contractor shall provide necessary tools to measure the depth to the utility or obstruction. The Contractor shall excavate by hand when in the immediate vicinity of existing utilities to avoid damaging the utility. Any existing utility damaged by the Contractor's operations while excavating test pits shall be repaired at the Contractor's expense.

Test pits shall have the general dimensions of 3 feet wide x 6 long x 5 feet deep.

METHOD OF MEASUREMENT
Test Pit for Exploration shall be measured per each, complete.

BASIS OF PAYMENT
Test Pit for Exploration shall be paid for at the contract unit price per each, which price shall include all labor, materials, equipment, and incidental costs required to complete the work. Hand excavation where necessary is included in the cost for Item 113.

ITEM 810.2 ELECTRICAL HANDHOLE – PRECAST CONCRETE EACH

The work under this Item shall conform to the relevant provisions of Section 801 of the Standard Specifications, Section 800 of the Standard Specifications and City of Worcester Street Lighting Standards and Details, and the following:

All electric handhole boxes for street lighting shall be as indicated on the detail sheet of the drawing set.

Materials
The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer. All materials which have been damaged after delivery shall be removed and replaced with new.

All materials must be in compliance with the AASHTO and ASTM designations and with the approved manufacture's drawings.

Divider
All handholes and electrical cabinet shall have a divider to separate power and communication wiring.

Construction
Precast structure shall have four-3/4 inch galvanized steel suspension bolts or threaded rods that are threaded into the precast structure. The bolts must be placed to allow for proper and sufficient adjustment of the frame and cover as necessary to make the frame and cover flush to finish grade.

Furnish and install a 5/8" x 10' long copper clad ground rod, a grounding clamp, and 3 feet of bare #4 AWG with each electric handhole. The frame and cover of each handhole must be grounded in accordance with national and local electric codes.

Basis of Payment
Item 810.2 will be measured and paid for at the Contract unit price per Each electrical handhole, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 811.20	**ELECTRIC LOAD CENTER BASE (CONCRETE)**	**EACH**
ITEM 821.20	**STREET LIGHTING CONTROL LOAD CENTER**	**EACH**

DESCRIPTION
The work shall include, but not be limited to, the installation of electrical underground service conduit, meter sockets, electrical metering and control cabinet, distribution panels, circuit breakers, receptacles, foundations, and appropriate grounding

Submittals
List of materials and equipment requiring shop drawings shall include:

1. Conduits
2. Panelboards
3. Service Cabinets and Equipment
4. Meter Sockets
5. Disconnect Switch
6. Circuit Breakers
7. Wiring Devices and Receptacles
8. Contactor
9. Time Clock
10. Photocell

MATERIALS
General
Materials and products furnished shall be designed for the intended use, shall meet all requirements of the latest edition of the National Electric Code (NEC), and all local codes.

Materials shall be manufactured in accordance with the standards indicated in this Section, and typical industry standards and codes for the products specified. Materials and equipment shall be Underwriter's Laboratory (UL) listed.

The materials used shall be new, unused, and of the best quality for the intended use. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation. The required information should be marked on durable nameplates that are permanently fastened to the equipment.

Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored outside exposed to the elements. If

any equipment or apparatus is damaged, such damage shall be repaired at no additional cost, or replaced at no additional cost as directed by the Engineer.

Obtain all necessary permits and licenses, file necessary plans, and pay all fees for permits and inspections. Permit fees are the responsibility of the Contractor as part of his bid.

Enclosure Cabinet
Provide outdoor NEMA 4X metering cabinet. Contractor to size cabinet to coordinate with equipment to be installed within cabinets. Cabinet to include all equipment shown or implied and all equipment shall be installed inside of cabinet without physical conflicts and per NEC. Cabinet to be sized for all necessary conduits, whether active, spare or future as listed on panelboard schedules.

Cabinets to be manufactured from 14 gauge minimum stainless steel with 12 gauge steel panel, mounted inside. Cabinets to have integral keyed locking mechanism, keyed alike, with provision for pad-lock. Cabinets shall be ventilated type and factory painted black powder-coat. Cabinets to have door hold-open latches.

Utility Meter
Mounted on outside of cabinet. Watt hour meter socket, 200A with bypass 120/208V, 1PH, 3W. Cabinet must be painted black by manufacturer, as field painting is not acceptable.

Main Disconnect
NEMA 1, 120/208V, 1PH, 3W, 200AMP, 2 Pole, 22,000AIC ULSE rated.

Panelboard
NEMA 1, 16 circuit with (1) 200 AMP, 2 Pole MCB, (1) 40 AMP, 2 Pole breaker, (1) 60 AMP, 2 Pole breaker, (2) 20 AMP, 1 Pole breakers, (4) 20 AMP, 1 Pole spare breakers

Load Center
NEMA , 120/208V, 1PH, 3W, 200AMP

Light Contactor
NEMA 1 Enclosure 60 A, 2P, Solid Neutral, Mechanically held with two wire control relay and three position switch.

Time Clock
40 AMP, Astronomical time switch, 120 Volt, SPST. Set sunset to sunrise operation at 42deg North Latitude -16 min offset.

Receptacle
GFCI Duplex convenience receptacle: 120V, 20 AMP, GFCI (NEMA 5-20R) in handy box with cover.

Cabinet Light
Single pole single throw switch and light socket with 18W CFL.

Photocell
Twist lock photo electric switch cell. Provide ½" hole and glass window for photocell eye. Seal around window to make water tight. Coordinate the location on each cabinet to be in the top corner with the

photocell eye aimed in the Northwest direction.

Backboard
Provide interior plywood panel for mounting electrical components; finish with white enamel.

Foundation
Metering cabinet to be installed on new concrete foundation as shown in plans using Class D concrete, #3 rebar at 18" at the top, #5 rebar at 12" at the bottom, and a 12" gravel sub-base. Contractor responsible for coordinating foundation dimensions to be 6-inches wider than cabinet. Foundation shall rise 12" above finished grade and shall be at a depth of 24" below grade. Foundation shall have a 1" chamfer around edge.

Wiring
All conductors shall be annealed copper, 98% conductivity, Class B stranded, except conductors used for power and lighting circuits No. 10 AWG and smaller which may be solid. All conductors should be rated for 600 volts or less, with a thermal rating of 90° C.

The outside covering of all wiring for power, lighting, grounding, and control uses shall be color coded to identify polarity as follows:

Phase	Color
A or 1	Black
B or 2	Red
C or 3	Blue
Neutral	White
Equipment Ground	Green

Wire shall be sized as called out on the plans for each street lighting load center.

Raceways (Conduit)
Rigid Galvanized Steel (RGS) conduit shall be used for all wiring through the foundation. Conduit shall be fully threaded at both ends and each length shall be furnished with one threaded coupling.

Conduits shall be made electrically continuous at coupling and connections to cabinet by means joining fasteners or copper bond wires. Conduit shall be connected to grounded structural steel or the ground network. After assembly all conduit locknuts, all EMT coupling fittings, and all bond wire screws shall be set up tight before installation of wiring. Insulated metallic bushings shall be used on all conduits entering panel cabinets.

Polyvinyl Chloride (PVC) Conduit, electrical, gray, 3" Schedule 80, one or two conduits in a trench as specified in plans, meeting the requirements of UL 651 and NEMA TC-2. If concrete encasement is required, Class C concrete shall be used. All conduits placed under roadways, and subject to vehicular traffic, shall be concrete-encased 3" Schedule 80.

2" Schedule 80 PVC is only to be used between light pole foundations and the nearest connecting handhole, not for connections to lighting load center.

Grounding

#4 bare copper grounding wire is to be set in the foundation as shown in the plans. The #4 grounding wire should exit the top of the foundation through a ¾" PVC sleeve and be connected to the main breaker first and then to the enclosure grounding Lug.

Below grade, the #4 bare copper wire shall exit the foundation in two locations and connect to (2) 5/8" x 10' copper clad ground rods. The #4 bare copper wire shall be exothermically welded to the grounding rod. The grounding rods shall also be connected to a grounding grid of #1/0 bare copper grounding wire as shown in the plans.

CONSTRUCTION METHODS

General

This Section covers the requirements for installation of materials, proper workmanship, testing, cleaning, grounding, and work methods to be followed by the Contractor. This Section also includes specific instructions and to be used in conjunction with the contract Drawings. Any discrepancies noted between the specification, Drawings, and actual installation shall be reported immediately. Failure on the part of the Contractor to report discrepancies immediately will be considered negligent.

Work will be coordinated such that systems can be properly located, and conflicts and delays are avoided.

Materials And Workmanship

The Contractor's work shall be executed in workmanlike manner and shall present neat, rectilinear and mechanical appearance when completed. Material and equipment shall be new and installed according to manufacturer's recommended best practice so that complete installation shall operate safely and efficiently.

Testing, Inspection And Cleaning

The Contractor will test wiring and connections for continuity and grounds before fixtures are connected; demonstrate insulation resistance by megger test as required at not less than 500 volts. Insulation resistance between conductors and grounds for secondary distribution systems shall meet National Electrical Code (NEC) requirements.

Grounding

The Contractor shall ensure bond and ground equipment and systems connected under this Section are in accordance with standards of the NEC and other applicable regulations and codes.

Electrical Service Conduit Installation

Conduit for new underground utility service shall be 4" PVC Schedule 80, electrical conduit from existing utility manhole as shown. Conduit sweeps at metering cabinet shall be rigid galvanized steel (RGS), 24" minimum radius (as required by Utility). Provide 3-conductor, #3/0AWG 600V service cable with ground to utility transformer for new 200A service to metering cabinet.

Operating and Maintenance Manual

Upon completion of the work of this Contract, deliver to the Engineer two (2) copies of an Operation and Maintenance (O & M) Manual. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered

binders, with pocket folders for folded sheet information. Include a separate section for each system or sub-system. Sections shall be separated by heavy plastic dividers with tabs that identify the material in each section. Place a permanent label or title block on each binder for identification.

1. Include the following information on the label:

    a. O & M Manual for _____ (Project name)
    b. Date
    c. Name and address of Engineer
    d. Name and address of Contractor
    e. Name and address of Sub-Contractor

2. Provide the following in each manual:

    1. Table of Contents
    2. Listing of all service agents with addresses and telephone numbers
    3. Description of systems operation
    4. Emergency instructions for equipment and/or systems where appropriate
    5. Wiring diagrams and piping diagrams specific to systems installed.
    6. Manufacturers' operating and maintenance instructions for each piece of equipment installed
    7. Inspection procedures
    8. Spare parts list
    9. Copies of all panelboard circuit indexes.
    11. Copies of all warranties and guarantees.
    12. Copies of submittals and shop drawings.

BASIS OF PAYMENT

The cost for all work under these items shall be included in contract unit bid price per each and shall constitute full compensation for all equipment, labor, materials, set up and incidental costs necessary to furnish and install new metering cabinet, concrete foundation for metering cabinet, electrical service, meter socket, panelboard and all other accessories and other ancillary labor and materials, all as described in the previous sections herein or as shown on the plans.

ITEM 910.2017 BICYCLE RACK EACH

DESCRIPTION

This item of work shall consist of furnishing and installing Bike Racks at the locations shown on the plans and as specified herein.

SUBMITTALS

For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

MATERIALS

Bike Rack: – shall match trash receptacle from the Main Street Project.

1. Acceptable manufacturers include the following:
    a. DuMor, Inc. – Model No. Bike Rack 291
    b. Victor Stanley, Inc. – BRQS-101
    c. Landscape Forms – Bola
    d. Or equivalent.
2. Color and finish shall be a Medium Gloss Black Exterior Powder Coating. Shall have a minimum 3 year limited warranty.

3. Bicycle rack shall be embedded mount; surface mount shall not be acceptable.

4. The Contractor shall submit detailed shop drawings and product data describing Bike Rack dimensions and layout, mounting, accessories, materials, color, finish, handling, warranty and installation procedures for the approval of the Engineer.

CONSTRUCTION METHODS

The Bike Racks shall be embedded mounted to the paving at locations as shown on the plans and in accordance with the manufacturer's directions. The concrete sidewalk under the street furniture shall be adjusted to a thickness of 8" as specified in the details.

METHOD OF MEASUREMENT

This item shall be measured per each, complete in place.

BASIS OF PAYMENT

This item shall be paid for at the Contract unit price per each, which price shall constitute full and complete compensation for all labor, materials, including Bike Rack, mounting hardware and equipment and all other incidentals required to finish the work, complete and accepted by the Engineer.

ITEM 910.2021 FRAME & GRATE (OR COVER) REMOVED & STACKED EACH

The work to be performed under this item shall conform to the relevant provisions of Section 201 and 220 of the MassDOT Standard Specifications and the following:

All existing castings which are salvageable where designated on plans or as determined by the Engineer shall be removed and transported to the DPW yard at 1065 Millbury Street (formerly 115 Ballard Street). Non-salvageable castings where designated on plans or as determined by the Engineer shall become the property of the Contractor and shall be properly disposed of off the site.

METHOD OF MEASUREMENT

Frame and Grate (or Cover) Removed and Stacked shall be measured per each, complete.

BASIS OF PAYMENT

Frame and Grate (or Cover) Removed and Stacked shall be paid for at the contract unit price per each, which price shall include all labor, materials, equipment, transportation, and incidental costs required to complete the work.

ITEM 911.2021 18" PVC DRAIN BASIN AND PEDESTRIAN GRATE/COVER EACH

PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and

referenced within the contract specifications. The ductile iron grates and covers for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

MATERIALS
The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

The grates and frames furnished for all surface drainage inlets shall be ductile iron and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting various wheel loads as specified by Nyloplast. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Grates and covers shall be provided painted black.

INSTALLATION
The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 1, class 2, or class 3 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be well placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For load rated installations, a concrete slab shall be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

METHOD OF MEASUREMENT
18" PVC Drain Basin and Pedestrian Grate/Cover shall be measured per each, complete.

BASIS OF PAYMENT
18" PVC Drain Basin and Pedestrian Grate/Cover shall be paid for at the contract unit price per each, which price shall include all excavation, fine grading, compacting, labor, materials, equipment, transportation, and incidental costs required to complete the work. No additional payments for these items will be made under their individual bid item prices.

ITEM 912.2021 HOSE BIB EACH
ITEM 913.2021 METER CHAMBER EACH

The work under these Items shall conform to the relevant provisions of Section 300 of the Standard Specifications and the following:

General
The work under these Items shall include all materials, equipment, labor and incidentals for the complete installation of the new water service piping, meter chamber with meter and backflow prevention device, boxed ground hydrants and all necessary fittings and appurtenances within the limits of the project as noted on the Drawings.

Materials

Meter Chamber

Meter chamber structure shall have a minimum 28 day compressive strength of 4000 psi, reinforced for AASHTO H-20 loading. Vault to be absent a base section and installed on a base of crushed stone to allow for drainage of vault structure.

Hose Bib

The boxed ground hydrant shall be model M-5100 as manufactured by Murdock Mfg., or approved equal. Hydrant shall be equipped with a ¾" inlet connection and ¾" hose thread outlet connection.

Construction Methods

Meter Chamber

The meter chamber shall be set on compacted crushed stone with vertical sections and steps in true alignment. Chamber sections shall be sealed as shown on the Contract Drawings. Gaskets shall be installed in all joints in accordance with the manufacturer's recommendation. Manhole frame shall be set with the top conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings or directed. Frames shall be set concentric with the top of the masonry and in full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

Hose Bib

Hose Bib shall be installed as shown on the Drawings, set in a true vertical position with the tops set flush with finished grade.

Method of Measurement

Meter Chamber

Meter chamber will be measured for payment for each meter chamber installed and accepted by the Engineer.

Hose Bib

Hose Bib will be measured for payment for each Hose Bib installed and accepted by the Engineer.

Basis of Payment

Service Fittings

All service fittings required to complete the work shall be incidental to the laying of the copper tubing.

Meter Chamber

The unit price shall constitute full compensation for furnishing and installing the meter chamber, complete, as shown on the Drawings and as specified. Excavation , including saw cutting existing pavement, concrete, removal and resetting of existing brickwork, removal and disposal of concrete and bituminous concrete, if encountered, bedding, backfill and restoration of property including sidewalk reconstruction and dust control measures and all other incidental work not included under other Items. The unit price shall also include the furnishing and installation of all interior plumbing components included the reduced pressure zone assembly and all pipe, fittings and adaptors required to complete the work as shown on the Drawings and as specified.

Hose Bib
The unit price shall constitute full compensation for furnishing and installing box ground hydrants, complete, as shown on the Drawings or as directed by the Engineer, including excavation, removal and disposal of concrete and bituminous concrete, if encountered, bedding, backfill and restoration of the property to include loaming, seeing and curbing (granite or concrete reset in concrete) and sidewalk restoration.

ITEM 914.2020 TRASH RECEPTACLE EACH

DESCRIPTION:
This item of work shall consist of furnishing and installing Trash Receptacles at the locations shown on the plans and as specified herein.

SUBMITTALS
For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

MATERIALS
Trash Receptacle – shall match trash receptacle from the Main Street Project.

1. Acceptable manufacturers include the following:
    a. DuMor, Inc. – Model No. Receptacle 157-32
    b. Victor Stanley, Inc. – Model No. S-42
    c. Landscape Forms – Plainwell
    d. Or equivalent.

2. Color and finish shall be a Medium Gloss Black Exterior Powder Coating. (trash receptacle, liner and lid) Receptacle shall have a minimum 20 year limited warranty.

3. The lid shall be side opening with a sand pan.

4. Trash Receptacle shall be surface mount. Bolts shall be a ½ inch x 8 inches, vandal resistant, stainless steel. Expansion shield shall be of the correct size to receive the bolt specified above.

5. The Contractor shall submit detailed shop drawings and product data describing Trash Receptacle dimensions and layout, mounting, accessories, materials, color, finish, handling, warranty and installation procedures for the approval of the Engineer.

CONSTRUCTION METHODS
The Trash Receptacles shall be installed at locations as shown on the plans and in accordance with the manufacturer's directions. The concrete sidewalk under the street furniture shall be adjusted to a thickness of 8" as specified in the details.

METHOD OF MEASUREMENT
This item shall be measured per each, complete in place.

BASIS OF PAYMENT

This item shall be paid for at the Contract unit price per each, which price shall constitute full and complete compensation for all labor, materials, including Trash Receptacle, mounting hardware and equipment and all other incidentals required to finish the work, complete and accepted by the Engineer.

ITEM 914.2021	**LANDSCAPE CURB - STRAIGHT**	**FOOT**
ITEM 915.2021	**LANDSCAPE CURB – RADIAL**	**FOOT**

GENERAL

The work to be done under these items shall conform to the relevant provisions of Section 501 of the Standard Specifications and the following:

This item of work shall consist of fabricating and installing curbs and mortar joints. This item shall include the labor, materials, and equipment required to furnish and install the curbs. Construct items to the lines and grades as shown on the drawings and to the satisfaction of the Engineer.

SUBMITTALS

Provide the submittals for approval before proceeding with the work.

Shop Drawings

Granite items showing sections and profiles.

Samples and Product Literature

Granite pieces (5) that represent general range of texture and color proposed.

MATERIALS

Granite

Granite shall be Tabor Black, Addison Black, Cold Spring Black, Cambrian Black, Imperial Black, or or approved equivalent (fine to medium textured black stone). Only one variety will be accepted for all items using this type. Provide flamed finish on all exposed sides.

An acceptable vendor of granite are:

Vermont Stone Art
Architectural Sales MA/NH/ME/CT/RI
Office: (802) 505-2503.
14 North Main Street, Suite 2010, Barre, VT 05641

Polycor
Jerome Bureau
Regional Sales Manager
Cell 819-214-0098

Structural Stone, LLC,
285 Smith Street,
North Kingstown, RI 02852
401/667-4969

Granite shall be sound and uniform in quality, texture, and strength, and shall be free of flaws, reeds, rifts, laminations, cracks, seams, starts, or other defects that may impair its strength, durability, function, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects that would affect its appearance. The Dimension Stone Design Manual, Version VIII, 2016 Marble Institute of America quality standards shall apply to the work.

Granite Fabrication

1. Obtain all granite from single source.
2. All faces shall be at right angles to the plane of the top unless otherwise noted.
3. Granite shall be cut accurately to required shapes and dimensions. Tolerances shall be less than 1/8".
4. Holes, cut-outs, sinkages and openings in granite work for anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to required dimensions, as shown on the approved Shop Drawings, and as necessary to secure granite in place to insure correct location and accurate fit of all fixtures.
5. Arrises shall be cut sharp and true to square and continuous with adjoining arrises. Where exposed, arrises shall be eased as shown on contract documents and approved shop drawings.

Sand (In Mortar)

Sand shall be clean, washed uniformly well graded masonry sand conforming to the requirements of ASTM Specification C 144 70 with the further requirements that the fineness modulus shall be maintained at 2.25 plus/minus 0.10. Sand shall be from a single source meeting these requirements and as approved by the Engineer after laboratory test. Source of supply shall not be changed during the course of job without written consent of the Engineer.

Portland Cement (In Mortar)

Portland cement shall conform to the requirements of AASHTO M240 mortar.

Latex Bonding Agent (In Mortar)

The latex bonding agent shall be non re emulsifiable in the presence of moisture and shall have not less than 50% internally plasticized solids. It shall be similar and equal to Laticrete and used in accordance with manufacturer's instructions. Laticrete #3701 is a grout and mortar admixture, manufactured by Laticrete International, Woodbridge, Connecticut.

Colorant (In Mortar)

The colorant shall be of a type and quality which will not adversely affect workability, setting or strength and shall be compatible with the latex bonding agent employed. The color shall be chemically inert, non fading, alkali fast mineral oxides, finely ground and specially prepared for use in cement mortar.

Concrete Base

Concrete for base course shall conform to the requirements of M4.02.00 for Class C cement concrete. Concrete shall be High Early Strength (HES).

Water

Water shall be potable and free of injurious contaminants.

CONSTRUCTION METHODS

Cut landscape curbs at utility structures as needed.

Extreme care shall be taken during the handling to avoid damage to the Materials. Slings, nylon straps, or other such non-invasive devices must be used to move the stones. Chains will NOT be allowed. The Contractor shall be responsible for the replacement of any stones that become damaged during handling at no additional cost to the client.

Construct items to the lines and grades as shown on the drawings and to the satisfaction of the Engineer. Install components level and plumb. Anchor components securely in place. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

Measurement and Payment

Curb shall be measured complete in place as determined by the Engineer.

Curb will be paid for at the contract unit price, as Linear Foot, complete in place which price will be full compensation for furnishing, installing all granite, mortar, joints, and HES concrete foundations. Also included is the cutting of the landscape curbs at utility structures. This price includes incidental labor and materials necessary to complete the work.

Excavation will be paid for under Item 120.1 – Unclassified Excavation, Crushed stone will be paid for under Item 156.12 - Crushed Stone for Curb Foundation. Concrete for haunch support shall be included in the cost of the curbing items.

ITEM 916.2021 NEW CONCRETE SIDEWALK 5 INCH W/ WWM SQUARE YARD

Work under this item shall conform to the relevant provisions of Section 701 of the MassDOT Standard Specifications, Section 440 of the City of Worcester Standard Specifications and the following:

Control joints shall be sawcut to a depth equal to at least one-quarter the concrete thickness and a width of one-eight inch. Joints in exposed sidewalk slabs shall be in uniform intervals according to the Drawings, or as directed by the Engineer.

Contractor shall provide and install welded wire mesh per the drawings.

METHOD OF MEASUREMENT

New Concrete Sidewalk shall be measured per square yard, complete in place.

BASIS OF PAYMENT

Payment for Item 440 shall constitute full payment for all labor and materials required to construct new cement concrete sidewalks, including all gravel, excavation, fine grading, compacting and brooming to the grade specified by the Contracting Officer. No additional payments for these items will be made under their individual bid item prices.

ITEM 917.2021 HOT MIX ASPHALT FOR MISCELLANEOUS WORK TON

Work under this item shall conform to the relevant provisions of Sections 420, 460, 470, 501, 701 of the MassDOT Standard Specifications and the following:

Hot mix asphalt shall also be used for restoration of pavement surface after the installation of drainage and water pipes and pavement patch repairs where such areas are specified by the Engineer. The Contractor is advised that this is material which will be spread primarily by hand.

No payment will be made for roadway patching done outside the limit of pay excavation shown on the plans and details.

The subsequent removal of this material, if directed by the Engineer, shall also be included in this item.

Hot mix asphalt for miscellaneous work shall be placed only upon the direction of the Engineer.

BASIS OF PAYMENT

Compensation for this work shall be paid for at the contract unit price per ton under the above item which price shall include all labor, materials, equipment, transportation and incidental costs necessary to complete the work to the satisfaction of the Engineer.

ITEM 918.2021 SECURITYBOLLARD MODULE – 2 BOLLARD EACH
ITEM 919.2021 SECURITYBOLLARD MODULE – 3 BOLLARD EACH

The work to be performed under these items includes furnishing and installing security bollard modules at the locations shown on the plans and as directed by the Engineer.

Security Bollards shall be certified as meeting a K12 rating for 50 MPH. The security bollard assembly shall be included on the most recently published Department of Defense (DoD) Anti-Ram Vehicle Barrier List. The assembly shall be a shallow foundation design capable of being installed in modules of 2 bollard or 3 bollard assemblies as needed to fit within the proposed geometry shown on the plans.

Security Bollard Modules shall be Model DSC 600 Shallow Foundation Bollard as manufactured by Delta Scientific or approved equal.

Security bollard modules shall be arranged in assemblies of 2 bollard and 3 bollard arrays. Bollard arrays shall include any modifications required to provide corner assemblies. When separate modules directly abut an adjacent module, the modules shall be installed so as to maintain the required spacing between bollards. Spacing shall be as specified by the manufacturer.

Contractor shall layout the location of the bollard modules prior to excavation. Contractor is responsible for verifying all dimensions to ensure that the modules can be installed as intended.

The location of the bollard module shall be excavated to the proper depth to receive the module. Modules shall be set on a 6 inch base of 3/4" crushed stone. The stone shall be properly compacted to ensure a level, stable base for the module. Module shall be set so that the bollards are located at the locations shown or directed and are level and plumb. Once the Engineer has approved the installation of the modules, concrete fill shall be placed. Concrete shall be 3,000 PSI, 1.5 Inch, 470 Cement Concrete meeting the requirements of Section M4.02.00 of the MassDOT Standard Specifications.

METHOD OF MEASUREMENT

Security Bollard Module – 2 Bollard and Security Bollard Module - 3 Bollard shall be measured per each type of module installed and accepted.

BASIS OF PAYMENT
Security Bollard Module – 2 Bollard and Security Bollard Module - 3 Bollard shall be paid for at the contract unit price per each for the type of module installed, which price shall include all labor, materials, equipment including but not limited to transportation, excavation, compacted crushed stone base, cement concrete and any incidental costs required to complete the work. No additional payment will be made for modified modules required to meet curved installations. Surface treatment shall be paid for under the appropriate item(s).

ITEM 919.2020 STREET LIGHT REMOVED & STACKED EACH

Work under this Item shall include the dismantling, removal, and stacking of the existing roadside highway light poles. All materials owned by the City of Worcester to be removed and stacked as part of this Contract shall be carefully transported by the Contractor to the DPW yard at 1065 Millbury Street (formerly 115 Ballard Street). The Contractor shall be held responsible for any damage to these stacked materials.

CONSTRUCTION METHODS
The work under this item shall also include the removal and disposal of the light pole supports and their foundations as directed by the Engineer.

If the Engineer or the City determines that any part of the stacked materials is unsuitable for re-use, said materials shall become the property of the Contractor and he shall dispose of them outside and away from the limits of the project, without additional compensation.

The work shall include removing the supports, excavating the existing foundation, the disposal of the concrete and supports, the backfilling with compacted gravel of the holes resulting from the excavation and removal of the supports and the replacement, in kind, of any surface material disturbed.

The existing lights shall not be removed until the new lights and structures replacing them are ready for installation or until the Engineer orders their removal.

METHOD OF MEASUREMENT
Street Light Removed and Stacked shall be measured per each light removed and stacked at the City's yard, complete.

BASIS OF PAYMENT
Street Light Removed and Stacked shall be paid for at the contract unit price per each, which price shall include all labor, materials, equipment, transportation, and incidental costs required to complete the work.

ITEM 920.2021 CONCRETE PAVERS SQUARE YARD

GENERAL
The work under this item shall consist of furnishing and laying of concrete pavers with on a sand setting bed on a HES concrete slab.

References

This specification makes reference to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification prior to preparation and installation of any pavements.

1. ASTM International, latest edition:
    a. C 33, Standard Specification for Concrete Aggregates.
    b. C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.
    c. C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
    d. C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
    e. C 144 Standard Specifications for Aggregate for Masonry Mortar.
    f. D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
    g. C 936, Standard Specification for Solid Concrete Interlocking Paving Units.
    h. C 979, Standard Specification for Pigments for Integrally Colored Concrete.
    i. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
    j. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10 lb (44.5 N) Rammer and 18 in. (457 mm) drop.
    k. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units
    l. D 1883, Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
    m. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.
    n. D 4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

SUBMITTALS

Before proceeding with the work, the Contractor will be required to provide the following submittals to the Engineer for approval.

Shop Drawings

Samples

Paver pieces (5) that represent general range of texture, color and size

Product Data

Submit manufacturer's product data for the following:

1. Concrete Pavers
2. Polymeric Joint Sand
3. Bedding Sand

Sample Panel

Construct of concrete pavers on the specified base and before the start of any granite piece paving. Sample panel shall exhibit proposed color range, texture, bond, jointing, pattern, finish, paver size, and workmanship. Unless otherwise indicated, size of panel shall be 6 feet x 6 feet minimum.

MATERIALS

Concrete Pavers

Concrete Pavers shall be manufactured by Unilock or approved equivalent. Pavers shall be Umbriano to the sizes and patterns shown on the drawings and below:

1. Color shall be Summer Wheat. Final Color shall be approved by the Engineer.
2. Sizes:
    a. Large Rectangle: 20.625" x 13.75" x 3.125"
    b. Square: 13.75" x 13.75" x 3.125"
    c. Small Rectangle: 7.125" x 14.125" x 3.125"

3. Sales Representative
    Daniel Neviackas
    Commercial Sales - Unilock New York, Inc. Boston Division
    Office: 508-278-4536 | Mobile: 508-341-4306 | Fax: 508-278-4572
    35 Commerce Drive, Uxbridge, MA 01569

4. Provide pavers meeting the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.

5. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).

6. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.

7. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

Polymeric Sand

Joint filler between paver joints shall be: Polymeric Jointing Sand as manufactured by Techni-Seal, Inc., www.techniseal.com; DP SuperSand Bond by Alliance, at www.supersandbond.com, or approved equal.

Sand Setting Bed

Provide Setting Bed Sand as follows:Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.

Do not use limestone screenings, stone dust, or sand material that does not conform to conform to the grading requirements of ASTM C 33.

Do not use mason sand or sand conforming to ASTM C 144.

Conform to the grading requirements of ASTM C 33 with modifications as shown in Table 2 below:

TABLE 2 – SETTING BED SAND

GRADATION REQUIREMENTS FOR SETTING BED SAND

ASTM C 33

Sieve Size	Percent Passing
3/8 in (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075)	0 to 1

Concrete Base
Concrete for base course shall conform to the requirements of M4.02.00 for Class C cement concrete. Concrete shall be High Early Strength (HES).

Water
Water shall be potable and free of injurious contaminants.

CONSTRUCTION METHODS
General
Masonry shall be laid by skilled workmen under adequate supervision, and shall be laid true to lines and levels referred to in previous paragraphs. Masonry work shall not be laid in temperatures below 40 degrees F., unless provisions are made to adequately protect the masonry materials and the finished work from frost by heating materials, enclosing the work, and heating the enclosed spaces and contact surfaces. All masonry materials used in freezing weather shall be at a temperature between 50 degrees F. and 90 degrees F. Protect masonry against freezing for a minimum of forty-eight (48) hours after being laid. Anti-Freezing admixtures will not be allowed in the mortar. Frozen work shall not be built upon. Any completed work found to be affected by the frost shall be taken apart and rebuilt at the Contractor's expense.

The block paving has been designed to provide adequate drainage at all points. If any condition is encountered between given elevations where drain-off is questionable, the Contractor shall notify the Engineer thereof and not proceed with the work until instructions are given. The finished work shall not deviate from the graded elevations.

The Contractor shall be responsible for closing off traffic to avoid damage to paving until mortar has set.

In case the continuity of the work is suspended, the Contractor shall terminate his paving against temporary wood blocking. The blocks along this blocking shall be set in sand to allow removal and toothing of the blocks in the work to be later continued. All exposed block surfaces shall be thoroughly cleaned with a solution of soap and water, using stiff fiber brushes. In extreme cases area should be wetted with a five (5) percent solution of muriatic (hydrochloric)) acid but this shall be preceded and followed by a copious bath of fresh clean water.

Excavation

The paving shall be designed to provide proper drainage at all points, above and below ground and the required excavation shall be made and the subgrade shall be fine graded 1/8 inch to 1/4 inch per foot to provide proper drainage of the ground before placing the gravel subbase.

Concrete Base Slab

The cement concrete base slab shall be constructed on the gravel subbase and rough finished true, uniform, parallel with and below the surface of the finished block paved areas. Expansion joints in the slab shall be located as shown on the plans or where required by the Engineer. These are located not more than sixteen (16) feet apart.

Setting Bed Sand

1. Provide and spread Setting Bed Sand evenly over the Concrete Underlayment and screed to a nominal thickness of 1 in. (25 mm).
2. Protect screeded Setting Bed Sand from being disturbed by either pedestrian or vehicular traffic.
    a. Screed only the area which can be covered by pavers in one day.
    b. Do not use Setting Bed Sand material to fill depressions greater than depths showing the drawings in the base surface.
3. Keep moisture content constant and density loose and constant until Concrete Pavers are set and compacted.
4. Screed the Setting Bed Sand using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards.
5. Carefully maintain spread Setting Bed Sand in a loose condition, and protected against incidental compaction, both prior to and following screeding. Loosen any incidentally compacted sand or screeded sand left overnight before further paving units are placed.
6. Provide lightly screeded Setting Bed Sand in a loose condition to the predetermined depth, only slightly ahead of the paving units.
7. Fully protect screed Setting Bed Sand against incidental compaction, including compaction by rain. Remove any screeded Setting Bed Sand that is incidentally compacted prior to laying of the paving units. Do not permit either pedestrian or vehicular traffic on the screeded Setting Bed Sand.
8. Inspect the Setting Bed Sand course prior to commencing the placement of the Concrete Pavers. Acceptance of the Setting Bed Sand occurs with the initiation of Concrete Paver placement.

Concrete Pavers

1. Replace Concrete Pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix each color of Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).
3. Exercise care in handling face mix concrete pavers to prevent surfaces from contacting backs or edges of other units.
4. Provide Concrete Pavers using laying pattern as indicated. Adjust laying pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers no smaller than one-third of a whole paver.
5. Use string lines or chalk lines on Setting Bed Sand to hold all pattern lines true.
6. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or

channels.

7. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
    a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
8. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
9. Prevent joint (bond) lines from shifting more than ±1/2 in. (±13 mm) over 50 ft. (15 m) from string lines.
10. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
11. Prevent all traffic on installed Concrete Pavers until Joint Sand has been vibrated into joints. Keep skid steer and forklift equipment off newly laid Concrete Pavers that have not received initial compaction and Joint Sand material.
12. Vibrate Concrete Pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
    a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
    b. Compact installed Concrete Pavers to within 6 feet (2 meters) of the laying face before ending each day's work. Cover Concrete Pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Setting Bed Sand from becoming disturbed.
13. Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.
14. Remove any cracked or structurally damaged Concrete Pavers and replace with new units prior to installing Joint Sand material.

Joint Sand

1. Polymeric Joint Sand
    a. Install Polymeric Joint Sand per manufacturers recommended instructions.Protect surfaces from pedestrian and vehicular traffic for a minimum of 24 hours.

Field Quality Control

1. Verify final elevations for conformance to the drawings after sweeping the surface clean.
    a. Prevent final Concrete Paver finished grade elevations from deviating more than ±3/8 in. (±10 mm) under a 10 ft (3 m) straightedge or indicated slope, for finished surface of paving.
2. Lippage: No greater than 1/32 in. (0.8 mm) difference in height between Concrete Pavers and adjacent paved surfaces.

Repairing, Cleaning And Sealing

1. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
2. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean.
    a. Clean Concrete Pavers in accordance with the manufacturer’s written recommendations.
    b. Clean pavers discolored and stained by concrete cutters slurry immediately. Do not let

pavers site with foreign materials on the surface.

Protection

1. Protect completed work from damage due to subsequent construction activity on the site.

MEASUREMENT AND PAYMENT

Concrete Pavers will be measured and paid for at the contract unit price, per square yard, complete in place which price will be full compensation for furnishing, installing the concrete pavers, HES concrete base courses, gravel, excavation, fine grading, compacting and all incidental labor and materials necessary to complete the work. No additional payments for these items will be made under their individual bid item prices.

ITEM 921.2021 EXPOSED AGGREGATE CONCRETE SQUARE YARD

Work under this item shall conform to the relevant provisions of Sections 476 of the Standard Specifications and the following:

DESCRIPTION

This work shall consist of installing (Decorative) Exposed Aggregate Cement Concrete sidewalks on prepared gravel bases and includes:

1. Dry-shake colored hardener applied to pavements
2. Curing of colored concrete.

Application shall be at the locations indicated on the plans or directed by the Engineer, all in accordance with these specifications.

SUBMITTALS

For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

The Contractor shall construct a finished 5' x 5' sample panel on site for review and approval. The Panel shall remain for reference until all conc. is finished.

MATERIALS

All materials shall be in accordance with applicable sections of the Massachusetts Department of Transportation Standard Specifications for Highway and Bridges and its amendments unless specified below.

DRY-SHAKE COLORED HARDENER:

Dry-shake Colored Hardener: **EMERCHROME SC** Color Hardener; L. M. SCOFIELD COMPANY, factory proportioned, mixed, and packaged, ready-to-use surface hardener. **Color: Smoke Beige 4948**

CURING COMPOUND:
Curing Compound for Dry-Shake Colored Hardener Concrete: Comply with ASTM C309 and be of same manufacturer as colored admixture, for use with dry-shake colored hardener concrete.
Exterior Dry-Shake Colored Hardener Concrete Curing Compound: **LITHOCHROME® COLORWAX**;; L. M.SCOFIELD COMPANY. Use to cure exterior flatwork that will be allowed to weather naturally with no or only occasional maintenance. Color: As selected by design professional from manufacturer's full range.

RETARDER:
Retarder shall be **LITHOCAST Surface Retarder 03**. Contractor must follow the manufacturer's products recommendations.

CURING AND SEALING COMPOUND:
Comply with ASTM C309 and be of same manufacturer as colored admixture, for use with colored concrete. A second coat (seal coat) should be applied 28 days after placement of concrete. L. M. SCOFIELD COMPANY; SCOFIELD® **SCOFIELD® Repello® FPS**

CONSTRUCTION METHODS: All construction methods shall be in accordance with Massachusetts Department of Transportation Standard Specifications for Highway and Bridges and its amendments unless specified below.

Comply with requirements of Section 476 of the Standard Specifications and the following:

1. Minimum Cement Content: Six sacks per cubic yard of concrete.
2. Provide Welded wire mesh as required by the drawings.
3. Slump of concrete shall be consistent throughout Project at 4 inches or less. At no time shall slump exceed 5 inches. If super plasticizers or mid-range water reducers are allowed, slump shall not exceed 8 inches.
    a. Do not add calcium chloride to mix as it causes mottling and surface discoloration.
    b. Supplemental admixtures shall not be used unless approved by manufacturer.
    c. Do not add water to the mix in the field.
    d. Maximum air content shall not exceed 5 percent.

The Contractor shall construct 5' by 5' panel as an example of the finished sidewalk and have this panel approved by the Engineer before completing the rest of the work. This panel shall remain on site until the sidewalk work has been completed.

CONCRETE PLACEMENT

1. Move concrete into place with square-tipped shovels or concrete rakes.
2. Vibrators, when used, shall be inserted and withdrawn vertically.
3. Concrete shall be struck to specified level with wood or magnesium straight edge or mechanical vibrating screed.

4. Concrete surface shall be further leveled and consolidated with highway magnesium straight edge and/or magnesium bull float.
5. Mechanically float concrete surfaces as soon as concrete surface has taken its initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator.

INSTALLATION – DRY-SHAKE COLORED HARDENER

1. Apply 2/3 of specified application rate to freshly floated concrete surface. Bleed water shall not be present during or following application of first and second shake.
2. Distribute evenly by hand or mechanical spreader designed to apply hardeners. Consult L. M. SCOFIELD COMPANY for recommended manufacturers of mechanical spreaders.
3. As soon as dry-shake material has absorbed moisture, indicated by uniform darkening of surface, mechanically float concrete surface a second time, just enough to bring moisture from base slab through dry-shake color hardener.
4. Immediately following second floating, apply remaining 1/3 of specified application rate. If applied by hand, broadcast in opposite direction of first application for a more uniform coverage. If a mechanical spreader is used, apply the same manner as previously described.
5. As soon as dry-shake material has absorbed moisture, mechanically float concrete surface a third time.
6. Do not add water to the surface.
7. As surface further stiffens, remove float blades to expose the power finishing blades or raise combination blades slightly. Flat trowel surface to remove marks and pinholes.
8. Further troweling operations can be done, each time raising blades, until desired texture or finish is obtained.
9. DO NOT BURNISH TROWEL COLORED SURFACE FLOOR HARDENERS.

RETARDER

1. Finishing the method employed to achieve the desired results shall be in applying a chemical concrete set retarder admixture to the surface of the concrete immediately following the trowel finishing operations. The amount of retardant applied shall be per manufacturer's recommendations. The Contractor shall follow the manufacturer's recommendations for using the set retarder to attain the desired results with consideration given to the concrete mix, ambient, curing temperatures, and recommended curing time before performing the mortar procedure.

CURING

1. Pavements shall be cured with liquid membrane curing compound as recommended by manufacturer.
    a. Apply immediately after floor surface has hardened sufficiently so that application of curing compound will not mar surface. Apply uniformly over entire surface at coverage rate recommended by manufacturer and meeting or exceeding the moisture retention requirements of ASTM C309. One coat should be applied as a cure coat. The seal coat should not be applied until 28 days after placement of concrete.
    b. There shall be no free water on surface at time of application.

SEALING

1. Prepare dry, cured concrete surfaces according to manufacturer's instructions.
    a. The seal coat should not be applied until 28 days after placement of concrete, and assumes that a cure coat has been applied.
2. Verify adequacy of slip resistance.

PROTECTION OF FINISHED WORK

1. The General Contractor is responsible for using Temporary Floor Protection throughout the project to safeguard the surface quality of concrete slabs before and after application of decorative finishes or installations of other materials.
    a. All concrete floors that will be not be covered by other materials will be protected throughout the project. The concrete slab must be treated as a finished floor at all times during construction.
    b. Temporary Floor Protection will be removed only while finish work to the concrete is being performed and will be replaced after the final finish has cured sufficiently.

APPLICATOR

3. For a list of qualified contractors, contact your local L. M. SCOFIELD COMPANY representative or the appropriate Division Office: Eastern Division – 201-672-9051; Western Division – 323-720-3000; Central Division Office – 630-377-5959.

Control Joints shall be saw cut per plans. No Additional compensation will be provided for saw cutting joints.

METHOD OF MEASUREMENT

Item 476.13 Exposed Aggregate Concrete Pavement will be measured for payment by the square yard of sidewalk with exposed aggregate finish actually installed in accordance with the Plans and/or directed by the Engineer.

BASIS OF PAYMENT**:** Item 476.13 Exposed Aggregate Concrete Pavement will be paid for at the Contract unit price per square yard. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment, including control and expansion joints material, reinforcement, sealer, gravel, excavation, fine grading, compacting and all incidental labor and materials necessary to complete the work, complete and accepted by the Engineer. No additional payments for these items will be made under their individual bid item prices.

ITEM 922.2021 **RAISED STAGE** **LUMP SUM**

DESCRIPTION

The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to purchase, deliver and install the Raised Stage in locations as shown and detailed on the Drawings.

SUBMITTALS

Submit manufacturer's product data for the wood, mesh panels and hardware.

Submit shop drawing based on field measurements for the Raised Stage.

MATERIALS

Decking

Decking shall be ipe or other approved tropical hardwood lengths per drawings

Framing

Framing shall be Douglas fir timbers or other approved hardwood lengths per drawings

1. Wood shall be pressure treated to prevent rot and decay

Brackets

Hidden brackets shall be galvanized steel. Exposed Brackets shall be 316 Stainless Steel

Hardware

Perforated Metal and Hardware shall be 316 Stainless steel unless otherwise noted in the drawings.

Perforated Metal Mesh (Panels): cut and form to curved shape as shown on drawings. Weld frame to panels on underside.

2. Perforated Metal Mesh shall be McNichol's 316 Stainless steel; 1/2" round holes on 11/16 centers staggered, 11 gauge(.120") 48 % open 2.64 lbs/sqft.
3.

Metal framing shall be 316 Stainless steel; 1/2" wide by lengths indicated on the drawings, 11 gauge(.120") provide framing around entire edge of each mesh panel. Provide drill holes for mounting hardware. Finish per drawing and in accordance with the following ASTM designations unless otherwise indicated: Bars and Shapes A276, AISI Type 316.

Cement Concrete

Concrete for foundation shall conform to the requirements of M4.02.00 for Class C cement concrete. Concrete shall be High Early Strength (HES).

CONSTRUCTION METHODS

All construction methods shall be in accordance with Massachusetts Department of Transportation Standard Specifications for Highway and Bridges and its amendments unless specified below.

Fabrication

1. Fabricate Raised Stage to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
2. Cut wood in the shop to greatest extent possible to minimize field assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
3. Miter decking at corners

Installation

1. Install in locations shown on the Drawings. Install level and plumb.
2. Securely bracket to concrete per manufacturer's instructions.
3. Pre-drill holes in slats and posts to receive hardware
4. Provide additional structural components as needed to provide adequate support

Cleaning

Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed surfaces; wash and scrub clean.

Protection

Protect completed work from damage due to subsequent construction activity on the site.

MEASUREMENT AND PAYMENT

Raised Stage shall be measured complete in place as determined by the Engineer.

Raised Stage will be paid for at the contract unit price, as Lump Sum. complete in place which price will be full compensation for furnishing, installing all wood framing and decking, metal work, hardware, brackets, and concrete footings, This price includes incidental labor and materials necessary to complete the work.

Excavation will be paid for under Item 120.1 - Unclassified Excavation. Gravel will be paid for under Item 151.02 - Gravel.

ITEM 923.2021 EXTERIOR FOUNTAINS LUMP SUM

(BID ALTERNATE #1)

GENERAL

Work of this Section includes all labor, materials, equipment, tools, incidentals, and services necessary to design, engineer, manufacture, supply, and install the Stationary Fountain with related mechanical and electrical systems complete including all components, hardware, and accessories as indicated on the Contract Drawing and specified herein:

Discharge piping systems.
Electrical conduit and wiring systems.
Subterranean Vault
Mechanical and electrical equipment with components and accessories.
Manufacture of primary fountain equipment and components is a "Basis of Design".
Include fountain system testing, adjustment, and operational training for Owner.
Custom fabricated fixtures.
Coordinate with sculpture AV designer

Related Fountain System Work to be Provided by Other Separate Contractors:

Paving systems.
Earthwork including trench excavation and backfill. Art Structure / Pedestal

The customer supplied incoming DMX line will come into the control panel. In the control panel, the DMX signal will go to a DMX to Analog converter that will output a 0-10V signal to the PLC. The PLC will in turn send that speed data to the drive. The data for the DMX signal will be 2 addresses. 1 address will be used for each pump speed. VFD start and stop will be controlled by the PLC.

REFERENCES AND STANDARDS

General: As Specified in Division 1.

"Rules Governing and Restricting the Use and Supply of Water", Worcester, MA.

Department of
Environmental Protection, Bureau of Water and Sewer Operations, Division of Water Connections and Permits.

Other Standards and References:

American Society for Testing and Materials (ASTM). American Water Works Association (AWWAA).
American Public Works Association (APWA).
American National Standards Institute, Inc. (ANSI). National Fire Protection Association (NFPA).

Underwriters Laboratories, Inc. (UL).
National Sanitation Foundation (NSF).
Department of Health (DOH).
National Electric Code (NEC).
American Society of Mechanical Engineers (ASME).
American Society of Sanitary Engineering (ASSE).
Commercial Standards (CS).
National Electrical Manufacturer's Association (NEMA).
Uniform Building Code (UBC).
Institute of Electrical and Electronic Engineers (IEEE).
Insulated Power Cable Engineers Association (IPCEA).
International Plumbing Code (IPC)

All work shall conform to the latest edition of the National Building Code and/or International Plumbing Code.

SYSTEM REQUIREMENTS

Design Requirements:
The fountain described in this Section shall be a fully automated, drain to waste type stationary feature.
The work of this Section shall include design of equipment items for fabrication and installation of fountain equipment and components to suit Project requirements as approved by Owner. See Division 1 for additional provisions related to delegated design by Owner's Engineer.

Performance Requirements:

The fog water feature is a non-circulating drain to waste feature consisting of two zones, each zone shall be operated by a 1 HP high pressure fog pump with variable frequency drive, and 3 discharge points. Each discharge shall go to a custom machined fog puck with six .60 capacity stainless steel fog nozzles. Each zone shall operate at .9 G.P.M. at 1000 P.S.I.

SUBMITTALS

General: Refer to and comply with Division 1 Section, for procedures and additional submittal criteria.

Installer Qualifications: Comply with Article "Quality Assurance" herein. Submit fountain system installer qualifications including resume and system identification of previous work experience on fountain systems of type indicated for Project and the following work:
Plumbing work.
Electrical work
Concrete and Waterproofing Work.
Other specific work; rock work, stainless steel, etc…

Product Data:

Submit manufacturers' data for all equipment and individual components listed in "Part 2 – Products".
Submit a comprehensive electrical package to include a power diagram, logic diagram, process and instrumentation diagram, panel layout, component schedule, and cut sheets on all individual components in the control panel. The contractor shall furnish evidence that the building department has been contacted to assure local compliance and that any exceptions to local requirements or the National Electric Code have been addressed.
Submit for other items and materials of system not indicated in this Section including for items of conduit, wiring, electrical devices, piping and fittings, sealants and/or seals to confirm compatibility and conformance to Project wide requirements.

Shop Drawings: A concise plan, details, and section(s) shall accompany the submittal data on all components to assure compliance with the intended design as specified and shown on the Contract Drawings.

> Include equipment and material handling instructions and interfacing requirements and coordination notes with other trades and contractors.
> If family product data sheets are submitted for approval, cross out all items not appropriate and highlight the selections for the components to be submitted, include all options.

Samples for Verification: Submit for surface exposed elements of system as requested by Architect and highlight only the information that is pertinent.

Quality Control Submittals:

> Test Reports: Fountain manufacturer's test report must be included in the control panel information package. This report shall include results of the test on both motors and all lighting circuits and uncommissioning report indicating proper operation.
> Field Reports: The manufacturer shall provide a field test report in the controls package. This report, which includes information on the field voltage, current, and resistance at all components, must be filled out by the installing electrical contractor and submitted to the manufacturer and the Architect for approval.

Contract Closeout, Operations and Maintenance: Submit manuals pertaining to the operations and maintenance of the fountain system prior to final approval of system installation. The manuals shall include specification sheets, operations and maintenance data, exploded diagrams, replacement part lists, copies of field and test reports, and warranty information. Comply with Division 1.

QUALITY ASSURANCE

General:

Insofar as possible, all materials and equipment used in the installation of this work shall be of the same brand or manufacturer throughout for each class of material or equipment. The specification has allowed for substitutions, however, the substitution process will be strictly

adhered to. If the process is incomplete, or not within the time frame, no substitutions will be considered. Substitutions will not be partially approved. If any item is not approved, the entire submittal will be rejected, not for resubmission. There will be no consideration for alternates, after the bid. Conform to Reference Standards and other Project Manual Sections as applicable. Piping materials shall bear label, stamp, or other markings of specified testing agency.
Use numbers of skilled workmen equal to work requirement or occasion. The skilled workman shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with the specified requirements and methods needed for proper performance of the work in this Section.

Fountain Manufacturer: The fountain equipment described in this section shall be supplied by Delta Fountains, Jacksonville, Florida, (800) 641-6675, Fax: (904) 886-9089. All other fountain manufacturers requesting approval must comply with the requirements listed in the SUBMITTALS section under the Product Data paragraph. All manufacturers' data on individual components listed in PART 2: Products, or pre approved equals where allowed, shall be submitted to the Landscape Architect and fountain consultant, prior to approval. Manufacturers requesting prior approval shall submit to owner, at least 10 business days prior to the bid date, all data on all individual components listed in PART 2: Products, for review by the owner and fountain consultant. All approvals will be issued in an addendum prior to the bid date.

Installer's Qualifications: Plumbing and electrical work for fountain system installation shall be performed by firms with each having at least 5 years of successful commercial fountain installation experience on features similar to that required for the Project.

Water feature contractor qualifications:

1. In entering into a contract covering this work, the Contractor accepts the specifications and drawings and guarantees that the work will be performed in accordance with the requirements of the specifications and drawings or such modifications to said specifications and drawings as may be made in the contract documents. The Contractor, in accepting the contract, has verified the design, and will perform such work as is required to achieve the design intent.
2. The contractor shall currently be in the business of constructing custom water features and shall have a continuous 5 year record of no less than 5 successful projects of equal or greater scope.
3. The Contractor further guarantees that the workmanship and material will be of the best quality procurable and that none but experienced workmen, familiar with each particular class of work, will be employed
4. The Contractor further agrees to hold himself responsible for any defects which may develop in any part of the entire system, including equipment as provided for under this specification, due to faulty workmanship, design or material and to replace, make good, without cost to the Owner, any such faulty parts or construction which may develop at any time within one (1) year from the date of the final acceptance. Any repairs or replacements required because of defects, as outlined in this clause, are to be made promptly and approved in writing by the Landscape Architect.

Field Measurements: Verify dimensions with other work on Project which adjoins the equipment item(s) of this Section or to which work of this Section will be a part.

DELIVERY, STORAGE, AND HANDLING

Packing and Shipping: Fountain manufacturer shall adequately package all shipments to protect the material during shipment. Consolidate freight of like items when possible to ensure minimal shipments. All shipments to be freight on board, manufacturer's plant, with fully insured freight allowed to the jobsite.

Handling and Unloading: All shipments shall be driver signed and counted to verify that all components listed on the packing slips are included in shipment prior to leaving the manufacturer's premise.

Special Handling: Contractor to take necessary precautions in unloading, handling, moving, and storing all shipments, until it is installed in its final position, to protect all components from damage. Contractor to refer to all notes on the shop drawings for any additional instructions on handling fountain equipment.

Acceptance at Site: Contractor to schedule and arrange for delivery of all shipments. Contractor is responsible for preparations of all equipment necessary to safely facilitate the unloading of all shipments and moving it to the final location. Freight is F.O.B plant, full freight allowed to jobsite. Contractor to account for all items in each shipment for accuracy before signing for acceptance of shipment. All damages and shortages shall be clearly documented on the Bill of Lading and packing slip before the delivery driver leaves the premises. The manufacturer shall be promptly notified within 24 hours of any and all documented damages and shortages. By signing the bill of lading, it is mutually agreed that the goods listed are accepted in apparent good order, condition and correct quantity, except as noted, and are in proper condition for transportation according to the applicable regulations of the department of transportation (for truck load shipments). In cases where shipments that are damaged in-transit and are signed for in good condition, it will be the contractor's responsibility to replace those damaged items. All shipments are subject to the manufacture's standard terms and conditions.

Storage and Protection: Contractor shall store all components in their original packages and protect all items from damage until final placement occurs. Contractor shall rotate all motor shafts ¼ turn each and every month during storage up to the time of first performance to ensure motor shaft integrity.

WARRANTY

Contractor and installer shall furnish warranty for fountain system installation for a minimum period of one year from date of Substantial Completion of the Contract as specified in Contract Conditions. Contractor shall include provisions of warranty to Owner not otherwise covered by manufacturer. Warranty to include the following:

1. Fountain system to be free of defects of materials and workmanship.

2. Fountain system performance to the designated water volumes, heights, patterns, and display features, as outlined in the design requirements in section 1.3(E)(3).
3. Adjustments and/or corrections to warranted equipment shall be made at factory as per standard warranty terms.

The manufacturer shall warrant all properly installed and maintained fountain equipment (except lamps) as provided in "Part 2 – Products" of this Section, free of defects in material and workmanship for a minimum period of 18 months from shipment or one year from 1st performance, whichever comes first. The fountain manufacturer, at their option, shall replace or repair any materials, components, or workmanship found to be defective within the warranty period when returned to the factory, freight pre-paid. No component may be returned for repair or replacement without an approved return materials authorization.

1. Extended Warranties: Fountain manufacturer shall furnish to Owner any extended warranty that is standard and usually available from item manufacture/supplier for an item of equipment.

MAINTENANCE AND EXTRA MATERIALS

Contractor shall supply chemical treatment materials of sufficient quantity, in addition to materials needed for system testing and adjustment, for use by Owner in maintenance of the system for a period of at least one month after Substantial Completion.

Contractor shall supply any other special tools or parts that would be needed for Owner's maintenance of the fountain system.

Extra Materials – one additional replacement 1" solenoid valve

PART 2 – PRODUCTS

COMPONENTS

Mechanical Components: The major mechanical components of the stationary fountain are as follows:

1. DFCT-3600, 6' x 6' x 6' subterranean equipment vault, heavy-duty fiberglass constructed with minimum (13) layers of fiberglass or a minimum of 5/8" thick, one-piece molded construction on bottom shell and lid. Fabricating the bottom shell from fiberglass sheets and caulking the joints will not be acceptable. The tank access hatch shall be 4' x 4' landscape access hatch, black gel-coat finish with (2) 60lb, carbon steel lifters mounted on aluminum brackets and bolted to the fiberglass with stainless steel hardware. The hatch shall have a single point stainless steel V-grooved folding T Handle with standard lock cylinder keyed 545 with polished finish and bolted to the hatch with stainless steel fasteners. All pipe connection fittings to be glassed and sealed to the tank wall for watertight integrity. The use of bulkhead type fittings will not be accepted. A leveling skid

fabricated from steel tubing shall be glassed to the vault bottom allowing for clearance of the sump and for ease of leveling and handling of the vault on site. The tank houses the automatic sump pumps, fog pumps, water make up system, water softener, ventilation, high water alarm, and access ladder. The vault is pre-plumbed and pre-wired ready for installation.

2. DFVAL-500, exterior/interior equipment vault access ladder shall be aluminum and fiberglass constructed. The access ladder shall be bolted to the inside of the tank using stainless steel hardware and 1/4" x 2" aluminum custom extensions to give the ladder a 15 deg. angle. The Ladder shall is to be installed in accordance to OSHA standards. All fasteners penetrating the vault wall shall follow the proprietary 3-step waterproofing method to seal penetrations through the vault structure. This includes the use of a proprietary high performance 2-part methacrylate adhesive, a minimum (3) layers of fiberglass and a waterproof layer of gel coat to seal the entire penetration and prevent hygroscopic water intrusion. This ladder shall come with Safe-T fall protection ladder extension system. Safe-T extension shall be constructed out of galvanized steel, tool-less installation and shall comply with OSHA standards.
3. DFHWA-125VF, 1/8" N.P.T., 24VDC, stainless steel vertical float switch to be used as a high water alarm system.
4. DFFP-075fog, 3/4 hp 208v, 3 phase direct drive plunger fog pump, 3450 R.P.M. motor pump is constructed of die cast aluminum with heavy duty stainless steel plunger rods and high density polished, solid ceramic plungers operating at .9 G.P.M. @ 1000 P.S.I. The discharge manifold is to be constructed of high strength forged brass calcium stick. A pre-filter system is to be provided with the system to reduce nozzle clogging. Provided with manual pressure reducing valve and pressure gauges. 3/8" high-pressure tubing rated for 1200 P.S.I. operating pressure and 2400 P.S.I. burst pressure to be provided by installing contractor. Max inlet pressure for potable water feed is 50 P.S.I
5. DFWS-100, Water Softener, continuously monitors water usage, allowing the unit to regenerate only when required, eliminating excessive salt and water usage. Precision brining cycle increases salt efficiency and assures minimum water usage during regeneration. High Flow Control Valves thru 1" – Flow Rates 17 GPM (15% PSI LOSS) - Up to 90,000 Grain Tank Capacity per Tank - Maximum Operating Pressure – 125 psi/110º F. Minimum water pressure 25 PSI - Clack™ Control Valves - Time Clock or Electronic Meter Regeneration - Premium Cation Resin 3 cu.Ft.- Hard Water Bypass - Brine Tank – HDPE material, Salt Grid Plate or - Gravel under-bed, Safety Brine Valve (18" diameter), Air Check and Overflow
6. DFMP-400, Custom machined type 304 stainless steel fog puck with (6) 1/4" N.P.T. discharge points, 1" N.P.T. inlet, and a mounting flange as shown on the drawings. Contractor to supply hardware for mounting fog pucks.
7. DFFN-025-SS, 1/4" M.P.T. full cone spray fog nozzle with fine mesh strainner, heavy duty machined stainless steel constructed with .016 orifice producing a fine mist spray 3 G.P.H. at 1000 p.s.i. nozzle to be mounted in DFFS-350 fog discharge sump with riser. As shown on the drawings.
8. DFWMUA-100, 1" water make-up assembly, type 304, schedule 40 stainless steel constructed with 110V, bronze, slow closing solenoid valve, water hammer

arrestor and (3) 1" heavy-duty bronze constructed ball valves. The water make-up assembly is pre-plumbed ready for installation by the contractor. PVC or copper construction is not acceptable. The contractor shall connect in-line on fresh water make-up line and provide back-flow preventer and/or reduced pressure zone, and pressure reducing valve to ensure the incoming line pressure does not exceed 50 P.S.I.

9. Hammer Arrestor, ASSE 1010 certified, type L copper tube, HHPP piston with two lubricated EPDM O-rings, FDA approved lubricant, rolled piston stop, wrought copper male thread adapter. (manufacturer and product: Sioux Chief Mfg. Co., Inc., Series 650 and 660).

Electrical Components: The major components to be included in the control panel and to be incorporated into a fully functional operating fountain system are specified and listed below:

<u>GENERAL</u>

1. The fountain control system shall be designed for 208 Volts, 3 phase, 4 wire service and shall operate (2) 1 Hp fog pump, (2) 1 Hp VFD, (1) water softener, and appurtenances of the fountain.
2. Enclosures shall be provided per sizes as follows:

A. Up to 48"H x 36"W: NEMA 3R enclosure of galvanized steel construction, primed and phosphatized, finished with ANSI 49 gray baked on enamel, manufactured by Hoffman, equal to HCR series shall be provided. The enclosure shall have collar studs for sub-panel mounting, hasp and staple for padlocking, butterfly type stainless steel draw latches and hinged cover. All Hardware shall be stainless steel.

B. Over 48"H x 36"W: NEMA 12 enclosure of cold roll steel construction, primed and phosphatized, finished with ANSI 61 gray baked on enamel outside and baked on white enamel inside, manufactured by Hoffman, equal to A12 series shall be provided. The enclosure shall have collar studs for sub-panel mounting, hasp and staple for padlocking, screw-down door clamps and hinged cover. To meet NEMA 3R specifications, a drip shield option shall be provided on the NEMA 12 enclosure.

3. All components shall be mounted to a removable sub-panel. The sub-panel shall be fabricated from 14-gauge steel and shall be finished with baked on white enamel.
4. A Power Distribution Block shall be provided, sized for 600 volts, 175-amp minimum to accept Branch Circuit Conductors. The power distribution block shall have a flammability rating of UL 94V-0, shall be based on NEC table using 75 degrees C wire and shall be equivalent to Square D class 9080.
5. A 600V lightning arrestor shall be provided and connected to the Power Distribution Block for 3 phase power and 250V lighting arrestor for single phase power.
6. Motor starters for feature pump shall be IEC rated full voltage, non-reversing with thermal overload relay. Auxiliary contacts shall be provided as required for the specific control functions. Motor starters shall be as manufactured by Square 'D', Allen Bradley or pre-approved equal.
7. All 120-volt equipment shall be protected individually by thermal magnetic circuit breakers with an interrupting rating of 10KAIC @ 240 volt minimum. All circuit breakers shall be calibrated and sealed at the factory and shall be equivalent to Square D, type QOU.

8. The lighting and filter pump contactors shall be 30 amps rated and shall be equivalent to Omron type g72 or equal.
9. The fountain feature / filter pump, and lights shall be controlled by individual 24-hour time clock settings. The time clocks shall be electronic with 24-hour capabilities or shall be integral to the memory module or PLC.
10. The motor and lights shall be controlled by touch screen, designated “Hand - Off - Auto”. In the “Hand” mode, the appropriate motor or set of lights shall be energized until the selection is placed in the “Off” mode. In the “Auto” mode, the appropriate motor shall be controlled by the appropriate time clock.
11. All power wiring shall be color coded using MTW #12 AWG minimum. Control wiring shall be MTW #14 AWG minimum and be numbered/lettered at each end. Wire numbers/letters shall be equivalent to Pass and Seymore “LeGrande”.
12. All wiring shall be routed through a wiring duct system to provide wire protection and an organized appearance.
13. Terminals shall be provided for interface with field-installed equipment. The terminal blocks shall be mounted on a 30-degree angle for ease of field connection. Terminals shall be equivalent to Siemens, Allen Bradley, or Square D.
14. All components shall be labeled using a laser-screened Mylar nameplate. The nameplate shall be a laminated two-part system using black letters on a white background on the door and yellow background on the back panel providing protection against fading, pealing, or warping. The labeling system shall be computer controlled to provide logos, post- script type or custom design. The use of engraved plastic type tags is not acceptable.
15. The control system shall have complete drawings/schematics using AutoCAD. The drawing shall have a complete Bill of Materials, front panel view with component locations and electrical schematic. References to the Bill of Materials shall be located for each component.
16. The control system shall be designed and manufactured to meet all state and local codes, Underwriters Laboratories and the National Electric Code (particular attention to article 430 and 680)
17. The entire control system shall bear a UL 508 serialized label “Enclosed Industrial Control Panel”. The use of the UL label “industrial control panel enclosure” without the UL 508 serialized label is not acceptable. Additionally the control panel shall bear a UL label for “Industrial Control Panel for Permanently Attached Fountains”.

<u>Programmable Logic Controller for Machine Logic Sequencing</u>

A programmable logic controller shall control the fountain pumps. The PLC shall be an Allen Bradley Micrologix series, Siemens S71200 series, or pre-approved equivalent.

a. Mechanical features
1) Rugged, compact plastic housing;
2) Easily accessible connection elements and controls
3) Assembly on standard horizontal or vertical;
4) Terminal block as permanent wiring assembly.

b. Design features

1) Data integrity; the user program is the most important
2) Parameter settings are stored in the internal EEPROM.
3) Built-in DC 24V sensor/load power supply for the
4) Direct connection of sensors and actuators;
5) On-board digital input/outputs (CPU with 12 inputs and 12 outputs)
6) Interrupt points;
7) High-speed counters;
8) Easy expandability;
9) 2 high-frequency pulse outputs;
10) EEPROM 16K memory sub-module with real time clock.
11) Battery module for long-term back up.
12) Embedded web page for remote access and monitoring.

c. Functions

1) Fast instruction execution; Instruction execution times of ms or 0.8
2) Extensive instruction set; A large variety of basic operations such as binary logic, result assignment, save, count, time generation, load, transfer, compare, shift, rotate, complement generation, call subroutines, integrated communications instructions and other user-friendly functions such as pulse duration modulation, pulse train function, arithmetic functions, floating-point arithmetic, PID closed-loop control, jump functions, loop functions and code conversions serve to simplify programming.
3) Counting;
4) Interrupt handling;
5) Edge-controlled interrupts
6) Time-driven interrupts
7) Counter interrupts
8) Communications interrupts.
9) Direct interrogation and driving of inputs and outputs;
10) Password protection;
11) Full access
12) Read only
13) Complete protection.
14) Debugging and diagnostic functions.
15) "Forcing" of inputs and outputs in debugging and diagnostic mode

d. Communications: The built-in PPI (point-to-point interface) provides a range of communications features.

1. If the control panel drawings include remote communication, the avenue of connection through Ethernet via cat5 cable or WIFI will be installed by contractor. The communications capabilities can range from PLC upload/download, to full HMI, VFD, and PLC monitoring and control.

Programming: The PLC shall be supplied with a fully functional program that shall perform basic operations including time clock settings, pump/motor lockouts and water level control functions.

HMI (Human Machine Interface) – Touchscreen

The Siemens KTP700 (HMI) basic color touch screen is equipped with a 7" inch STN- display. A resolution of 800 x 480 pixels enables the representation of less complex operating screens. The panel can be operated by a resistive analog touch screen and additionally by 4 freely configurable function keys which – when actuated – provide tactile feedback. Allen Bradly, Square D or pre-approved equivalent.

The HMI shall be programmed to provide a minimum of user accessible screens. There shall be individual screens as applicable:

1. Main (providing access to all screens).
2. Feature Pump (includes Hand Off Auto, Run Status, Strainer/Low Level/Lockout Alarms.
3. Feature Pump Auto Set (includes 2-time clocks for multiple on/off selections).
4. Filter Pump (includes Hand Off Auto, Run Status, Strainer/Low Level/Lockout Alarms.
5. Filter Pump Auto Set (includes 1-time clock for multiple on/off selections).
6. Water Level (includes all level settings/timers, alarms).
7. Backwash (includes all Filter Backwash settings/timers.
8. Lights (includes Hand Off Auto, Color Status, Low Level/Lockout Alarms).
9. Lights Auto Set (includes 2-times clock for multiple on/off selections).
10. Wind (includes High Wind Lockout of Feature Pumps/ Low Wind Reset).
11. Status (a Quick screen shot of the Status of all Fountain Equipment

Variable Frequency Drive

The VFD shall be the Siemens SINAMICS G120 drive series. The vfd shall have the latest power component technology, including the PM240-2 power modules with higher power densities, matching control units, new operator panels, enhanced vector control and basic positioning capabilities.

POWER MODULE

The Power Unit shall be PM240-2 series.

Advantages include:

-Side-by-side mounting without derating

-Integrated, comprehensive safety concept up to PLe/SIL3

-Available in three voltage classes: 200V, 400V and 690V -

Increased ruggedness

-Innovative push-through design also available

Features include:

Voltage: 1AC / 3AC 200 … 240V; 3AC 380 … 480V; 3AC 500 … 690V

Power range: 0.55–250 kW (0.75–400 hp)

Degree of protection: IP20 Environmental class 3C2 (3C3 is possible with SIPLUS Control Unit—for frames D, E, F)
Ambient temperature: –10° C to +60° C (up to +40° C with derating)
EMC: According to EN 61800-3 up to Category C2
Standards: CE, UL, cUL, c-Tick
Safety technology Safety Integrated: STO (up to SIL 3, PL e, Cat. 3), SS1, SBC, SLS, SDI, SSM, PROFIsafe
Communication: PROFINET, PROFIBUS, USS, Modbus, Ethernet/ IP, BACnet
Closed-loop control modes V/f, flux current control (FCC), vector control with and without encoder Functions: Basic positioning function with EPos, energy recovery using efficient infeed technology, PROFIenergy, PROFIdrive

CONTROL UNIT

The Control Unit shall be CU240P-2. The Control Unit controls and monitors the Power Module and the connected motor.

OPERATOR PANEL

The Operator Panel shall be BOP-2. The Control Unit controls and monitors the Power Module and the connected motor. The BOP-2 connects to the Inverter through an RS232 interface. The BOP-2 automatically recognize all variants of the following Control Units from the SINAMICS G120 CU230P-2

WARRANTY

The drive shall have an extended warranty for not less than 5 years. The replacement shall include all parts that fail within the 5-year time period. The warranty shall be documented with the drive manufacture utilizing model/serial numbers up to the date of commissioning.

INSTALLATION COMPONENTS

Piping Materials:

1. Unless architects specifications indicate otherwise, the suggested minimum piping and fitting standard recommended for this installation is Type 1.
2. All interconnecting piping and associated fittings, supplied by installing Contractor, shall be a minimum of Schedule 80 PVC, NSF-PW rated.
3. All welded PVC fittings above 6” diameter shall be fiberglass reinforced and used only on non-pressurized lines.
4. Use only clear PVC cleaner meeting NSF, UPC, and ASTM standards for cleaning and repairing PVC pipe and fitting surfaces for solvent cementing (IPS

Corporation “Weld-On” Type C-65 or equivalent). Follow all directions and instructions appearing on product label.

5. Use only purple PVC primer meeting NSF, UPC, and ASTM #F-656 standards for softening and preparing field pipe and fitting surfaces for solvent cementing (IPS Corporation “Weld-On Type P-70 or equivalent). Follow all directions and instructions appearing on product label.
6. Use only clear or white, heavy bodied, medium setting PVC cement meeting NSF, UPC, and ASTM #D-2564 standards for solvent cementing PVC plastic pipe and fittings (IPS Corporation “Weld-On” Type 711 or equivalent). Follow all directions and instructions on product label.
7. Provide Link Seal for all penetrations in equipment room. All penetrations through outside walls to below grade shall be sealed per building specifications. Using “easy-link seals” is recommended
8. All piping penetrations through structure walls into open areas below pool structure must have the necessary allowances made for settlement.
9. Pipe hangers and supports per national plumbing code. All piping in open areas below the pools shall be installed free hanging from the ceiling in the level below with pipe hangers/per specifications and code
10. Reference requirements of other Project Manual Specifications for materials and items not specified herein.
11. 3/8” high pressure tubing rated to handle 1000 p.s.i. working pressure and 2000 p.s.i burst pressure

Electrical Materials:

1. Rigid conduit shall be corrosion resistant and either galvanized steel or rigid PVC as specified in Part 3 Article “Basic Electrical Methods” herein. Submit Product Data and related specifications on materials to be used. All electrical conduit and conduit fittings between submersible light fixture niches, junction boxes and control panels will be U.L. listed rigid, nonmetallic, PVC NEMA, TC-2 max. 90°C, sunlight resistant for above and below ground use. All conduits shall be protected at all times from possible water ingress. Use only approved primer and PVS glue suitable for joining all PVC conduits and fittings per manufacturer’s instructions.
2. All conductors shall be copper with insulation suitable for the particular wiring location as specified in Part 3.4 Article “Basic Electrical Methods” herein. Submit Product Data and related specifications on materials to be used underwater.
3. Reference requirements of other Project Manual Specifications for materials and items not specified herein.
4. All PVC conduit connections underground shall be SCH40 pressure fittings ((FE) male adaptors and couplings). Use color coded primer, pressure fitting PVC glue, and Teflon paste. The use of normal electrical PVC fittings is prohibited.
5. All connections in the pool/fountain shall be made with the assistance of a plumber, using Teflon paste or Teflon tape to eliminate all leaks. Use only tapered (NPT) stainless steel fittings and nipples. The use of galvanized, black, brass or steel piping is prohibited.

6. All conduit connections between dissimilar metals must be made with dielectric fittings, and sealed with dielectric thread compound to prevent galvanic degradation

EXAMINATION

Verification of existing elevations: Verify all joining elevations prior to laying pipe or setting pipe. Notify Fountain equipment manufacturer, Architect, and or Engineer of all discrepancies before proceeding with the construction of the fountain.

Verification of Dimensions: Before proceeding with any work, the contractor shall check and verify all dimensions, sizes, and the like, and shall assume full responsibility for the fitting-in of all materials and equipment to the conditions on site if the Fountain equipment manufacturer, Architect, and or Engineer is not notified in writing and a resolution is not agreed upon.

All conflicts relating to any penetration size, dimension, elevation, equipment location, or equipment size or dimension, shall be addressed and resolved with the manufacturer, Architect, and or Engineer of record before the contractor can proceed with the construction of any part of the fountain that may be or become affected by the confliction.

Verify Utilities: Contractor shall verify with local authorities where the proper tie into sanitary or storm sewer for overflow and drain.

Contractor shall verify matching voltage and phase of main power feed provided to serve the fountain equipment control panel and report all discrepancies in writing to the Fountain Manufacturer, Architect, and Engineer.

INSTALLATION

All equipment furnished under this Section shall be installed in full conformity with the Contract Documents, engineering data, instructions, and recommendations of the manufacturer.

Contractor shall obtain all necessary installation permits and inspections

Installation of fountain equipment appurtenances shall confirm with provisions of Reference Standards and suit existing conditions on site as approved by Architect.

Contractor shall insure that installation complies with all applicable national and local codes and project specifications.

The incoming water supply line pressure must not exceed 50 PSI and is part of the building contract, not the fountain.

Install horizontal piping 1’ below freeze line.

Excavation, Backfill, and Compaction:

1. Excavating, trenching, and backfilling shall be as specified in the Contract Documents and as noted on the drawings and compaction done in a maximum of 6" lifts.

All pools/splash pads shall be waterproofed by specified approved means.

Prior to any finishing materials (I.E. lights, jets, cover plates) being installed, all pools shall be tested for leaks for a minimum of 72 hours and all waterproofing and tile work shall be completed.

Refer to mechanical and electrical notes on drawing for further information.

Contractor shall field verify all dimensions.

Consult architectural, structural, mechanical, and electrical drawings for additional details not shown on these drawings.

When applicable, all weirs shall be installed with an accuracy of "+" or "-"1/16" over the entire weir length. Unless otherwise noted, refer to the architectural drawings for weir details.

Contractor shall provide all concrete work as required by all mechanical and electrical fountain equipment requirements including, but not limited to, housekeeping pads, lock-down slabs, and thrust blocks where indicated.

Contractor shall provide all utilities such as power supplies, water supplies, and sewer connections under the building contract up to the fountain controls, equipment and/or pool fittings where indicated.

Contractor shall provide and is responsible for all elevation and X-Y coordinates relating to all fountain equipment including vaults, pool floors, and pumps.

BASIC PIPING METHODS

The Contractor shall verify and confirm all piping layouts, locations, and dimensions shown in these drawings, and insure that the specified locations do not interfere with other equipment, architecture, or construction before installation. All piping shall be installed as shown and as otherwise specified to make a complete, workable, and neat system. All piping shall be cut accurately from dimensions established at the Project site and allowances shall be made for clearance of other devices.

All intra-connecting piping and associated fittings, supplied by system manufacturer, shall be a minimum of Schedule 80 PVC, NSF-PW rated. Interconnecting-intraconnecting interface points shall be slip fit, threaded or flanged

All interconnecting piping and associated fittings, supports, and seals shall be per section 2.1 A.

The Contractor shall not deviate from the pipe sizes shown herein unless prior written approval is obtained from the manufacturer and Architect. When a size is not indicated, the Contractor shall request the pipe size from the fountain manufacturer. In the event that interference with

other equipment or architecture requires relocation of pipes or a layout different from that shown herein, the Contractor shall notify the fountain manufacturer immediately for reexamination of hydraulic parameters of the affected sections.

Pipe and accessories shall be handled in such a manner to not cause damage. All cutting shall be done in a good workmanlike manner. Before installation, all piping and fittings shall be visually inspected for damage or defects. The interior of the pipe shall be clean during the laying operation. Pipe shall not be laid in water or in the trench when weather conditions are unsuitable for the work. Water shall be kept out of the trench until the pipe is installed. While work is in progress, open ends of the pipe and fittings shall be securely closed so that no trench water, earth, or other foreign matter will enter the piping system or fittings.

Perform adequate trenching and backfill operations when installing PVC piping below grade. Trench width should be minimum of "pipe O.D. plus 12 inches" and deep enough to allow piping to be buried a minimum of 12" below the maximum expected frost penetration line to avoid freeze damage. Lay piping in horizontal, parallel, or perpendicular manner. Avoid vertical stacking of pipes. Space minimum of 3" apart on all parallel runs.

Use only clean, free-flowing, non-expansive backfill material (naturally rounded ¼" pea gravel, 57 stone, or sand) and backfill in 6" lifts with adequate and complete compaction between lifts to 90% of maximum density per ASTM 1557-70. Compaction to excessive loads shall not be permitted. A second pressure test on the piping system must be made at this time to insure that piping has not been damaged during backfill operations.

Concrete "thrust" blocking is recommended at all directional changes (tee's, elbows, etc.), reducer fittings and line terminations (bushings, end caps, plugs, etc.) in fountain display discharge piping 6" and larger.

The bearing surface for the concrete thrust blocks, where possible, should be placed against undisturbed soil. Where it is not possible, the fill between bearing surface and undisturbed soil must be compacted to at least 90% standard proctor density. Thrust block shall be a concrete mix not leaner than one part cement, two and one-half sand, and five parts stone. Contractor shall coordinate the location of the thrust block with other work and existing conditions. Work shall be performed in accordance with all applicable codes. For additional information, refer to NFPA 24.

The sump pump in the equipment vault shall be connected as immediately as possible after secure placement and shall have a continuous power supply for the duration of the fountain system installation process.

Pressure test all piping as specified in Part 3 Article "Field Quality Control" herein.

Avoid laying suction piping in a manner that could result in a suction loop before, during, or after backfilling and compaction. Always pitch pipe in a downward direction to avoid a suction loop that will cause air to be permanently trapped, causing loss in performance of the piping system due to increased friction and work load demand.

Piping in areas subject to freezing shall be installed at elevation of minimum 1 foot below frost line.

Do not install any water lines above the control panel.

Any and all costs associated with above are responsibility of installer.

BASIC ELECTRICAL METHODS

The information supplied in the drawings specifies the general requirements of a complete functioning electrical power distribution and control system. The electrical subcontractor shall coordinate all electrical installation activities with the Construction Manager, Contractor, Architect, and (with respect to work Phase) other separate contractors performing work related to fountain installation.

All electrical work shall comply with the latest edition of the National Electric Code (NEC), Section 680, published by the National Fire Protection Association; Quincy, Massachusetts. In the event of conflicting requirements between Contract Documents and any local electric code or other governing organizations for this location, the most stringent shall govern and take precedence. In this event, the Architect shall be notified immediately in writing of such conflict.

The installation of electrical equipment and wiring in water can produce extreme hazards. It is the responsibility of the installing electrical contractor to consult and comply with all electrical codes and safety regulations prior to installation of electrical equipment. Local codes take precedence over the general notes where discrepancies of conflicts exist.

All wiring and conduit shall be sized by the electrical sub-contractor in accordance with the latest edition of the NEC and all electrical codes and regulations. Where wiring and conduit sizes are specified herein, they shall be interpreted as minimum allowable sizes. All conductors shall be copper with insulation suitable for the particular wiring location. Minimum acceptable insulation is type THWN or better, suitable for both dry and wet locations. Conductor insulation shall be moisture resistant, flame-retardant thermoplastic as approved by the NEC. Conductor sizing shall be based on an ambient temperature of 30□C and a conductor temperature rating of 75□C maximum per Article 310 of NEC. All underwater electrical cable shall either be encased in waterproof, sealed PVC conduit or shall be rated for continuous operation in underwater, marine environments.

Contractor shall obtain all necessary installation permits and inspections.

It is the responsibility of the installing electrical contractor to insure that all electrical equipment is installed and wired, in accordance with Section 2.4 paragraph D above, whether it is called out or not within the contract documents. This is to be done by a qualified, licensed electrician, experienced in fountain system wiring. Delta Fountains assumes no responsibility for liability whatsoever for installations not carried out by a qualified, licensed, electrician in accordance with our shop drawings, and all provisions of the latest edition of NEC in general, Article 680 specifically, and local safety regulations. All Delta Fountains electrical control panels include GFCI’s when and where required, when furnished.

It is the responsibility of the installing electrical contractor to verify all field dimensions critical to fountain equipment installation and performance and report any discrepancies to Delta Fountains and the engineer upon immediate notice.

All conductors shall be run in rigid conduit sized for the number of wires contained within per NEC requirements. Rigid conduit shall be corrosion resistant and either galvanized steel or rigid PVC. When conduit is submerged or in other wet locations, rigid PVC shall be required. Conductor sizing shall be corrected for the number of wires to be run in a single conduit or raceway in accordance with NEC. All conduit locations and routing shall be approved by the Architect before installation.

The work includes such necessary material and devices of a minor nature that may not be indicated on the drawings or mentioned in the specifications, but which are necessary for the compliance with codes and for the successful operation of the entire control system. The contractor shall be allowed no extra compensation because of this requirement.

All GFCI protected circuits must have a separate neutral. All GFCI breakers have pigtails wired to a neutral bar. A Class 'A' ground fault circuit interrupter (GFCI) must be installed in each branch circuit supplying submersible or underwater fountain equipment. Equipment operating at 15 volts or less must be protected by suitable transformer U.L. Listed and marked for the application.

Conduits are drawn for clarity and do not necessarily show exact routing. Contractor shall install conduits with as few changes in direction as jobsite conditions will allow.

All electrical equipment must be properly bonded and grounded for safety, per the latest NEC and local code requirements. All bonding lugs shall be provided by installing electrical contractor. Installing contractor shall verify all necessary requirements of local inspector before installing, and notify Delta Fountains of any required deviations from specifications or plans or notes, and resolve all conflicts before installing equipment. Contractor to insure that all bonding codes are complied with for each metal pool equipment component.

Submersible/underwater lighting fixtures must be installed for operation at 150 volts or less between conductors. Submersible pumps most operate at 300 volts or less between conductors.

Submersible lighting fixtures must be installed with the top of the fixture lens a minimum of 2" below the normal operation water level and must have the lens adequately guarded to prevent contact by any person.

All electrical equipment which depends on submersion for safe operation must be protected against overheating by an independent low water cutoff device if the water level drops below normal operating levels, or contain an internal Thermal Bimetallic Ambient compensating overload.

Maximum length of exposed submersible cord in the fountain is limited to 9 feet. Cords extending beyond fountain perimeter must be enclosed in approved wiring enclosures.

All submersible lights and pumps must have sufficient cord length to allow removal from the water for re-lamping and normal maintenance. Fixtures can not be permanently embedded in the fountain structure so that the water level must be reduced or the fountain drained for re-lamping, maintenance, or inspection.

Submersible equipment must be inherently stable or be securely fastened in place with non-corrosive fasteners suitable for the purpose.

Underwater junction boxes must be filled with an approved re-enterable electrical potting compound (wax or paraffin is not acceptable) prior to filling pool and after all circuits have been checked to prevent the entry of moisture and must be firmly attached to supports or directly to the fountain surface and bonded as required. All conduit stubbed up through pool floor must be stainless steel. PVC, Red Brass, and Everdur are not acceptable as a conduit support stub for submersible junction boxes. All conduit entries must be completely sealed prior to potting to prevent compound from entering conduit system. After testing, junction boxes shall be sealed with scotch 3M re-enterable compound or other approved filling compound.

All underwater junction boxes must be equipped with threaded conduit entries and compression type cord connectors for cord entry. Strain relief connectors serving niche-Mounted underwater lights shall be capable of sealing both the fixture cord and an AWG #8 insulated bonding wire which may be required by some local codes.

Pull correct quantity and size conductors, wired with separate ground, through conduit into junction box. Make all splices and connections tight and well insulated. Connect ground wire to ground lug in junction box, or other suitable grounding location.

Insert each submersible cord through the brass cord seals provided on the junction box and tighten completely.

Do not operate submersible lights or pumps more than ten seconds unless completely submerged or damage will result and warranty will be voided.

The installing electrical contractor will verify that all electrical equipment grounds will have the same reference potential and will give evidence of such to Delta Fountains before any equipment is initially energized.

The installing contractor shall size all feed-wires leading to fountain control panel for no more than 2% voltage drop, and shall notify Delta Fountains before fabricating electrical control panel if wire is upsized such that extra large wire lugs are required. It is the responsibility of electrical contractor to provide any disconnect required by local code requirements.

The fountain control panel shall be adequately protected from debris and stored properly during construction and prior to initial operation and shall be vacuumed clean and all screws for terminal connections tightened.

The electrical contractor shall ensure that supply voltage is within 5% of design voltage when all equipment is in operation and shall re-tap transformer, up size wire, or supply a buck and boost transformer to get supply voltage to necessary level, if necessary.

Wires for water level sensors must be run in a separate conduit to the fountain control panel.

All conduit penetrations through structure walls into trade areas below the pool structure must have the necessary allowances made for settlement.

Floor mounted motor control centers and transformers for fountain related equipment shall be installed on a 4" concrete housekeeping pad in equipment room.

Contractor installing fountain manufacturer supplied deck boxes in concrete for fountain lighting is to ensure that all open conduit ports are plugged watertight prior to slab pour around deck boxes.

All penetrations through outside walls to below grade shall be sealed per building specifications. Using "easy-link-seals" is recommended.

Any and all costs associated with the above are the responsibility of installing contractor.

FIELD QUALITY CONTROL

Inspection and Testing, General: Labor, materials, instruments, and power for testing shall be furnished by the Contractor. All tests shall be performed to the satisfaction of the Owner, Architect, and such other parties that may have legal jurisdiction. Item or system to be tested shall not be closed up, buried, or covered until testing is completed and owner confirms approval. Prepare reports of testing activities and submit as specified.

2. Reference Division 1 Section 01400 "Quality Requirements" for related and additional provisions.

Piping Test:

1. Conduct piping tests before joints are covered and after thrust blocks have been hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Flush out all pipes with clean water prior to performing leak tests.
2. Do not include equipment in tests which could be damaged by high pressure.
3. Automatic water make-up systems shall be thoroughly tested and operative at the time of final observation.
4. Pressure testing requires that a prescribed period of curing / drying time be allowed in order to allow the PVC cement to properly cure and take a permanent set. The following table sets forth the minimum drying period before the required pressure tests. Note that the table applies only to weather temperatures ranging from 50□ F. to 90□F. For drying times during temperatures that differ from this, consult the fountain manufacturer.

Piping Size	**Curing Time**
1.5" – 2.5"	8 hours
3" – 4"	18 hours
6" –8"	24 hours
10" & higher	36 hours

5. A 24-hour static pressure test of 10 ft. above highest vacuum, drainage, or gravity pipe invert elevation shall be performed on all vacuum and or gravity pipe lines using water

as the medium. All vacuum and gravity drain piping shall be tested with no loss of water, pressure, or noticeable leaks. All pressure testing shall include a visual check of each joint by the Contractor in the presence of Construction Manager, owner, authorized representative, and/or Architect.

6. The Contractor shall provide all pumps, pressure plugs, gauges, and other instruments and devices necessary to perform the hydrostatic pressure tests specified herein. Each complete discharge piping system shall be hydrostatically tested to a pressure of 150% of the system working pressure. For purposes of this test, system-working pressure shall be defined at 50 PSIG and the hydrostatic test shall be performed at 75 PSIG. Pressure test for at least 8 hours, at which time pressure shall remain constant, without additional pumping, pressure loss, or noticeable leaks. PSI is required on all pressure piping to include return inlets piping using water as the medium.
7. Pressure test all water piping prior to commencing backfill operations. Hydrostatic (water) testing shall be the only approved method. DO NOT PRESSURE TEST WITH COMPRESSED AIR as severe pipe damage and bodily injury can occur. Do not exceed the rated operational pressure of the piping and/or fittings carrying the lowest pressure rating. Locate and repair any leaks and retest prior to completion of backfill operations
8. After the system has operated for one week, contractor and owner's representative shall inspect water make-up rates and agree that water usage is appropriate for a system of this type, are within local ordinances or codes, and that such rates are not indicative of excessive leakage from system. A water meter shall be placed on the fill line for this purpose, if necessary to document precise water usage.

Manufacturer's Field Services:

1. The fountain manufacturer shall be present for a minimum of 4 site coordination meetings, which includes the review of the plans and shop drawings with the mechanical, electrical, and structural disciplines. The fountain manufacturer must be available at the jobsite within a one week notice. The representative shall be a factory employee, not a local representative.

START UP AND ADJUSTMENTS

Manufacturer shall be present for the initial start up of the fountain system.

Contractor shall adjust fountain water system for volume and water flow characteristics to reflect design intent as approved by Architect.

Contractor shall have the following conditions satisfied prior to departure of personnel from factory.

1. All electrical connections shall be made and tested.
2. All underwater lighting shall be lamped, installed and tested.
3. Thoroughly test all fixtures, services, and all circuits for proper operating conditions and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions

4. All underwater junction boxes shall be wired and sealed with potting compound.
5. Pump and filter motors shall be power tested to insure proper impeller rotation at specified voltage.
6. Electronic water level control and/or low water cut-off control shall be installed and wired for operation.
7. All hydraulic lines and fittings shall be pressure tested for leaks, repaired as necessary, and flushed clean. Basket strainers shall be checked and cleaned as required.
8. All nozzles, jets, manifolds, headers, and spray apparatus shall be installed properly and flushed of debris as required. Final nozzle adjustment for position and T hrottling to achieved specified performance for all display discharge points to be performed by installing contractor.
9. Pump vaults, when supplied by manufacturer shall be thoroughly cleaned of debris, tested for electrical integrity and pressure tested for leaks.
10. Chemical feed system, when supplied, shall be filled to proper level with required dosage of chemicals. (Manufacturer does not supply chemicals unless specifically listed in proposal).
11. The fountain basin shall be thoroughly cleaned and filled to proper water level with clean, fresh water.
12. Contractor shall make available to factory personnel a plumber and electrician who have first hand knowledge of the fountain installation, at contractors own expense.
13. Contractor will perform any manual labor or provide any tools for adjustment and start- up.

Contractor acknowledges the above requirements and understands that, should above requirements not be completed, factory personnel may immediately cancel visit and return to factory. In such case, Contractor shall be responsible for all costs and expenses incurred by manufacturer.

DEMONSTRATION

Furnish complete on-site instructions and demonstration to owner in the operation, adjustment and maintenance of fountain system.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Exterior Fountain will not be measured separately for payment but will be included in the Lump Sum bid price and shall include all labor, material and equipment required to complete the item to the satisfaction of the Engineer.

ITEM 924.2021 TEMPORARY FENCE FOOT

The work under this item shall include furnishing, installing, maintaining, removing, resetting, and final removal of 72-inch chain-link fence in the location indicated on the plan and/or as

directed by the Engineer. The fence shall be used to close off the construction area from other activities and pedestrian movements within and adjacent to the plaza.

Fencing shall conform to the relevant provisions of Section 644 of the Standard Specifications.

The Contractor will be responsible for providing the Engineer with an acceptable method for the installation of the Temporary Fence that will provide for the pedestrian and worker safety and security for which it is intended.

All posts, including end, corner, and intermediate brace posts, and all gates and gate posts, shall be included in the linear foot cost. All fencing height shall be 72-inches (minimum). Materials need not be new, but shall be in good condition, shall not be deteriorated, nor in a condition which in any way may jeopardize the safety and security purposes intended. All materials shall meet the approval of the Engineer. The Contractor shall be responsible for maintenance of the Temporary Fence and for assuming that the work area remains secure and is inaccessible to the general public at all times. It may be necessary to remove sections of Temporary Fence at times during construction. Any removing and resetting of Temporary Fence by the Contractor to facilitate his construction operations shall be done at no additional cost to the City. Fence fabric shall be placed on the top face of the post away from the work area. A top tension wire, rather than a pipe top rail, shall be used. The top edge of the fabric shall be finished with a "knuckled" selvage. The Temporary Fence shall not be removed until the construction is completed, or until directed by the Engineer.

Compensation for this item will be at contract unit price bid per foot, and shall include all equipment, materials and labor costs for a complete installation as described herein, including but not limited to removing and resetting fence as needed or directed. The cost of removal and proper disposal of any existing chain-link fence as directed by the Engineer shall be considered incidental.

Compensation for this item shall also include the replacement and/or restoration of fence damaged due to the construction, and/or accidents, vandalism or in any other manner.

ITEM 925.2021	**GRANITE SEATWALL**	**FOOT**
ITEM 926.2021	**GRANITE WALL AND GUARD RAIL**	**FOOT**
ITEM 927.2021	**GRANITE STAIRS**	**FOOT**
ITEM 928.2021	**GRANITE PAD**	**EACH**

General

Work under this item shall consist of furnishing and installing granite, metal rail, mortar, joints, concrete foundations, gravel, rebar, stainless steel pins and epoxy. This item shall include labor, materials, and equipment required to furnish and install the items. Construct items to the lines and grades as shown on the drawings and to the satisfaction of the Engineer.

Submittals

Provide the following submittals for approval before proceeding with the work.

Shop Drawings
Granite items showing sections and profiles.

Metal railing items showing sections and profiles.

Samples
Granite pieces (5) that represent general range of texture and color proposed.

Product Literature
Submit product literature for Steel Shackle

Manufacturers Certificates
Provide certificates from both the galvanizer and powder coating facility that the criteria outlined in the requirements will be met.

References

The following quality standards shall apply to the work of this Section in addition to any standards mentioned within in the specification:

- The Dimension Stone Design Manual, Version VIII, 2016 Marble Institute of America
- Welding shall be in accordance with the Welding Code of the American Welding Society.

Materials

Granite
Granite shall be Tabor Black, Addison Black, Cold Spring Black, Cambrian Black, Imperial Black, or or approved equivalent (fine to medium textured black stone). Only one variety will be accepted for all items using this type. Provide flamed finish on all exposed sides.

An acceptable vendor of granite are:

Vermont Stone Art
Architectural Sales MA/NH/ME/CT/RI
Office: (802) 505-2503.
14 North Main Street, Suite 2010, Barre, VT 05641

Polycor
Jerome Bureau
Regional Sales Manager
Cell 819-214-0098

Structural Stone, LLC,
285 Smith Street,
North Kingstown, RI 02852
401/667-4969

Granite shall be sound and uniform in quality, texture, and strength, and shall be free of flaws, reeds, rifts, laminations, cracks, seams, starts, or other defects that may impair its strength, durability, function, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects that would affect its appearance. The Dimension Stone Design Manual, Version VIII, 2016 Marble Institute of America quality standards shall apply to the work.

Granite Fabrication

1. Obtain all granite from single source.
2. All curved granite shall be cut radial;
3. See drawings for jointing, mitered joints shall not be accepted.
4. All faces shall be at right angles to the plane of the top unless otherwise noted.
5. Granite shall be cut accurately to required shapes and dimensions. Tolerances shall be less than 1/8".
6. Holes, cut-outs, sinkages and openings in granite work for anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to required dimensions, as shown on the approved Shop Drawings, and as necessary to secure granite in place to insure correct location and accurate fit of all fixtures.
7. Arrises shall be cut sharp and true to square and continuous with adjoining arrises. Where exposed, arrises shall be eased as shown on contract documents and approved shop drawings.

Metal Materials

Metal used in the fabrication and installation of the site improvements of this Section shall conform to the following Specifications:

Stainless Steel, Type 316 and in accordance with the following ASTM designations unless otherwise indicated: Bars and Shapes A276, AISI Type 316. Provide brushed finish

Sand (In Mortar)

Sand shall be clean, washed uniformly well graded masonry sand conforming to the requirements of ASTM Specification C-144-70 with the further requirements that the fineness modulus shall be maintained at 2.25 plus/minus 0.10. Sand shall be from a single source meeting these requirements and as approved by the Engineer after laboratory test. Source of supply shall not be changed during the course of job without written consent of the Engineer.

Portland Cement (In Mortar)

Portland cement shall conform to the requirements of AASHTO M240 mortar.

Latex Bonding Agent (In Mortar)

The latex bonding agent shall be non re-emulsifiable in the presence of moisture and shall have not less than 50% internally plasticized solids. It shall be similar and equal to Laticrete and used in accordance with manufacturer's instructions. Laticrete #3701 is a grout and mortar admixture, manufactured by Laticrete International, Woodbridge, Connecticut.

Colorant (In Mortar)

The colorant shall be of a type and quality which will not adversely affect workability, setting or strength and shall be compatible with the latex bonding agent employed. The color shall be chemically inert, non-fading, alkali fast mineral oxides, finely ground and specially prepared for use in cement mortar.

Concrete Base

Concrete for base course shall conform to the requirements of M4.02.00 for Class C cement concrete.

Gravel

Gravel materials shall consist of compacted gravel (M1.03.0, Type B)

Reinforcing Bars
Reinforcing Bars shall meet ASTM A 615/A 615M, Grade 60, deformed. Supports for Reinforcing: Use wire bar type supports complying with CRSI specifications.

Stainless Steel Pins
Stainless steel Pins to anchor Stone to new concrete shall be Type 304 and meet the requirements of ASTM A-582. Shall be of sizes indicated on the drawings

Epoxy
Epoxy shall be a high strength non-shrink grout that is suitable for outdoor use. It shall have a minimum compressive strength of 8,000 psi after 28 days as determined by testing under ASTM C109. The epoxy shall not exhibit any measurable decrease in volume during curing. All epoxy materials must be on the MassDOT Approved Materials List. Epoxy Color shall match the color of the adjacent Stone.

Water
Water shall be potable and free of injurious contaminants.

Construction Methods
Extreme care shall be taken during the handling to avoid damage to the Materials. Slings, nylon straps, or other such non-invasive devices must be used to move the stones. Chains will NOT be allowed. The Contractor shall be responsible for the replacement of any stones that become damaged during handling at no additional cost to the client.

The granite shall be installed at locations shown on the Plans, as outlined on the details, as outlined below or as directed by the Engineer.

Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Exposed surfaces shall have smooth finish and sharp, well defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves. All welding, except as otherwise indicated, shall extend the entire length of joints. All welded face joints shall be ground flush and smooth. All welds shall be water tight. Ornamental metalwork shall be cut, drilled, countersunk, and tapped as required for the attachment of other work where shown on the drawings or when instructions for such work are given on the approved shop drawings. Ornamental metalwork to be built in with concrete or masonry shall be of the form required for anchorage, or shall be provided with suitable anchors or expansion shields.

Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw cut and carefully fit together. All connections shall be full welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation, or variation.

In assembling and during welding, the component parts shall be held by sufficient clamps or other means to keep the parts straight and level.

Welding procedures and materials used for welding shall conform to the current Specifications of the American Welding Society for the metals involved with all welds ground smooth.

After being deposited, welds shall be brushed with wire brushes, show uniform section, smoothness of weld metal, feather edges without envelopes and freedom from porosity. Visual inspection at edges and ends of fillets and butt joint welds shall indicate good fusion with and penetration into the base metals. All welds shall be watertight, and precaution shall be taken to minimize locked-up stresses and distortion due to heat.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Join by welding all joints continuously. Remove sharp or rough areas on exposed surfaces.

Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes in the bottom of all posts, horizontal rails and where water may accumulate.

Install components level and plumb. Anchor components securely in place.

Clean by washing thoroughly with clean water and soap and rinsing with clean water.

Measurement and Payment

Granite Seatwall, Granite Wall and Guard Rail, Granite Stairs and Granite Pad shall be measured complete in place as determined by the Engineer.

Granite Seatwall, Granite Wall and Guard Rail, Granite Stairs will be paid for at the contract unit price, as Per Linear Foot. Granite Pad will be paid for at the contract unit price, as Per Each. complete in place which price will be full compensation for furnishing, installing all granite, metal railings, mortar, joints, concrete base, rebar, stainless steel pins, and epoxy. This price includes incidental labor and materials necessary to complete the work.

Excavation will be paid for under Item 112 - Unclassified Excavation and Backfill. Gravel will be paid for under Item 126 – Gravel Borrow.

ITEM 929.2021 SILT SACK EACH

The work under this item includes the furnishing, installation, maintenance and removal of a fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas.

CONSTRUCTION METHODS:

Inlet Protection Sacks shall be installed in catch basins within the project limits and as required by the Engineer.

The inlet protection sack shall be manufactured to fit the opening of the City of Worcester's Municipal Catch Basin under regular flow conditions or approved equal. The filter material shall be installed in accordance with the construction detail as shown on the plans.

Inlet protection sacks shall be manufactured by:

- Atlantic Construction Fabrics, Inc. 1801-A Willis Road, Richmond, VA 23237
- ESS Brothers 23230 West Thomess Blvd.,Loretto, MN 55357

- Bowhead Manufacturing Company PO Box 80327, Seattle, WA 98108

- or approved equivalent.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Owner.

METHOD OF MEASUREMENT:
Silt Sacks shall be measured per each, complete in place.

BASIS OF PAYMENT:
Silt Sacks shall be measured and paid for at the Contract unit price per each which price and payment shall constitute full compensation for furnishing, placing, relocating, maintaining, removing and disposing the silt sack including all materials, labor, equipment, tools, appurtenances, and incidentals necessary to satisfactorily complete this item of work, complete in place.

ITEM 930.2021 TABLES AND CHAIRS EACH

This item of work shall consist of furnishing and installing Tables and Chairs at the locations shown on the plans and as specified herein.

SUBMITTALS
For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

MATERIALS
Tables:

1. Tables shall be Landscape Forms – Park Centre Table or equivalent.
    a. Parc Centre". Table shall be freestanding
    b. Size shall be 30" Round
    c. Free standing with adjustable levelers.
    d. Color shall be Titanium

Chairs:

1. Chairs shall be Landscape Forms – Park Centre Chairs or equivalent.
    a. Provide (3) chairs for each table.
    b. Color shall be Titanium
    c. No Arms

Final Color shall be as approved by the Engineer.

The Contractor shall submit detailed shop drawings and product data describing the Table dimensions and layout, mounting, accessories, materials, color, finish, handling, warranty and installation procedures for the approval of the Engineer.

CONSTRUCTION METHOD
The tables and chairs shall be installed at locations as shown on the plans and in accordance with the manufacturer's directions.

METHOD OF MEASUREMENT
This item shall be measured per each, complete in place.

BASIS OF PAYMENT
This item shall be paid for at the Contract unit price bid per each, which price shall constitute full and complete compensation for all labor, materials, including bench, mounting hardware and equipment and all other incidentals required to finish the work, complete and accepted by the Engineer.

ITEM 931.2021 WIRE ROPE ASSEMBLIES LUMP SUM

DESCRIPTION
This item of work shall consist of furnishing and installing wire rope assemblies including stainless steel cable railing system and mounting hardware as shown on the drawings and as specified herein.

SUBMITTALS
For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

Shop Drawings: Show layout, sizes, dimensions, details, and installation. Include Details of rope attachment, tensioning methods, hardware, and tensioning and mounting methodology.

MATERIALS
Stainless steel cable railing system and mounting hardware shall be Type 316 stainless steel products and Fittings, Hardware, and Accessories: AISI 304, 316 or 316L stainless steel manufactured and sold by:

Carl Stahl DécorCable Innovations, Inc.,
8080 South Madison Street, Burr Ridge, IL USA 60527.
Tel: 312-474-1100, Fax: 312-474-1789, E:
sales@decorcable.com, Web: www.decorcable.com.
Or approved equivalent.

5. Specific products and model numbers shall be as shown on the drawings.
6. Provide grommet, bushings, nuts, washers, turnbuckles, fittings and other components as required for system installation.
7. Length:
    a. Provide optimum adjustment in both directions by calculating final tendon lengths with allowance for tensioning fittings with 2/3 open and with 1/3 of thread length engaged.

b. Measure tendon length from center of pin to center of pin, or center of eye to center of eye.

CONSTRUCTION METHODS

Stainless Steel Cables and Fittings shall be dimensioned and fabricated to specified size and labeled according to shop drawings and installer's specifications.

Preassemble items in shop to greatest extent practicable to minimize assembly at project site. Disassemble units only to extent necessary for shipping and handling limitations. Mark units for reassembly.

Take field measurements after permanent end terminations are in place and prior to preparation of shop drawings and fabrication, to ensure fitting of work.

INSTALLATION

1. Install rope assemblies in accordance with manufacturer's instructions and the approved shop drawings.
2. Provide anchorage devices and fittings to secure to in-place construction; including threaded fittings for concrete inserts, toggle bolts and through-bolts.
3. Anchor rope assemblies to mounting surfaces as indicated on the drawings.
4. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.
5. Use manufacturer's supplied mounting hardware.
6. Terminate and tension cable system in accordance with manufacturer's instructions.
7. Ensure ropes are clean, and without kinks or sags.
8. After final adjustment provide tamper resistant locktight materials on all fittings.
9.

CLEANING

1. Remove temporary coverings and protection of adjacent work areas.
2. Clean installed products in accordance with manufacturer's instructions before owner's acceptance. Do not use chlorine-based or abrasive cleaners.
3. Remove from project site and legally dispose of construction debris associated with this work.

PROTECTION

1. Protection: Protect installed product from damage during subsequent construction activities.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Wire rope assemblies will be not be measured separately for payment but will be included in the Lump Sum bid price and shall include all labor, material and equipment required to complete the item to the satisfaction of the Engineer.

ITEM 932.2021 FLAGPOLE EACH

DESCRIPTION

This item of work shall consist of furnishing and installing internal halyard, 30' overall height fiberglass flagpole (1 total) complete with all accessories and flag as herein specified for a

complete installation at locations indicated on contract documents at the locations shown on the plans and as specified herein.

SUBMITTALS

For all materials outlined the Contractor shall submit to the Engineer manufactures' product data. No materials shall be ordered until all pay item submittals have been approved by the Engineer.

1. Product Data: For each type of flagpole required, submit manufacturer s technical data and standard installation instructions.

2. Shop Drawings: Show general layout, jointing, anchorage, support systems, and accessories.

PERFORMANCE REQUIREMENTS

Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to NAAMM FP 1001-97, Guide Specifications for Design of Metal Flagpoles.

Un-flagged wind speed: 120mph

Base flagpole design on maximum standard size nylon flag suitable for use with pole or flag size indicated, whichever is more stringent.

QUALITY ASSURANCE

1. Source: Obtain each flagpole as a complete unit from single manufacturer, including fittings, accessories, bases, and anchorage devices.

DELIVERY, STORAGE, AND HANDLING

1. General: Spiral wrap flagpoles with a heavy paper or other lightweight wrapping.

2. Store bare flagpoles in a dry location, protected from the weather and moisture, as recommended by the manufacturer.

3. Ship to project site in one piece.

WARRANTY

1. Fiberglass flagpoles will be free from defects in materials and workmanship, under normal use, proper installation, and responsible care for a period of ten (10) years from date of first shipment to the original owner.

2. Manufacturer further warrants that during use by the original owner after proper installation and responsible use, all commercial flagpole shafts will withstand wind gusts up to 120 miles per hour, unflagged. The use of oversized flags will negate this warrantee. As well, in the event of extreme weather conditions such as hurricanes, monsoons, tornados etc. it is the responsibility of the owner to remove all flagging in advance of the bad weather.

MATERIALS

Manufacturer, subject to compliance with requirements, shall be:

1. Atlantic Fiberglass Products, P.O. Box 3934, Amity Station, New Haven, CT, 1-800-826-6687 (telephone), http://www.atlanticfiberglass.com

2. Fiberglass Flagpole Construction: High quality pressure molded fiberglass flagpole fabricates from wrapping fiberglass and polyester around a rubber inflatable bladder and then placing it inside a steel mold which is coated internally with gel coat resulting in a tensile strength not less than 10,000 psi.

    a. Model: GS-30
    b. Shape: Provide cone-tapered flagpoles, per manufacturer's standard rate of taper and true entasis shape.
    c. Finish: Gel-coat finish, color white
    d. Above ground height: 30'
    e. Base Diameter: 5.5"
    f. Top Diameter: 2.5"
    g. Foundation Size: 24"w X40"d.
    h. Halyard Type: Internal halyard with winch mechanism and winch handle
    i. Accessories: ground sleeve, revolving truck, flash collar, flag clips, finial.

3. Alternate manufacturers meeting the performance and materials as specified shall be considered "or equal" to the specified flagpole.

4. Specifications have been based upon Atlantic Fiberglass, Model GS-30, Single Mast, internal halyard, ground sleeve installation.

Concrete Base
Concrete for base course shall conform to the requirements of M4.02.00 for Class C cement concrete.

MOUNTING

1. Ground Sleeve: Provide manufacturer's standard ground sleeve and all mounting accessories for a complete, in-ground installation. Ground sleeve to be specially designed and manufactured to receive flagpole height and diameter as specified herein.

2.4 ACCESSORIES

2. Finial Ball: Manufacturer's standard finial sized as indicated for height of flagpole.
    a. Gold paint is electrostatically adhered to the inside of a clear high density Plexiglas finial

3. Halyard: Provide internal halyard, winch mechanism, and winch crank handle. Stainless steel plate to be provided with access port with security bolt to prevent unauthorized operation of internal halyard. Winch mechanism to include halyard spool, stainless steel roller with non-ratcheting friction brake, and holding bracket.

4. Halyard Flag Clips: Provide 2 snap hooks per halyard.

5. Flash Collar: Manufacturer's 14" standard flash collar manufactured of UV resistant, flexible polypropylene. Color to match flagpole finish.

2.5 MISCELLANEOUS MATERIALS

1. Concrete: Comply with requirements of M4.02.00 for Class C cement concrete.

2. Flags: Furnish the following flags for use with flagpoles:

    1. Provide one (1) United States of America flag, 6' x 10', nylon

CONSTRUCTION METHODS

PREPARATION

A. Excavation: For foundations, excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure forms, foundation tube, ground sleeve, or anchor bolts in position, braced to prevent displacement during concreting.

C. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than 7 days or use a non-staining curing compound.

D. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks and uniform in texture and appearance. Provide positive slope for water runoff to base perimeter

FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to shop drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastometric sealant and cover with flashing collar.

METHOD OF MEASUREMENT
This item shall be measured per each, complete in place.

BASIS OF PAYMENT
This item shall be paid for at the Contract unit price per each, which price shall constitute full and complete compensation for all labor, materials, including flagpole, flag, foundation,

concrete, mounting hardware and equipment and all other incidentals required to finish the work, complete and accepted by the Engineer.

Excavation will be paid for under Item 112 - Unclassified Excavation and Backfill. Gravel will be paid for under Item 126 – Gravel Borrow.

ITEM 933.2021 PLANTER REMOVED AND DISPOSED EACH

Work to be done under this item shall include all labor, materials and equipment required to remove and dispose of existing Concrete Planters as shown on the Drawings or as directed by the Engineer.

Planters shall be disposed of by the Contractor in accordance with all applicable Federal, State and local requirements. Any plant material or soil remaining in the planter shall also be properly disposed of.

METHOD OF MEASUREMENT
Planters Removed and Disposed shall be measured per each, complete.

BASIS OF PAYMENT
The unit bid price per each shall be full compensation for all work required as directed by the Engineer

ITEM 934.2021 BOLLARDS REMOVED AND DISPOSED EACH
Work to be done under this item shall include all labor, materials and equipment required to remove and dispose of existing security bollards as shown on the Drawings or as directed by the Engineer.

Removal shall include bollard, decorative sleeve, foundation and any other incidental items related to the bollards. Bollards shall be disposed of by the Contractor in accordance with all applicable Federal, State and local requirements.

METHOD OF MEASUREMENT
Bollards Removed and Disposed shall be measured per each, complete.

BASIS OF PAYMENT
The unit bid price per each shall be full compensation for all work required as directed by the Engineer

ITEM 935.2021 CARROLL PLAZA SCULPTURE LUMP SUM

General

Work under this item shall consist of developing, testing, furnishing, and installing a responsive custom sculpture. The sculpture shall integrate the programming of motion sensors, lights, mist, and sound to create an interactive feature that responds to daily preprogrammed displays as well as automates triggered scenes from an integrated controller housed within an electrical cabinet. Final design and prototyping of internal components shall be included in the work as well as robust coordination with other items including the audio-visual system and water feature.

Project elements include metal sculpture, internal components, concrete foundations, gravel, rebar, stainless steel pins and epoxy. This item shall include labor, materials, and equipment required to furnish and install the items. Construct items to the lines and grades as shown on the drawings and to the satisfaction of the Engineer.

This work shall include providing all labor, equipment, materials, incidental work, and construction methods necessary to install a fully functional Carroll Plaza Sculpture in the location as shown and detailed on the Drawings.

Submittals

Provide the following submittals for approval before proceeding with the work.

Programming:
Animation/script of the of year-round daily operation of lighting, water, and audio.
Animation of the motion sensors cues/automated scenes.

Shop Drawings:
Provide shop drawings for the following

- Metal items showing sections and profiles.
- Internal components - stainless-steel brackets and supports within the sculpture columns.

Mockup:
Full scale sample one column. Sample to be of the same size (height/diameter) as a permanent column.

References

The following quality standards shall apply to the work of this Section in addition to any standards mentioned within in the specification:

- Welding shall be in accordance with the Welding Code of the American Welding Society.

Materials

Metal Materials
Metal used in the fabrication and installation of the site improvements of this Section shall conform to the following Specifications:

Stainless Steel, Type 304 and in accordance with the following ASTM designations unless otherwise indicated:

Top cap shall be 11 gauge, welded 1.5” ring with 11-gauge removable center disk, attached w (4) button head hex 3/8” bolts

Perforated spiral weld cylinder column wall thickness shall be 14 GA, perf code 64, 1/2” holes x 11/16 staggered or as approved by the Engineer.

Column base wall thickness shall be SCH 10, with, w/access panel(s), cutouts, drill holes, etc. or as approved by the Engineer.

Steel Columns: Each steel tube shall be sized per the drawings. The base solid tube section would be welded to the upper perforated spiral section. A removal access panel shall be provided at the base of each tube. All hardware shall be vandal resistant. The access panel shall be large enough get tools in to tighten J-bolts, to place, adjust and maintain fog nozzles, lights, sensors, and speakers.

The final fabrication shall be a smooth surface, welds smoothed, and electropolished to a matte orange skin type texture for all exposed elements.

Concrete Base
Concrete for base course shall conform to the requirements of M4.02.00 for Class C cement concrete. Conduit shall be PVC unless otherwise noted.

Gravel
Gravel materials shall consist of compacted gravel (M1.03.0, Type B)

Reinforcing Bars
Reinforcing Bars shall meet ASTM A 615/A 615M, Grade 60, deformed. Supports for Reinforcing: Use wire bar type supports complying with CRSI specifications.

Stainless Steel Anchor Bolts
Stainless steel Pins to anchor Stone to new concrete shall be Type 304. Shall be of sizes indicated on the drawings

Water
Water shall be potable and free of injurious contaminants.

QUALITY ASSURANCE

2. Source: Obtain each column as a complete unit from single manufacturer, including fittings, accessories, bases, and anchorage devices.

DELIVERY, STORAGE, AND HANDLING

4. Store Steel Columns in a dry location, protected from the weather and moisture, as recommended by the manufacturer.

5. Ship to project site in one piece.

Construction Methods

Extreme care shall be taken during the handling to avoid damage to the Materials.

Fabricate Steel Columns to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Exposed surfaces shall have smooth finish and sharp, well defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves. All welding, except as otherwise indicated, shall extend the entire length of joints. All welded face joints shall be ground flush and smooth. All welds shall be water tight. Ornamental metalwork shall be cut, drilled, countersunk, and tapped as required for the attachment of other work where shown on the drawings or when instructions for such work are given on the approved shop drawings. Ornamental metalwork to be built in with concrete or masonry shall be of the form required for anchorage, or shall be provided with suitable anchors or expansion shields.

Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw cut and carefully fit together. All connections shall be full welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation, or variation.

In assembling and during welding, the component parts shall be held by sufficient clamps or other means to keep the parts straight and level.

Welding procedures and materials used for welding shall conform to the current Specifications of the American Welding Society for the metals involved with all welds ground smooth.

After being deposited, welds shall be brushed with wire brushes, show uniform section, smoothness of weld metal, feather edges without envelopes and freedom from porosity. Visual inspection at edges and ends of fillets and butt joint welds shall indicate good fusion with and penetration into the base metals. All welds shall be watertight, and precaution shall be taken to minimize locked-up stresses and distortion due to heat.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Join by welding all joints continuously. Remove sharp or rough areas on exposed surfaces.

Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes in the bottom of all posts, horizontal rails and where water may accumulate.

Install components level and plumb. Anchor components securely in place.

Clean by washing thoroughly with clean water and soap and rinsing with clean water.

Measurement and Payment

Sculpture shall be measured complete in place as determined by the Engineer.

Sculpture will be paid for at the contract unit price, as Lump Sum. complete in place which price will be full compensation for developing, testing, furnishing, and installing a responsive custom sculpture including metal columns, concrete base, rebar, and stainless steel anchors. This price includes incidental labor and materials necessary to complete the work.

Excavation will be paid for under Item 120.1 - Unclassified Excavation. Gravel will be paid for under Item 151.02 - Gravel.

ITEM 936.2021 SIDEWALK THICKNESS ADJUSTMENT UNDER STREET FURNITURE SQUARE YARD

CONSTRUCTION METHODS
The concrete sidewalk thickness should be adjusted to 8" under street furniture as shown in "Detail for Street Furniture". The concrete shall be the same material used in Item 701 – Cement Concrete Sidewalk.

METHOD OF MEASUREMENT
This item shall be measured per square yard, complete in place.

BASIS OF PAYMENT
This item shall be paid for at the contract unit price bid square yard, which price shall constitute full and complete compensation for all labor, materials, and equipment and all other incidentals required to finish the work, complete and accepted by the Engineer.
The following table shows the maximum allowable concrete (SY) to be used and paid for per item:

ITEM	DESCRIPTION	CONCRETE QUANTITY (SY)
910.2017	BIKE RACK	1
914.2020	TRASH RECEPTACLE	1

ITEM 937.2021 PLANTING SOIL MIX CUBIC YARD

DESCRIPTION:
The work under this item shall conform to the applicable requirements of Section 751 of the Standard Specifications and the following:

The work of this Section consists of providing all equipment, materials and labor necessary to supply and place Planting Soil Mix as indicated on the Drawings and as specified herein or both. Supplying and placement of Planting Soil Mix shall include, but not be limited to:

Supplying, testing, placing, spreading and grading of all materials required in the Planting Soil Mix system under the sidewalk, including sand-based Planting Soil Mix.

REFERENCES

1. Massachusetts Department of Transportation (MassDOT): Standard Specifications for Highways and Bridges
2. American Society for Testing and Materials (ASTM):
    a. D 75 Practice for Sampling Aggregates
    b. D 422 Test Method for Particle-Size Analysis of Soils
    c. D1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-in. Drop
3. A.O.A.C.: Association of Official Agricultural Chemists.
4. USDA: United States Department of Agriculture
5. AASHTO: American Association of State highway and Transportation Officials
6. Massachusetts Department of Agriculture

SUBMITTALS

Submit the following samples and submittals for approval in conformance with the requirements of this Section.

All testing and analysis shall be at the expense of the Contractor.

1. Loam for use in manufacturing Planting Soil Mix shall be sampled and tested in accordance with the following:

    The Contractor shall provide a one cubic foot representative sample from each proposed source of Loam, and organic amendment for testing, analysis, and approval. Additionally, the Contractor shall provide one cubic foot representative samples of Planting Soil Mix delivered to the site and stockpiled for use. Samples from on-site stockpiles of these three soil materials shall be taken as directed by the Engineer and packaged in the presence of the Engineer.

    The Contractor shall deliver all samples to testing laboratories and shall have the testing report sent directly to the Engineer. Tests for gradation, organics, soil chemistry and pH shall be performed by a soil testing agency recommended by the University of Massachusetts Extension Program and approved by the Engineer and Department. Test reports shall include the following tests and recommendations.

    a. Sieve analysis shall be performed and compared to the USDA Soil Classification System. Sieve analysis shall be by combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D 422 after destruction of organic matter by ignition. The silt and clay content shall be determined by a hydrometer test of soil passing the #200 sieve. To facilitate review and approval of sieve analysis, provide a computer generated gradation curve from UMASS Soil & Plant Tissue Laboratory.

    b. Percent of organics shall be determined by the loss on ignition of oven-dried samples. Test Samples shall be oven-dried to a constant weight at a temperature of 230 degrees F, plus or minus 9 degrees.

c. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, extractable Aluminum, Soluble Salts, and acidity (pH) and buffer (pH). Nutrient levels shall be measured in parts per million (PPM). A Conductance Meter shall be used to measure Soluble Salt levels in soils: water extracts.

d. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish particular planting objectives noted.

e. All tests shall be performed in accordance with the current standards of the Association of Official Analytical Chemists.

2. Limestone: Submit supplier's certification to the Engineer certifying that the limestone being supplied conforms to these Specifications.

3. Fertilizer: Submit product literature of planting fertilizer and 6 certificates showing composition and analysis. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.

4. If biosolid compost is used as an organic component of the proposed planting soil mixture, the amount of organic material used shall not exceed agronomic rates for nitrogen and phosphorus for trees and shrubs, turf or ornamental perennials.

   Provide certificates of agronomic rates from vendor for organic matter used in loam borrow manufacturing process. Provide name of manufacturer of compost, telephone number of contact person at the manufacturer, the specific site of the manufacturing of the compost.

DELIVERY, HANDLING, AND STORAGE

1. Do not deliver or place soils in frozen, wet, or muddy conditions. Do not deliver or place materials in an excessively moist condition.

2. Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain to near optimum compaction moisture content.

EXAMINATION OF CONDITIONS

1. All areas to receive Planting Soil Mix shall be inspected by the Contractor before starting work and all defects such as incorrect grading, compaction and inadequate drainage etc. shall be reported to the Engineer prior to beginning this work.

2. The Contractor shall be responsible for judging the full extent of work requirements involved, including but not limited to the potential need for temporary storage and staging of soils, including moving soil stock piles at the site to accommodate scheduling of other work and the need to protect installed soils from compaction, erosion and contamination.

MATERIALS

Loam:

8. Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Loam shall not be delivered or used for planting while in a frozen or muddy condition. Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Minimum	Maximum
10	100	--
18	87	100
35	65	92
60	45	80
140	26	46
270	16	32
0.002mm	2	5

9. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 5 or less. (D80/D30 < 5).

10. Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

11. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

12. The organic content shall be between 3.5 and 6.0 percent.

Organic Amendment Materials (Compost):

1. Compost for amending planting media shall be a stable, humus-like material produced from the aerobic decomposition of organic residues. The residues, if biosolids, shall consist of compost meeting the required criteria as listed herein this Section or approved equal. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by the producer.

    a. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.

    b. Stability shall be assessed by either a CO2 evolution test, a re-heating test, or the Solvita procedure. Protocols for each are specified by the coalition of Northeastern Governors Source Reduction Task Force (CONEG) in their 1966 report, "Model Procurement Specifications for Source Separated Compost." and the Solvita manual (version 3.5). For the CO2 test, the compost respiration shall be no more than 6 mg CO2-C/gBVS day. For re¬heating using the Dewar self-heating test, the maximum heat rise shall be no greater than 48 degrees F above room temperature (68 to 77 degrees F). For the Solvita test, the compost must achieve a maturity index of 6 or more. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.

c. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, and Commonwealth of Massachusetts 310 CMR 32.00 (for applications to soils with human activity).

d. Organic Content shall be at least 40 percent (dry weight). One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve according to procedures performed by a soil testing agency recommended by the Ohio State University Extension Program and approved by the Landscape Architect and Department. A 3 cubic inch sub-sample of the screened and mixed compost is ground to pass the number 60 sieve. 0.07 to 0.10 ounces of ground sample, dried to a constant weight at 221 degrees F is placed into a muffle furnace. The temperature is slowly raised (41 degrees F/minute) to 842 degrees F and maintained for three hours. The sample is removed toan oven to equilibrate at 224F and the weight is taken. Organic matter is calculated as loss on ignition.

e. PH: The pH shall be between 5.5 to 8.0 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis, Part 2, 1986.

f. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 2.0 mmohs/cm (dS/m).

g. The compost shall be screened to 3/8 inch maximum particle size and shall contain not more that 3 percent material finer that the 200 Sieve as determined by hydrometer test on ashed material.

h. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and

Soil Additives:

1. Acidulant for adjustment of Planting Soil Mix and Planting Pit Medium pH shall be commercial grade flours of sulphur, ferrous sulfate, or aluminum sulfate that are unadulterated. Acidulants shall be delivered in unopened containers with the name of the manufacturer, material, analysis and net weight appearing on each container.

2. Ground limestone for adjustment of Planting Soil Mix pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve.

Planting Fertilizer:

1. Commercial fertilizer for use in Planting Soil Mix shall be a product complying with the State and United States fertilizer laws. Deliver fertilizer to the site in the original unopened containers, which shall bear the manufacturer's certificate of compliance

covering analysis, which shall be furnished to the Engineer. Fertilizer shall be free of nitrogen with percentages of weight for phosphorus and potassium as recommended by soil testing and analysis. Phosphorus and potassium shall be added to the top 18 inches of the Planting Soil Mix in 6-inch lifts as the Planting Soil Mix is placed. Rototill fertilizer into each successive 6-inch lift. Planting Soil Mix shall be sampled and tested after application of fertilizer to verify that amended Planting Soil Mix meets the requirements of the soil test analysis recommendations. Submit soil test results to the Engineer for review and approval.

CONSTRUCTION METHODS

Sub-surface Conditions:

1. Notify the Engineer of subsurface conditions, which will affect the Contractor's ability to complete the work.

2. Locate and confirm the location of all underground utility lines and structures prior to the start of any excavation.

3. The contractor shall exercise extreme care and caution when excavating around existing utilities and shall repair any underground utilities or foundations damaged by the Contractor during the progress of this work. The cost of all repairs shall be at the Contractor's expense.

Site Preparation:

1. Do not proceed with the installation of the Planting Soil Mix material until all walls, curb footings and utility work in the area has been installed. For site elements dependent on Planting Soil Mix for foundation support, postpone installation until immediately after the installation of Planting Soil Mix.

2. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the Contract Documents. Maintain all required angles of repose of the adjacent materials as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures.

3. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the Contract Documents.

4. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout silts or other material harmful to plants has been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.

5. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

6. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each

working day. Any damage to the paving caused by the soils installation contractor shall be repaired by the General Contractor at the General Contractor's expense.

7. Maintain all silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do not track soil from the site onto adjacent property and the public right of way.

Planting Media Mix Design:

1. Mix Design Planting Soil Mix

    a. The Sand-Based Planting Soil Mix shall consist of a blend of (3) parts by volume of Loam and (1) parts by volume of Organic Amendment. Blending of the components shall be carried out with earth moving equipment prior to placement. The components shall be blended to create a uniform mixture as determined by the Engineer. The final mix shall conform to the following gradation requirements for material passing a Number 10 sieve.

Placement of Planting Soil Mix:

1. Contractor shall obtain Engineer's written approval of previously completed work of rough grading of subsoil prior to commencing loam borrow or Planting Soil Mix placement work.

2. Immediately prior to dumping and spreading the Planting Soil Mix, the subgrade shall be cleaned of all debris or rubbish. Such material shall be removed from the site. After subgrade levels have been reached, and immediately prior to placing Sand-Based Planting Soil Mix the entire subgrade area shall be thorough compacted, then loosened to a minimum depth of four inches utilizing the teeth on the bucket of a backhoe or by deep raking.

3. The Contractor shall install Planting Soil in successive horizontal lifts no thicker than 6 inches in turf areas to the required compaction levels as described herein. At the edges of bituminous concrete walkway, the Contractor shall install Planting Soil at a higher level to anticipate any reduction of Planting Soil volume due to settling during the warranty period.

    a. Compact Planting Soil to the required density as specified herein.
    b. Maximum dry density for Planting Soil shall be determined in accordance with ASTM D698. In lawn areas the following percentages of minimum to maximum dry densities shall be achieved:

Minimum	Maximum
83%	86%

4. The surface area of each lift hall shall be scarified by raking prior to placing the next lift. In addition to the range cited above, compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The Planting Soil in each lift should feel firm to the foot in all areas and make only slight heel prints. At completion of the Planting Soil installation, the soil should offer a firm, even resistance when a soil sampling tube is inserted from lift to lift.

5. Select equipment and otherwise phase the installation of the Planting Soil to ensure that equipment does not travel over already installed soil. Contractor shall back his way out of the project site.
6. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of Planting Soil to the finished grade.

Acceptance
Confirm that the final grade of the Planting Soil is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the Engineer to inspect final grade. Do not proceed with the remaining work of this Contract until the Engineer has given his/her written approval of the final grade.

Method of Measurement and Basis of Payment

Item No. 751.3, PLANTING SOIL MIX, will be measured per cubic yard, installed complete-in-place all which price and payment shall constitute full compensation for complete compliance with requirements of this item, including providing testing, amending, excavation, placing, spreading, material, compacting and fine grading.

938.2021	**SLENDER SILHOUTTEE SWEETGUM 2.5-3 INCH CALIPER**	**EACH**
939.2021	**IVORY PILLAR TREE LILAC 2.5-3 INCH CALIPER**	**EACH**
940.2021	**EMERALD CITY TULIP TREE 2.5-3 INCH CALIPER**	**EACH**
941.2021	**AUTUMN GOLD GINKGO 2.5"-3" CAL.**	**EACH**
942.2021	**DWARF FOUNTAIN GRASS - 'HAMELIN' 1 GALLON**	**EACH**
943.2021	**MALE WINTERBERRY 15"-18"**	**EACH**
944.2021	**RED SPRITE WINTERBERRY 24"-30"**	**EACH**
945.2021	**BLUE PACIFIC JUNIPER 18"-24"**	**EACH**
946.2021	**SCARLETTA LEUCOTHOE 18"-24"**	**EACH**
947.2021	**PRAIRIE DROPSEED 1 GALLON**	**EACH**
948.2021	**SALSA RED CONEFLOWER (4" POTS)**	**EACH**
949.2021	**HAPPY RETURNS DAYLILY (4" POTS)**	**EACH**
950.2021	**PARDON ME DAYLILY (4" POTS)**	**EACH**
951.2021	**BIG BLUE LIRIOPE 1 GALLON**	**EACH**
952.2021	**AUTUMN JOY STONECROP (4" POTS)**	**EACH**
953.2021	**CORAL REEF STONECROP (4" POTS)**	**EACH**
954.2021	**WHITE MYRTLE (4" POTS)**	**EACH**

DESCRIPTION
The work under these items shall conform to the relevant Provisions of Section 771 PLANTING TREES, SHRUBS AND GROUNDCOVER of the Standard Specifications, except as amended and supplemented and as indicated on the drawings and as specified below.

Backfill Mixture for Plant Material
The Contractor shall provide testing of soils in planting locations. The Contractor shall provide test results and recommendations as necessary for soil amendment to the Engineer for his approval. Backfill shall be a blend of three-part loam borrow, one-part organic material.

Prior to installing plants, the Contractor will request inspection by the City's Tree Warden at least 10 days before the anticipated date of installation.

At the end of the Maintenance Period, the Contractor will request inspection by the City's Tree Warden at least 10 days before the anticipated date of inspection.

Compensation
The items listed above will be measured for payment per each, complete in place.

The items listed above will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 804.2	**2 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL)**	**FOOT**
ITEM 804.3	**3 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL)**	**FOOT**
ITEM 955.2021	**1 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL)**	**FOOT**
ITEM 956.2021	**1.5 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL)**	**FOOT**
ITEM 957.2021	**2.5 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC - (UL)**	**FOOT**

The work under these Items shall conform to the relevant provisions of Section 801 of the Standard Specifications, Section 800 of the City of Worcester Standard Specifications and Details, and the following:

Conduit for traffic signals, service connections, street lighting and communication, whether shown on the plans or additional lengths placed as directed by the Engineer, may be increased or decreased by the Engineer depending upon actual conditions encountered, as provided for in Section 4.06 of the Standard Specifications.

All non-metallic conduit shall be sunlight resistant Polyvinyl Chloride (PVC), SCHEDULE 80, meeting the requirements of National Electrical Manufacturing Association (NEMA)

Specification TC-2 and Underwriter Laboratory (UL) standards UL-514; and/or ASTM D-1784. Fittings shall meet NEMA TC-3 and UL-514. New conduit for traffic signal and interconnect systems shall be installed where shown and with the sizes shown on the plans and as shown in the details. For conduit crossing the roadway, conduit shall be backfilled with Controlled Density Fill (CDF) - Type 2E, as shown in the details. Existing conduit lines to be retained that are collapsed or damaged shall, at the direction of the Engineer, be replaced with new conduit under these items.

All underground installations, including any required wiring, must be completed before the finished surface is placed on the roadways and sidewalk. All excavations in roadways and sidewalks required for the installation of conduit shall be completed prior to placing and compacting roadway and sidewalk gravel subbase.

In locations where a trench has been cut in roadway areas to be cold-planed and resurfaced, the roadway shall be repaired and maintained as follows:

Cut the existing pavement to neat true lines by mechanical means along the length of trench equally spaced from the centerline of trench and not more than 18 inches apart. The conduit shall be placed on a sand bed, backfilled with controlled density fill (Type 2E) conforming to the requirements of Section M4.08.0 of the Standard Specifications.

Where conduit crosses the roadways, no separate payment shall be made for the saw-cutting of pavement, excavation, sand bedding, controlled density fill, or incidental materials, but all costs in connection therewith shall be included in the contract unit price.

In all other locations, conduit trenches shall be filled with gravel in accordance with the Standard Specifications and Standard Details.

One (1) two-inch conduit shall be installed through the existing foundation wall of the Hanover Theater into the mechanical room. The conduit shall be cut and capped 12 inches from the interior wall. The penetration through the wall shall be cored. Hammering shall not be permitted. The cored hole shall be of sufficient diameter to allow for the insertion of the two-inch conduit and a sufficeint thickness of grout to seal the opening. Grout shall be a product listed on the MassDOT List of Approved Materials. An approximate location of the pentration is shown on the plans. The exact location shall be determined in the field in consultation with the Engineer and the Theater. The cost of coring through the wall, installing the condut and grouting shall be included in the cost of Item 804.2.

METHOD OF MEASUREMENT

Conduit shall be measured by the linear foot along the axis of the conduit for the actual length installed between traffic signal cabinets, pull boxes or hand holes.

BASIS OF PAYMENT

Payment under these Items shall be at the Contract Unit Price bid per Foot for furnishing and installing conduit, which price shall be full compensation for all necessary or incidental work, including saw-cutting, excavation, pull rope, warning strip, sand bedding, gravel borrow backfill, controlled density backfill, and compaction complete in place.

Sawcutting of roadway and sidewalk surfaces and temporary patch material shall be considered incidental to these conduit items and no additional compensation will be made.

Payment for penetrating and installing two-inch conduit through the Theater wall including excavation, coring, grouting, backfill and other incidental work to complete the installation shall be paid for under the unit cost per foot for Item 804.2.

ITEM 958.2021	**WIRE TYPE 7 NO. 6 GENERAL PURPOSE**	**FOOT**
ITEM 959.2021	**WIRE TYPE 7 NO. 4 GENERAL PURPOSE**	**FOOT**
ITEM 960.2021	**WIRE TYPE 7 NO. 3/0 GENERAL PURPOSE**	**FOOT**
ITEM 961.2021	**WIRE TYPE 7 NO. 12 GENERAL PURPOSE**	**FOOT**
ITEM 962.2021	**WIRE TYPE 10 NO. 12 GROUNDING AND BONDING**	**FOOT**
ITEM 963.2021	**WIRE TYPE 10 NO. 6 GROUNDING AND BONDING**	**FOOT**
ITEM 964.2021	**WIRE TYPE 10 NO. 4 GROUNDING AND BONDING**	**FOOT**

General
All work performed under these Items shall be in accordance with the relevant provisions of Section 813 of the Standard Specifications and the following:

The Contractor shall be required to furnish and install all materials, equipment and labor necessary to completely wire and operate the street lighting system. All materials and wiring procedures shall conform to the specifications contained herein and to the requirements and standard practices of the Section 800 and the following:

All wire and connectors shall conform to the standards of the National Electrical Manufacturers Association or the Underwriters' Laboratories, Inc., whichever is applicable. All materials and workmanship shall conform to the requirements of the National Electrical Code, Standards of the American Society for Testing and Materials, and any local ordinances that may apply.

Wherever any reference is made to the standards mentioned above, the reference should be construed to mean the standard that is in effect on the day the Notice to Proceed to the Contractor for the work is dated.

Wire sizes shall be based on American Wire Gage (AWG), as applied to copper conductors.

Submittals
Submittals for wire and splice materials shall be made in a timely fashion including all manufactures data sheets, and shop drawings, as applicable, and specified herein.

Materials
The conductor shall be composed of soft drawn 7-strand copper of the gauge shown on the drawings. The insulation shall be installed as a single jacket of cross-linked polyethylene of Underwriter's Laboratories Type XHHW rated at 90 degrees C continuous in wet and dry locations, 600 volt as per the Mass Electrical Code.

#4 AWG ground conductor shall be bare copper as specified in the standard specifications.

Wire and cable furnished and used shall be new and shall have the size, grade of insulation, voltage and manufacturer's name permanently marked on the outer covering at regular intervals. Wire and cable shall be delivered to the site in complete coils or reels with identifying size, type SS-111 and insulation tags. Wire and cable shall be protected from weather and damage during storage and handling.

Splicing Materials and Methods

Splicing shall be in accordance with the contract drawings and the standard specifications. All splices shall be suitable for wet locations, including splices in pole bases and load centers. Use of wire nuts is prohibited. Connections in the pole top shall be with insulated pressure connectors.

Construction
No wire shall be drawn in to any conduit until all work that may cause damage to the wire is complete.

All wire shall be continuous from light pole to light pole without running splices in conduits or handholes. Splices are prohibited in handholes except ground conductor.

All wire terminals, taps and splices shall be made secure with connectors, splicing materials and methods as hereinafter specified.

All incoming wires and outgoing wires in highway lighting load centers, handholes and poles shall be banded as indicated on the contract drawings.

Grounding
Coatings and rust on conduits and grounding rods shall be removed at the location where the ground fittings are to be installed.

The bare copper conductor shall be connected to the continuous insulated bonding lead, which shall be identified with green plastic marking tape as noted in the specifications. Bonding leads for lighting fixtures on poles shall be an insulated #10 AWG, marked green, which shall be extended to the nearest handhole and interconnected to the bare copper ground wire in the handhole of gauge shown on the contract drawings and the pig tail conductor shall be connected to the ground rod. The ground wire shall also connect to the ground lug on the handhole frame and be bonded to the handhole cover.

A conductor with the same insulation of the power leads shall be installed in all conduits as a continuous bond wire. All bonding leads from fixtures, pole, control boxes, fittings and ground rods shall be connected to the continuous insulated bonding lead which shall be identified with green plastic marking tape as noted in the specifications.

All grounding shall conform to the applicable provisions of the National Electrical Code.
SS-112

Field Tests
Upon the completion of each wiring system, and before any connection is made to operating equipment, the Contractor shall perform, in the presence of the Engineer, the following tests of each circuit to determine whether the installations are in acceptable working order.

a. Tests for continuity
b. Tests for ground
c. Tests for insulation resistance (Megger Test) from circuit wires to ground, and between circuit wires.

Tests for ground shall be performed in accordance with the relevant provisions of Section 813 of the Standard Specifications. The entire electrical wiring system shall be tested for continuity, grounds, resistance to ground, insulation, shorts and opens. This shall be done by means of a megohm meter test.

After installation of the wiring system is complete with the required splices, the lamp ballast primary shall be disconnected and each circuit shall be tested with a 1000 volt megger. Tests on each circuit shall be between each conductor. When the measured value is less than 200 megohms between two conductors, the Contractor shall locate the point or points at fault, make proper corrections, and then demonstrate by further test the elimination of such faults.
These tests shall be performed in the presence of the Engineer.

The test results shall be submitted to the Engineer for review and approval. If any results are questionable or inconsistent, the Contractor shall repeat the tests and make any necessary corrections at the request of the Engineer. No wiring system will be accepted until these are satisfactorily performed and approved.

The Contractor shall furnish the Engineer with a report of the megohm-meter readings for a permanent project record.

All tests and any necessary repairs or replacements that are indicated by the Engineer to produce a fault-free system will be performed at the Contractor's expense.

Warranties
The Contractor shall provide a performance warranty for one year on the entire work performed under this contract including the performance of all equipment and components of the roadway lighting system specified. The performance warranty responsibility of the contractor shall commence after official acceptance by the City of Worcester or the Engineer.
NOTE: The Contractor shall be completely responsible for all maintenance, repairs and replacement of damaged equipment during the functional test and throughout the performance warranty period.

If within 48 hours after notification by the Engineer of a malfunction, and the Contractor fails to make such repairs as necessary, the Engineer will undertake repairs of which all costs are to be
SS-113 borne by the Contractor. The cost of any maintenance necessary, except electrical energy, shall be at the Contractor's expense and will be considered as included in the price paid for the
Contract item involved and no additional compensation will be allowed therefore.

Method of Measurement
The work of this section shall be measured by the linear foot along the center line of the conduit in which the conductor is placed. No allowance will be made for the necessary lengths of slacked cable laid around the sides of manholes, handholes, junction boxes, pull boxes, or extending from foundations for making splices, taps in cable, and connecting the internal components of control cabinets. No allowance will be made for cable in controllers, light poles or other items other than conduit.

Basis of Payment
Payment will be made unit price by the linear foot which price shall constitute full compensation for furnishing, installing and connecting the street lighting cables, the grounding of the system, testing the lighting circuit wiring, grounding wire testing, and for furnishing any equipment and/or materials required.

The cost of any maintenance necessary to include testing, replacement of lamps, luminaires, wiring splices, grounding, and all appurtenances, except electrical energy, shall be at the

Contractor's expense and will be considered as included in the price paid for the contract item involved and no additional compensation will be allowed therefore.

ITEM 965.2021 SITE LIGHTING LUMP SUM

The work to be done under this Item shall conform to the relevant provisions of the Standard Specification and the following:

FIXTURE G - STREET LIGHTING POLE AND FOUNDATION

DESCRIPTION

General
The work shall include, but not be limited to, the excavation, removal and disposal of existing soil, the installation of new precast light pole foundations and restoration of pavement surfaces to match existing.

The work shall include, but not be limited to, the installation of Decorative light poles, light fixtures, bulbs, ballasts, receptacles and appropriate grounding. Contractor shall provide all labor, materials, equipment, tools, supplies and transportation involved in the installation of electrical equipment as specified.

Submittals
List of materials and equipment requiring shop drawings shall include:

1. Concrete Products
2. Light Poles, Fixtures
3. Light Pole Accessories

MATERIALS

General
Materials and products furnished shall be designed for the intended use, shall meet all requirements of the latest edition of the National Electric Code (NEC), and all local codes.

Materials shall be manufactured in accordance with the standards indicated in this Section, and typical industry standards and codes for the products specified.

The materials used shall be new, unused, and of the best quality for the intended use. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation. The required information should be marked on durable nameplates that are permanently fastened to the equipment.

Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment (excluding light poles) shall not be stored outside exposed to the elements. If any equipment or apparatus is damaged, such damage shall be repaired at no additional cost, or replaced at no additional cost as directed by the Engineer.

Raceways (Conduit)
Polyvinyl Chloride (PVC) Conduit, electrical, gray, Schedule 40 as specified, meeting the requirements of UL 651 and NEMA TC-2.

Minimum size of conduit shall be 2". Unless indicated on Drawings, conduit sizes can be sized in accordance with National Electric Code (NEC). Conduit bends shall not have kinks or flats, and shall not be less than standard radii.

Foundations Decorative Street Lights
Provide approved foundations, and other devices as necessary and as required.

Foundations for Decorative light poles shall be specified by lighting manufacture and City of Worcester, including number, type and location of anchor bolts. Foundations shall be made of minimum 5,000 psi concrete (at 28 days) and have steel reinforcement meeting ASTM A-615, grade 60 (cover to steel, 1" minimum). Foundations shall have a minimum of two (2) 2" PVC conduits for lighting circuits, 180 degrees apart. Foundations to be installed with the top of the concrete 2-4 inches above final grade. Anchor bolts to be 3/4" diameter by 30" long "J-hook" type galvanized steel (4 per foundation).

Bolt circle diameter (12") and bolt orientation shall be as shown on Contract Drawings. Concrete foundation shall be 24-inches diameter.

Wire and Cable
Unless otherwise noted, conductors for power, lighting, and grounding above grade shall be No. 12 through No. 8 AWG, NEC type THWN/THHN, meeting the requirements of UL 83. Conductors for power and lighting shall be no smaller than No. 12 AWG.

All conductors shall be annealed copper, 98% conductivity, Class B stranded, except conductors used for power and lighting circuits No. 10 AWG and smaller which may be solid. All conductors should be rated for 600 volts or less, with a thermal rating of 90° C.

The outside covering of all wiring for power, lighting, grounding, and control uses shall be color coded to identify polarity as follows:

Phase	Color
A or 1	Black
B or 2	Red
C or 3	Blue
Neutral	White
Equipment Ground	Green

Decorative Street Lights
Provide outdoor Decorative lighting fixtures, poles, equipment and luminaire components (lamps, ballasts, etc.) where shown as specified on Drawings, wired and assembled. Provide approved brackets, and other devices as necessary and as required.

Poles and Fixtures: Decorative Poles and Fixtures shall be City Standard

Poles for this project shall be by Holophane, North Yorkshire, with Atlanta Luminare, City Standard:

- Atlanta Style Luminaire (ALU): ALU, 250W High Pressure Sodium Mogul Base, 208V, Black, Asymmetric Teardrop Type IV Glass Door OUC

- Roadway Arm (OUC): OUC, 45" Single Arm, Cast Aluminum, Black, Boston Harbour, Swivel, Black

- Photocontrol receptacle for NEMA Twistlock photocontrol

- North Yorkshire Cast Iron & Steel Poles (NYS):

- NYS, 21 feet, Fluted Tapered, 17 inch Round, 3 X 8 Tenon, Anchor bolts, galvanized steel, Black Powder Coat

- Weatherproof Receptacle (FG): Large, In-Use Wet Location Cover,

- Black Cast Aluminum Banner Arm (BA): 2 Bolton Banner Arm, 24 inch, Half Sphere, 1" Diameter, Breakaway Arm, Black with

- Sylvania (LU250/ECO) 250HP Clear Mogul Lamp

- All Finished Standard Black.

Catalog Numbers are Holophane –
NYS21FTB17P15ABGBK R132A S186C E138C MOD/SHAFT - FG-SBK - BAB24H4BBA - EBBBK - (1)PRKNGMTRBRCK-BK - OUC45/1CABKH - RFD145654 - BHLF200SCABK - ALU250HP20B4 PS S-67578

NYS21FTB17P15ABGBK R132A S186C E138C MOD/SHAFT - FG-SBK - BAB24H4BBA - EBBBK - (2)PRKNGMTRBRCK-BK - OUC45/1CABKH - RFD145654 - BHLF200SCABK - ALU250HP20B4 PS S-67578

CONSTRUCTION METHODS

General

This Section covers the requirements for installation of materials, proper workmanship, testing, cleaning, grounding, and work methods to be followed by the Contractor. This Section also includes specific instructions and to be used in conjunction with the contract Drawings. Any discrepancies noted between the specification, Drawings, and actual installation shall be reported immediately to the Engineer. Failure on the part of the Contractor to report discrepancies immediately will be considered negligent.

Work will be coordinated such that systems can be properly located, and conflicts and delays are avoided. Contractor shall consider commencement of work acceptance of existing conditions.

Materials and Workmanship

Work shall be executed in workmanlike manner and shall present neat, rectilinear and mechanical appearance when completed. Material and equipment shall be new and installed according to manufacturer's recommended best practice so that complete installation shall operate safely and efficiently. Remove all debris caused by Contractors' work.

Installation of Precast Light Pole Foundations

Contractor shall remove and existing sidewalk materials, curbing and other masonry to be replaced after light pole foundation is replaced. Existing soil shall be excavated out and disposed of, taking care to not damage surrounding structures, electrical conduits and other utilities. Contractor to barricade areas disturbed until fully repaired unless directed otherwise.

New precast light pole foundation shall be installed in locations as shown. New 2" PVC electrical conduit connections should be attached to new light pole foundation, to maintain continuity of conduit system. New light pole foundation shall be installed level and plumb with existing conditions and at appropriate height above finished grade. Light pole foundation to be no closer than 12-inches from front edge of roadway curb to front edge of light pole foundation.

Repair of Existing Sidewalk
Repair sidewalk in complete panels only, if existing sidewalk must be disturbed. All disturbed sidewalk to be restored to match original, pre-construction condition.

Grounding
Grounding of all Decorative light poles and fixtures shall be in accordance Section 250 of the latest edition of the National Electrical Code. Equipment bonding conductor shall be installed from branch feeder circuit into adjacent electric handhole and into light pole base. Bonding conductor to be permanently attached to metal light pole per grounding stud provided by manufacturer or field installed if not provided. Bonding conductor to be bonding to metal handhole cover if present. Provide #12Awg copper binding conductor vertically up length of pole shaft along with power conductors and bond to fixture ground stud and GFCI receptacle (if provided). Test all bonding conductors to be continuous back to source. Perform ground resistance test at each pole location. Should ground resistance be less than 25 ohms, contractor shall provide additional ground rod electrode at pole foundation, in accordance with NEC requirements and re-test to determine if resistance is below 25 ohms. Report all instances where ground resistance is above 25 ohms. All grounding conductors to be provided with either green outer jacket or green marking tape.

Testing, Inspection and Cleaning
Test wiring and connections for continuity and grounds before fixtures are connected; demonstrate insulation resistance by megger test as required at not less than 500 volts. Insulation resistance between conductors and grounds for secondary distribution systems shall meet National Electrical Code (NEC) requirements. Test lighting fixtures with specified lamps in place for 100 hours. Replace lamps that fail within 1 year after acceptance, per MassDOT standard provisions.

Installation of Lighting Fixtures
Verify construction of light pole foundations is suitable, and provide fixtures, poles, hardware, and other accessories suitable for construction encountered.

Contractor to provide (furnish and install) new Decorative light poles and Decorative light fixtures. These light poles and fixtures shall be installed on precast concrete foundation, in locations as indicated on the Contract Drawings. Contractor to provide poles and fixtures. All poles are to be provided with factory installed 120V weatherproof receptacle, mounted near the top of the pole. Contractor to provide necessary field wiring for all light fixtures and receptacles. Light poles to be installed with one set of galvanized steel washers and nuts, sized per manufacturer's requirements.

Coordinate installation of fixtures with installation of surrounding materials. Investigate lighting

fixture locations and foundation supports to ensure that no interference exists between lighting fixtures, supports, and other equipment including that provided by other trades. Report any possible interference's to the Engineer. Minimum set back of light poles is 18-inches from front of curb to edge of light pole foundation.

Install 4/C - #12 Awg cable (2 hot, neutral and ground) from each light fixture to light pole base; to be connected to #4 Awg cable feeder from metering cabinet. Wire and connect receptacle, ballast and fixture, per manufacturer's instruction.

FIXTURES A,B,C,D,E,F

General

The work under this item shall conform to the applicable requirements of MassDOT Specifications Section 820, Highway Lighting, except as amended and supplemented as indicated on the drawings and as specified below.

The Lighting Assemblies shall be as generally described on the Drawings and as detailed in these Special Provisions. This work shall be done in accordance with the Standard Specifications and these Special Provisions, and as detailed on the Drawings. The contractor shall furnish all supervision, materials, equipment, poles, foundations, accessories, handling, shipping and delivery to provide the specified Lighting Assemblies as detailed herein, complete with all appurtenances. All transportation, handling, shipping costs, manufacturer's storage and other necessary costs shall be included.

This work shall include providing all labor, equipment, and materials to install the Lighting Assemblies, complete with lamp, drivers, wiring, grounding connections and all other items necessary to provide a complete and operational system. This work shall be done in accordance with the Standard Specifications and these Special Provisions, and as detailed on the Drawings.

References and Standards

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 6th Edition, with 2015 Interim Revisions.

B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1598 - Luminaires; Current Edition, Including All Revisions.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

Submittals

Submit detailed shop drawing submittals with all aspects and dimensions, as well as equipment and material specifications of the proposed pole, Luminaire and appurtenances clearly detailed.

Shop drawing submittal shall include point-by-point photometric calculations. Calculations shall be in maintained fc. Include light loss factors in report. Point-by-point calculations shall utilize an IES standard grid. To facilitate these calculations the manufacturer may contact the engineer to receive an Auto Cad .dwg file of the project area and pole layout.

Description
See Lighting Fixture Legend Schedule for catalog numbers, fixture descriptions, color temps and voltages.

Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

Acceptable Equipment
Bidders wanting to submit alternative lighting assembly equipment shall submit complete specifications and references for the proposed alternative product a minimum of 10 days prior to the bid submission deadline. The engineer shall evaluate the proposed alternative product and inform the bidder if the proposed alternative is acceptable to the engineer. Bids will only be accepted for Lighting Assemblies that have been found to be acceptable by the Town prior to submission of the bid packages.

Requests for evaluation of acceptable alternatives shall be accompanied by a listing of 5 equivalent installations utilizing the proposed alternative lighting equipment.

Wiring
Exterior and underground wiring in conduit and grounding conductors: 98% conductivity copper 600 volt insulation, XHHW, THHN/THWN, or THWN-2. Streetlight pole internal wiring: 98% conductivity copper 600 volt insulation, MTW, XHHW, THWN-2 or THHN/THWN.

Color code

All conductors shall have color-coded insulation to designate ground, neutral conductor and phases. Colored tape alone is not acceptable. Phases shall be black and red, receptacle branch circuit shall be black, neutral shall be white and ground shall be green.

Installation

Verify that field measurements are as shown on the drawings.

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

B. Verify that suitable support frames are installed where required.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

D. Verify that conditions are satisfactory for installation prior to starting work.

Preparation

Provide extension rings to bring outlet boxes flush with finished surface. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

Installation - Luminaires

A. Coordinate locations of outlet boxes provided under Section 16138 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Install luminaires plumb and square.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

Field Quality Control

A. See Section 01400 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.

Adjusting

Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place. Luminaires with Field-Rotatable Optics: Position

optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Engineer.

Cleaning

Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

Protection

Protect installed luminaires from subsequent construction operations.

Basis of Payment

The cost for all work under this item shall be included in the per unit price and shall constitute full compensation for all equipment, labor, materials, set up and incidental costs necessary to furnish and install new light pole foundations, restoration of disturbed sidewalk, light poles, fixtures, receptacles, and all other ancillary labor and materials and all as described in the previous sections herein or as shown on the plans. The cost of cable of all types and sizes required to provide a fully operational lighting system shall be included in the unit costs of the lights.

966.2021 SPECIAL PURPOSE LIGHTING AND AUDIO CONTROL LUMP SUM

General

The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform a unified, complete, operational and accepted Lighting, Audio/AV system and related items as indicated on the Drawings and as specified in this Section, including, but is not limited to, the following:

1. Control and operation all light fixtures within the project
2. Control and operation of audio equipment
3. Coordination, control and operation of the sculpture
4. Remote management of Lighting and Audio system
5. Final terminations, dressing, and testing of all Lighting and Audio cabling, inclusive of cables pulled by others.
6. Interconnecting wiring of the system components and equipment tuning and adjustment
7. Coordination, control and operation of the fountain and fountain displays.

In Coordination with the Project Artist:

1. Programming of year-round daily operation of lighting and Audio/AV
2. Programming of seasonal light and sound

These specifications and the drawings do not necessarily indicate every single component part of each system. It is the responsibility of the Contractor to engineer each system and its interconnection to provide, furnish, and install completely operational turnkey systems. No error or omission herein or on any related Construction Documents shall relieve the Contractor from this responsibility to do so.

Submittals

Provide the following submittals for approval before proceeding with the work.

Installer Qualifications

Provide at time of bid Submission (3) client references from similar project and project photos demonstrating work of similar type, size and quality.

Shop Drawings

Cable pull schedules and/or run sheets prior to cable installation. Documentation of the entire conduit and cabling installation shall be fully performed to construction documentation standards and as specified herein

Riser diagrams, detailed parts list, pin configurations Include detailed layout plans, enclosure elevations,

Product Info

For all equipment and materials outlined within the drawings and herein, the Contractor shall submit to the Engineer; manufactures' product data (cuts sheets), certified test results, and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No materials shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match the samples.

Programming Outline

Submit a narrative for approval of the programming outline of lighting, audio and fountain displays; a.) static cues, b.) slow color roll or shift in light, c) Movement cues.

Close out Documents

At the completion of the installation, the Contractor shall provide the following items, and submit at least four sets of each. Two full sets shall be submitted to the owner, one to the General Contractor and one to the consultant. The following list shall define "Close out Documents".

1. Equipment manufacturer's operation and maintenance manuals for each piece of equipment, bound in a three-ring binder. Include any "as modified" drawings pertaining to any equipment that has been modified by the contractor.

2. A full set of "As Built" or "As Installed" drawings showing all final connections and field wiring numbers.

3. Two copies of the final Mosaic program on SD card and one electronic copy.

System Operation and Maintenance Manual - The Contractor shall produce this manual specifically for the systems detailed herein. The "Operation" section shall describe in detail, all Typical procedures necessary to activate each system to provide for the functional requirements as listed under the Specifications. The reader of this manual shall be assumed to be technically competent, but unfamiliar with this facility.

Quality Assurance

Contractor Qualifications

The work of this section shall be furnished and installed by a specialty theatrical contractor, herein referred to as a Theatrical Systems Integrator. The Integrator shall provide all work necessary to provide a complete turnkey system; including but not limited to specialty lighting

and control equipment, accessories, Audio/AV system, speakers, playback and control systems.. Supervise system installation; provide low voltage terminations and system programming.

Theatrical Systems Integrator shall be a firm with at least ten (10) years' experience in the fabrication, assembly, and installation of lighting and audio-visual systems of similar magnitude.

The supervisor of the work of this section shall have at least five (5) years direct professional experience with devices, equipment, and system installation of the type and scope specified herein.

Quality of Materials and Equipment

1. All materials and equipment supplied by the Contractor shall be new and shall meet or exceed the latest published specification of the manufacturer in all respects.
2. The Contractor shall supply the latest model, available at the time of bidding, of each piece of equipment
3. The materials and completed Work of this Section shall conform to the applicable requirements of all current local and state codes.

Special Conditions

Contractor to coordinate providing internet connection with (1) static IP address with the theater.

Acceptable Integrator

4Wall Entertainment
Contact:
Paul DeRocher
Applications Engineer
Office: 781.961.3066
125 Shawmut Rd.
Canton, MA 02021

Product Delivery, Storage and Handling

1. Electrical equipment shall always be adequately protected against mechanical injury or damage by water. Electrical equipment (excluding light poles) shall not be stored outside exposed to the elements. If any equipment or apparatus is damaged, such damage shall be repaired at no additional cost, or replaced at no additional cost as directed by the Engineer.
2. Ensure that the spaces where any electronic equipment is to be stored and/or installed is completely free from any foreign substances, such as concrete dust, or any other material that may otherwise be harmful to electronic equipment and connections. No allowances shall be made to the Contractor for equipment damage or delays due to environmental damage.

Guarantee and Maintenance

1. The Contractor shall guarantee all equipment and cabling, programming, and software furnished, in writing, against defects in workmanship and material for a period of **ONE YEAR** from the respective dates of final acceptance. All defects developing during that period shall be corrected in compliance with the "GUARANTEE" conditions under these specifications
2. The Contractor shall service the complete installation during this one-year guarantee period

3. This Guarantee clause shall in no way preclude or nullify any manufacturer's warranties.
4. All equipment and systems provided under this section shall be guaranteed to be free from defects in materials and workmanship for a period as indicated in the Contract Documents from the date of final acceptance, provided it does not show abuse
5. The Contractor shall maintain regular service facilities and provide a qualified technician familiar with the work of this section, at the site, within (48) hours of receipt of a notice of malfunction from the owner or his representative. As part of this guarantee, the Contractor shall provide, at no expense to the Owner, all material, devices, equipment, and personnel necessary and provide alternate facilities, services, and systems for the duration of the repairs
6. All repairs and service under this guarantee shall be at the job site unless in violation of manufacturer's warranty, and/or practically not possible.

Warranty Statement

1. To maintain certain manufacturers' warranties, said equipment must be installed, aligned, and serviced by those installers authorized by said manufacturer to perform those duties. If said manufacturer does not authorize the Contractor, it is the Contractors responsibility to make the appropriate arrangements and bear all cost and consequences thereof
2. All equipment provided by the contractor shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects

Service Contract

The Contractor shall offer a separate annual service contract covering all installed systems. This service contract shall cover a minimum of two (2) visits per year, at regular intervals, to perform operation checks of the equipment; clean and to lubricate moving parts as recommended by the respective manufacturers if applicable. The service contract shall commence immediately after expiration of the initial base-bid warranty period and continue for one year. This service contract may be renewed under separate agreements between the Theatrical Systems Integrator and the owner

The Contractor shall also submit separate costs for emergency "on-call" service visits and an "in-shop" hourly-rate for repair and maintenance work as part of the post-guarantee period herein.

The costs for this service contract shall not be commingled with the costs for the systems base bid.

This "Service Contract" shall not in any way conflict with the first-year warranty covered as specified herein. The intent of this paragraph is for the Owner's option in preparing budgets and comparing long-term costs between vendors. As such the Bidder shall provide costs for year two and three to include cost escalations

Materials

General

1. Materials and equipment furnished shall be designed for the intended use, shall meet all requirements of the latest edition of the National Electric Code (NEC), and all local codes. The materials used shall be new, unused, and of the best quality for the intended use. All equipment shall have the manufacturer's name, address, model or type designation, serial number and all applicable ratings clearly marked thereon in a location which can be readily observed after installation.

2. Materials shall be manufactured in accordance with the standards indicated in this Section, and typical industry standards and codes for the products specified. Materials and equipment shall be Underwriter's Laboratory (UL) listed.
3. Verify with all manufacturers and/or suppliers' availability and cost of all material and equipment proposed, including all material and equipment specified herein. No cost increases shall be allowed for manufacturers' cost increases, or for substitutions required because of unavailability of proposed equipment.
4. All products referenced herein to provide a baseline for standards of design, function and quality. Alternates will be reviewed at the Engineers discretion and at a minimum meet or exceed the performance standards.
    a. The manufacturer specifications shall be considered as minimum performance levels of acceptance. Where a particular model is specified its performance, operating, and physical characteristics are part of these specifications. Further, these characteristics are part of a design as a whole and particularly the Engineer's designs are in full coordination with these characteristics.

5. The itemized parts lists below represents, to the best of our knowledge, all major components required for the construction of a complete and working systems as described herein. It shall be the responsibility of the contractor to verify that no item has been omitted that may be required for complete and working systems. Any additional items needed shall be provided at no additional costs.

Data Wires

The Electrical Contractor shall provide all data and low voltage wiring as noted on the system riser drawing.

System Controls

1. All equipment shall be DIN rail mounted. All power supplies, DIN rail mounts, interconnects, brackets, etc., shall be included while they may not be specifically called out herein.
2. The itemized parts list below to this specification represents, to the best of our knowledge, all major components required for the construction of a complete and working systems as described herein. It shall be the responsibility of the contractor to verify that no item has been omitted that may be required for complete and working systems. Any additional items needed shall be provided at no additional costs.
3. Dry Contact: Included in the system controls is the remote installation and coordination of a control device installed into the fountain equipment room if needed.

System Controls Parts List:

Mosaic Show Controller 2 (1024 channels)	7180A1362	ETC
Mosaic Tessera Touchscreen Controller, 512 channels, Black	7180A1360-4	ETC
VIA16 Network Switch – 16 Port PoE	6716	Pathway Connectivity
DMX/RDM Repeater, 4-way, eDIN, Fully Isolated	1009	Pathway Connectivity
Pathway Demultiplexer,16	1004	Pathway

Channels, eDIN		Connectivity
Stereo Audio Playback System with Amplifier & DMX-512	Sd-25 w/DMX	Gilderfluke & Co.
Large DIN Rail Enclosure (14x28)	7180K1018	ETC
600W Dimmers	7179A1001	ETC
Motion Sensors	LC-151	DSC
Speakers	HS-61B	Herdio
Outdoor AV Wall Box	OWB-500P-SM	FSR
12v Power Supply	MDR-100-12	Mean Well
48v Power Supply	MDR-100-48	Mean Well

Construction Methods

Coordination

1. The Contractor shall coordinate the finish required for all fixtures, panels, and enclosures supplied as part of this specification section with the Engineer and Owner.
2. Theatrical Systems Integrator shall coordination of system components with the Electrical Contractor and programming of system with the Artist and Owner
3. Verify existing as-builds including cable labeling and ensure new documentation and installation cabling is coordinated and appropriately labeled.

Fabrication & Installation

The following matrix of responsibilities is intended to provide a guide for delineating the work between the Theatrical Systems Integrator and the Electrical Contractor.

Division of Responsibilities	Electrical Contractor		Theatrical Systems Integrator	
ITEM	Furnish	Install	Furnish	Install
All Line and High voltage wire	X	X		
Low voltage wire for Lighting Control system.	X	X		
Low voltage wire for Audio/AV Control system.	X	X		
All conduit, raceways and interconnecting boxes	X	X		
Line voltage wire testing and labeling	X	X		
Control wire continuity, testing and labeling	X	X		
Labeling back boxes and conduit	X	X		
Junction Boxes	X	X		
Power (Line Voltage) Terminations	X	X		

Provide terminations for all line/load circuits	X	X		
Termination Control system low voltage wire			X	
Theatrical Control Devices			X	X
Lighting Fixture Configuration and testing			X	X
Lighting Fixture Focus			X	X
Control System Initial programming			X	X
Audio/Video wiring	X	X		
Mounting Audio Speakers			X	X
Lighting and Audio Control Enclosure		X	X	
Final color Changing and Seasonal Programming			X	X

DIN Rail Enclosure Fabrication

1. All connections to control lines, input lines, and output lines shall be made via terminal strip connections.
2. Components in enclosure to be install after electrical rough in to avoid damage to the equipment.
3. All power supplies shall be located, oriented, and connected electrically so as to minimize hum and RFI interference.

Grounding

1. The Contractor shall follow all standard NEC and local codes for grounding practices on all of the audiovisual equipment and equipment racks.
2. It shall be the responsibility of the Contractor to follow good engineering practices. At no time shall there be a compromise in safety or any exception to the NEC and local codes.
3. Ground case of power strips/channels in equipment racks to the racks and insulate from power system ground.
4. Insulate all conductors in conduit, including shields, from the conduit, back boxes, and from each other for the entire conduit length.
5. Provide isolated ground receptacles typical for all power receptacles for all equipment.
6. The Contractor shall ensure that ONLY the audio-visual equipment is connected to the AUDIOVISUAL dedicated Ground system.

Identification

All installation shall bear the following identification plate, supplied by this contractor, mounted on the front of the main rack at the top:

System Fabricated & Installed By:

1. Contractor Name
2. Full Address
3. Telephone Number

Speaker and Lighting Installation

1. All installation practices shall be in accordance with, but not limited to, these specifications and drawings. Installation shall be performed in accordance with applicable standards.

2. Provide intelligible, permanent identification on or adjacent to all connectors, receptacles, switches, etc. The identification shall clearly indicate the function, or circuit.
3. All wire and cable shall be continuous and splice free for the entire length of run between designated connections or terminations.
4. Provide positioning and support elements for assemblies wherever required.
5. Coordinate installation of all assemblies to ensure proper projection of the respective elements, and access to them for maintenance and/or removal.
6. Verify that no assembly is subjected to stress, abrasion, or loading effects which could contribute to extraordinary failure.
7. Eliminate all conditions causing noise, rattle, or other extraneous sounds resulting from the operation of an assembly under any operating condition.
8. Verify that components are clear of any other obstructions.
9. Use tamper/vandal-proof screws for all items exposed to the public.

Adjusting
Aim and position adjustable luminaires and or speakers to achieve desired illumination/sound quality as indicated or as directed by Engineer and Artist. Secure locking fittings in place.

Physical Installation
All equipment shall be firmly secured in place
All boxes, equipment, etc. shall be secured plumb and square.
In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

Cable Length & Splices
All cables shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes. For equipment mounted, the interconnecting cables shall be provided with a service loop of appropriate length.

Cable Installation
All cables, regardless of length, shall be marked with wrap-around number or letter cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and run sheets. Clear heat shrink (or equal) shall protect numbers.
All inter-device cabling shall be neatly strapped, dressed, and adequately supported.

All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:

1. Power cables
2. Control cables
3. Audio cables

Cables and Connectors
1. Cables running in areas exposed to environmental factors such as, but not limited to, Exterior, UV, chemicals, direct burial, etc. shall be rated for such exposure and shall match the performance characteristics of its equivalent cable above.
2. All cables shall be cut to the length dictated by the run. No splices shall be permitted without prior permission of the Consultant. For equipment mounted in drawers or on

slides, the interconnecting cables shall be provided with a service loop of appropriate length.
3. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.
4. Each DMX cable run shall be provided with appropriate DMX terminator, 120 ohm resistors to prevent signal reflection.
5. Do not exceed the max. recommended cable lengths per type per run.
6. Limit fixture quantities in each run per the drawings.
7. Provide isolation devices as required to prevent the control system from damage due to electrical shock.

Programming:
General: The Contractor shall be fully responsible for the control system custom programming. The Contractor shall draft programming layout for review and approval during the Submittal phase. Further, the Contractor shall be responsible for the on-site programming, software de-bugging, and revising custom screens after initial use. Specific details are included in this document.

Including but not limited to:
1. Play background music via the Audio System, triggered from the Mosaic controller.
2. Fountain control cue or trigger integration into Mosaic control system.
3. Lighting control/triggering integration via Mosaic control system.

1. Addressing of all DMX Fixtures, pumps within the park to create a unified control system. This shall include confirmation of fixture operation for all DMX controlled fixtures. This includes other LED/DMX fixtures furnished by the Electrical and Fountain Contractors.
2. Remote Control of System: Mosaic controller programming to enable use of remote console plug-in equipment
3. Programming of (4) Seasonal Dynamic lighting, water and audio scenes for (5) minutes each. The dynamic light show should be tailored to the space, equipment, history and culture of the area.
    a. Each dynamic scene should include at a minimum;
        i. Dimming of site lighting to an acceptable safe level that doesn't compete with the light show.
        ii. A repeating pattern of changing color, and/ or functions over a period of time of all the lights in a visually interesting layout.
        iii. The show should not "flash" lights quickly in any way that would impair a person's ability to walk through the park.
        iv. Incorporation of fountain lights and pumps
        v. Incorporation of audio tracks that overlap with light and fog movement.
4. Programming of (10) Lighting Scenes
    a. Each static scene should include at a minimum:
        i. A Base level cue all scenes or cues return to after execution is complete.
        ii. Dimming of site lighting to an acceptable safe level that doesn't compete with the light show.
        iii. A slow-moving repeating pattern of changing color or functions over a period for all the lights in an interesting layout with (2-3) holiday colors.

Audio

The speakers shall be located in the sculpture as indicated in the drawings. The intent of the speakers is to provide ambient sound effects as supplied and directed by the Artist.

Tests and Adjustments

1. Before Acceptance Tests are scheduled, the Contractor shall perform his own system checkout. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:
    a. Maintain documentation of all performance tests for reference by the Consultant during the System Acceptance Tests
    b. Test all audio systems for compliance with the Performance Standards.
    c. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls and record these settings in the “System Operation and Maintenance Manual."
2. Provide the services of a manufacturer certified technician to verify the installation. Perform the following inspections and adjustments and submit to the Consultant the written results of each inspection for inclusion in the permanent records of the audio and video system.

Cleanup and Repair

1. Upon completion of the work the Contractor shall remove all his refuse and rubbish from and about the premises and shall leave the relevant areas and equipment clean and in an operational state. The Contractor shall be responsible for repairing any damage caused to the premises by the Contractor's installation activities, at no cost to the Owner.

System Acceptance Tests

System Acceptance Tests shall not be performed until the Contractor's System Checkout has been completed. The System Acceptance Tests shall be supervised by the Consultant, Owner Representative and Construction Manager and shall consist of the following:

1. A physical inventory shall be taken of all equipment on site and shall be compared to equipment lists in the specification section documents.
2. The Contractor shall demonstrate the operation of all system equipment.
3. Provide smooth, continuous light level control from zero percent light output through full light output for both increasing and decreasing light levels.
4. Adjust light direction and placement to meet design intent as approved by the engineer
5. Verify each DMX output device is working to ESTA standards.
6. Both subjective and objective tests shall be required by the Consultant, Owner’s Representative to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.
7. All final, “as-built" drawings, run sheets, manuals, and other required documents, otherwise known as “Close Out Documents,” as detailed herein, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to each the Consultant and General Contractor prior to the scheduling of Acceptance Tests).
8. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Consultant and/or Owner.

Operation Instruction

1. The Contractor shall provide on-the-job training by a suitably qualified instructor, to personnel designated by the Owner, to instruct them in the operation and maintenance of the systems. At no additional cost to the Owner, the Contractor shall provide a manufacturer's representative for such instruction in the event the Contractor does not have qualified instructors on staff for certain sophisticated equipment. All training shall take place after the systems are operational, but before the acceptance tests. There shall be a total of up to (8) hours of training on the systems included in this specification, at the discretion of the owner.
2. The Contractor shall orally instruct and demonstrate, to personnel selected by the Owner, the Owner's Operating Manual and all final drawings as provided for in this Section.
3. This training session shall be performed independent of any acceptance testing procedures, and factory training at any manufacturer's facility. This training session shall be performed independent of any other clause in the Section.

METHOD OF MEASUREMENT
Special Purpose Lighting, Audio and Control shall be measured as Lump Sum, complete in place.

BASIS OF PAYMENT
Special Purpose Lighting, Audio And Control will be paid for at the Contract unit price as Lump Sum, for all labor, equipment, materials, and construction methods necessary to perform a unified, complete, operational and accepted lighting, Audio /AV system, and all other incidentals necessary for the proper completion of this Item.

ITEM 967.2021 CONCRETE BARRIER REMOVED AND STACKED EACH

The work to be performed under this item shall conform to the relevant provisions of Section 201 and 220 of the MassDOT Standard Specifications and the following:

All existing concrete barrier which are salvageable where designated on plans or as determined by the Engineer shall be removed and transported to the DPW yard at 1065 Millbury Street (formerly 115 Ballard Street). Non-salvageable barrier where designated on plans or as determined by the Engineer shall become the property of the Contractor and shall be properly disposed of off the site.

METHOD OF MEASUREMENT
Concrete Barrier Removed and Stacked shall be measured per each section of barrier, complete.

BASIS OF PAYMENT
Concrete Barrier shall be paid for at the contract unit price per each, which price shall include all labor, materials, equipment, transportation, and incidental costs required to complete the work.

ITEM 968.2021 USPS MAIL BOX REMOVED AND RESET EACH

The work under this item shall conform to the relevant provisions of Section 715 and the following:

The mailboxes to be reset are USPS mailboxes. The Contractor shall coordinate the temporary removal and resetting with the postmaster of the Worcester Post Office prior to any work on the mailboxes. Mailboxes will be removed by the USPS. The Contractor shall provide the required concrete pad for resetting the mailboxes.

METHOD OF MEASUREMENT:

USPS Mail Box Removed and Reset will be measured for payment by the unit each, complete in place.

BASIS OF PAYMENT:

USPS Mailbox Removed and Reset will be paid for at the contract unit price each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 969.2021 REFLECTORIZED DRUM DAY
ITEM 970.2021 PORTABLE BREAKAWAY BARRICADE TYPE III EACH

The work to be performed under these items shall conform to the relevant provisions of Section 850 of the MassDOT Standard Specifications and the following:

METHOD OF MEASUREMENT
Reflectorized Drum shall be measured per day. Portable Breakaway Barricade Type III shall be measured per each.

BASIS OF PAYMENT
Reflectorized Drum and Portable Breakaway Barricade Type III shall be paid for at the contract unit price per day and per each, respectively, which price shall include all labor, materials, equipment, transportation, and incidental costs required to complete the work.

ITEM 971.2021 STAMPED ASPHALT CROSSWALK/MEDIAN WITH THERMOPLASTIC PAVEMENT MARKING SYSTEM SQUARE YARD

This work shall consist of the construction of a durable imprinted aggregate reinforced preformed thermoplastic pavement marking system ("System") in accordance with Sections 701 and 860 of the Standard Specifications, and the following:

The intent of the System is to replicate the grout lines common to brick or other types of unit pavers within a crosswalk or other asphalt surface.

Materials

The aggregate reinforced preformed thermoplastic shall be supplied in panels typically measuring approximately 2 feet x 2 feet The System must be able to be applied to asphalt surfaces without preheating the application surface to a specific temperature. The System shall be able to be applied in temperatures down to 45°F without any special storage, preheating or treatment of the material before application.

1. Preformed Thermoplastic Material: Shall be composed of an ester modified rosin impervious to degradation by motor fuels, lubricants, etc. in conjunction with aggregates, pigments, binders, and anti-skid/anti-slip elements. Pigments and anti-skid/anti-slip elements must be uniformly distributed throughout the material. Material shall conform to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, being non-reflective, and potentially being of a color different from white or yellow.

2. Pigments:

    a. White: The material shall be manufactured with sufficient titanium dioxide pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.

    b. Other Colors: The pigment system must not contain heavy metals nor any carcinogen, as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

3. Skid Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303.

4. Slip Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum static friction of coefficient of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.

5. Thickness: The material must be supplied at a minimum thickness of 150 mil (3.8mm).

6. Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.

7. Storage Life: The material may be stored for 12 months, if stored indoors and protected from the elements.

8. Transverse Lines to Supplement System Application: Supplied as white, retroreflective preformed thermoplastic line stripe material in 90 mil (2.3 mm) or 125 mil (3.2 mm) thicknesses, material is available in 6 in. (.15m), 8 in. (.20m) or 12 in. (.30m) widths. This preformed thermoplastic material may be supplied and applied by the certified applicator in conjunction with the System, and is available from the System manufacturer. (Consult the manufacturer's published application instructions for the preformed thermoplastic line stripe material selected, for proper application methods.)

Installation:

The System shall be applied to asphalt pavement using approved reciprocating infrared heating equipment. A two-part epoxy sealer specified by the manufacturer must be applied to the substrate prior to preformed thermoplastic application to ensure proper adhesion, and to provide reinforcement for larger volumes of material. Immediately following sealer application, panels of aggregate reinforced preformed thermoplastic are positioned properly on the asphalt substrate. The preformed thermoplastic is then heated to the required melting temperature. Additional aggregate may be applied to the preformed thermoplastic surface as needed following the melting process, to achieve added friction properties and a uniform surface appearance. As the material is cooling, it is imprinted with a vibratory plate compactor and a template made from 3/8 in. flexible wire rope in the required design to create crisp, clean lines which define the pattern.

Pattern and color shall be as shown on the plans or specified by the City of Worcester. The selected system shall be available in a variety of standard colors and patterns. White preformed thermoplastic transverse lines shall be installed on both sides of the crosswalk installation as directed.

The System shall utilize a resilient, aggregate reinforced preformed thermoplastic product which contains a minimum of thirty percent (30%) intermixed anti-skid/anti-slip elements and where the top surface contains anti-skid/anti-slip elements. These anti-skid/anti-slip elements must have a minimum hardness of 6 (Mohs scale).

The System must be resistant to the detrimental effects of motor fuels, antifreeze, lubricants, hydraulic fluids, etc.

The System manufacturer must be ISO 9001:2008 certified for design, development and manufacturing of preformed thermoplastic, and provide proof of current certification.

Specialized Application Equipment:

1. Stamping Templates: A wire rope template is required in the execution of the System. The template is used for imprinting the defined pattern once the preformed thermoplastic has been applied. The wire rope diameter for the imprinting template used for the specified pattern is 3/8 in. The stamping templates for imprinting shall be StreetPrint as manufactured by Integrated Paving Concepts or approved equal.

2. Heating Equipment: The System manufacturer shall distribute reciprocating infrared heating equipment designed specifically to elevate the temperature of the preformed thermoplastic material and asphalt pavement without adversely affecting it. The primary heating unit must employ a bank of propane-fired infrared heaters, mounted on a track device that allows the heater bank to reciprocate back and forth over a designated area, thereby allowing the operator to monitor the temperature of the preformed thermoplastic at all times during the pavement heating process.

   A smaller, mobile infrared heater distributed by the System manufacturer is designed specifically to heat areas such as borders and narrow areas that are inaccessible to the primary heaters. This secondary heater also allows the operator to monitor the temperature of the preformed thermoplastic at all times during the heating process.

   An approved hand-held propane heat torch distributed by the System manufacturer shall be used to heat isolated areas of the preformed thermoplastic.

3. Epoxy Sealer: A two-part epoxy sealer specified and distributed by the System manufacturer must be applied to the substrate prior to material application to ensure proper adhesion, and to provide reinforcement for larger volumes of material.

   A specialized sealer dispensing gun shall be used to dispense the required two-part epoxy sealer onto the substrate. The sealer dispensing guns shall be as distributed by the System manufacturer.

4. Hand Held Tools: Completion of the imprinting of the thermoplastic in areas around permanent structures, such as curbs and manholes covers, which may be inaccessible to the stamping template, shall be accomplished using a hand held finishing tool . Hand held finishing tools shall be as distributed by the System manufacturer.

5. Aggregates: Supplemental anti-skid/anti-slip elements (aggregates) shall be applied to the surface of the molten thermoplastic as needed, if the factory applied anti-skid/anti-slip elements embed too deeply into the surface of the molten thermoplastic material during the heating process. (Embedded aggregate is exposed upon wear for extended skid resistance.) The aggregate shall be suplied by the System manufacturer.

   Supplemental anti-skid/anti-slip elements (aggregate) on the surface of the molten preformed thermoplastic shall be applied in a uniform manner using an air powered spray hopper. The air powered spray hoppers shall be as distributed by the System manufacturer.

6. Vibratory Plate compactor: Pressing the 3/8" wire rope stamping templates into the thermoplastic and asphalt substrate to create the specified pattern shall be accomplished using a vibratory plate compactor (700-900 lb.). Plate compactors shall not damage the thermoplastic during pressing of the wire rope template.

Manufacturer's representative shall be available to provide technical assistance prior to, during and after the installation.

Stamped Asphalt Crosswalk/Median with Thermoplastic Pavement Marking System shall be measured by the actual number of square yards installed.

Stamped Asphalt Crosswalk/Median with Thermoplastic Pavement Marking System shall be paid for at the contract unit bid price per square yard, which price shall include furnishing all labor, materials and equipment including, but not limited to, Thermoplastic Pavement Marking System, imprinting template, heating equipment, supplemental aggregates, compaction equipment and any other incidental work necessary to provide a complete crosswalk or median surface installation acceptable to the City of Worcester.

ITEM 972.2021 STREET SIGN REMOVED AND STACKED EACH
ITEM 973.2021 TRAFFIC SIGN REMOVED AND STACKED EACH

Work under these Items shall include the dismantling, removal, and stacking of the existing roadside traffic signs and street signs. All materials owned by the City of Worcester to be removed and stacked as part of this Contract shall be carefully transported by the Contractor to the DPW yard at 1065 Millbury Street (formerly 115 Ballard Street). The Contractor shall be held responsible for any damage to these stacked materials.

CONSTRUCTION METHODS

The work under this item shall also include the removal and disposal of the sign supports and their foundations as directed by the Engineer.

If the Engineer or the City determines that any part of the stacked materials is unsuitable for re-use, said materials shall become the property of the Contractor and he shall properly dispose of them outside and away from the limits of the project, without additional compensation.

The work shall include removing the supports, excavating the existing foundation, the disposal of the concrete and supports, the backfilling with compacted gravel of the holes resulting from the excavation and removal of the supports and the replacement, in kind, of any surface material disturbed.

The existing signs shall not be removed until the new signs and structures replacing them are

ready for installation or until the Engineer orders their removal.

METHOD OF MEASUREMENT
Traffic Sign Removed and Stacked and Street Sign Removed and Stacked shall be measured per each, complete in place.

BASIS OF PAYMENT
Traffic Sign Removed and Stacked and Street Sign Removed and Stacked will be paid for at the Contract unit price per each, which price will be full compensation for dismantling, removal, and stacking the signs and supports as designated above, the excavation and disposal of the existing foundations, the supplying and placing of compacted gravel backfill where foundations and posts are removed, restoration of surface, and all other incidentals necessary for the proper completion of this Item.

ITEM 974.2021 TRAFFIC SIGN REMOVED AND RESET EACH

The work under this item shall conform to the relevant provisions of sections 828 and 840 of the MassDOT Standard Specifications and the following:

Work to be done under this item shall include the dismantling, removal, transporting and resetting of the existing signs at the location indicated on the plans. The Traffic signs will be set on new City Standard 2" black iron poles. The work also includes the removal and disposal of the existing sign supports.

CONSTRUCTION METHODS
The Contractor shall exercise particular care in the dismantling, removal, transporting and resetting of the existing signs designated to be reused. Any sign panel damaged through carelessness or lack of protection by the Contractor shall be replaced at the Contractor's expense.

The Contractor shall backfill with compacted gravel all holes resulting from the removal of the existing signs and their foundations and restore the area to match existing conditions of adjacent areas.

The existing signs shall not be removed or reset until instructed by the Engineer.

METHOD OF MEASUREMENT
Street and Traffic Signs Removed and Reset shall be measured per each, complete in place.

BASIS OF PAYMENT
Street Sign Removed and Reset and Traffic Sign Removed and Reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

The contract unit price for Traffic Sign Removed and Reset will include the new 2" black iron poles for which no additional payment will be made.