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SECTION 00 31 32

SUBSURFACE DATA

PART I - GENERAL

1.01 SCOPE:

A. A subsurface exploration program consisting of borings has been performed, with reasonable care. The results of the exploration program, appended hereto and are a part of the Contract Documents, include the following report(s):

- Geotechnical Engineering Report, Louise Levingston Cove Improvements – Cantilevered Deck, Retaining Walls, and New Path, Newton, Massachusetts (See Appendix A)

Samples of the materials encountered may be seen upon request during the bidding period only at the office of Weston & Sampson Engineers, Inc., 55 Walkers Brook Drive, Reading, MA 01867. If Contractors deem the subsurface information insufficient, they may, after obtaining Owner's permission, carry out additional subsurface explorations, at no expense to the Owner.

B. The attached geotechnical engineering report in Appendix A is provided for informational purposes only and is not a warranty of subsurface conditions. The Contractor has no right to rely on the interpretations, opinions, conclusions or recommendations included in the report, only the factual data relative to the specific times, locations, and depths/elevations referenced in the report. Specific project requirements, including any options selected from the geotechnical report, are referenced only in the drawings and specifications.

C. Subsurface information provided in the Contract Documents and the above report is limited by the methods used for obtaining and expressing such data and is subject to various interpretations. The terms used to describe soils, rock, groundwater and such other conditions are subject to local usage and individual interpretation.

D. Borings have been competed substantially at the locations indicated on the drawings and advanced to the depths shown on the logs. Soil information presented in the logs, as to classification, gradation, properties, density and consistency, is based on visual observation of recovered samples. Reported groundwater levels are those measured in the field at the particular location and at the time measurements were made, and do not necessarily represent permanent or variable groundwater elevations. Groundwater elevations may be affected by temperature, rainfall, and other factors that may not have been present at the time the measurements were made. The Contractors should be aware that groundwater level fluctuations may affect methods of construction.

E. Subsurface exploration data are for the general information of the Contractor. The Contractors bidding on the project are obligated to examine the site, review boring logs, all available information and records of explorations, investigations and other pertinent data for the site, and then based upon their own interpretations and investigations decide the character of material to be encountered and excavated, the suitability of the materials to be used for backfilling and such other purposes, the groundwater conditions, difficulties or obstacles likely to be encountered, and other conditions affecting the work. The subsurface data is accurate only at the particular locations and times the subsurface explorations were made. No other warranty either expressed or implied by the Owner, Engineer or their agents is made as to the accuracy of the subsurface information and data shown on the drawings or presented in the Contract Documents.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 00 31 43

PERMITS

PART 1 – GENERAL

1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

1.02 RELATED WORK:

A. Section 01 11 00, CONTROL OF WORK AND MATERIALS

B. Section 01 14 19.16, DUST CONTROL

C. Section 01 55 26.13**,** SIGNAGE (TRAFFIC CONTROL)

D. Section 01 57 19, ENVIRONMENTAL PROTECTION

E. Section 02 41 13, SELECTIVE SITE DEMOLITION

F. Section 31 00 00, EARTHWORK

G. Section 31 23 19, DEWATERING

1.03 GENERAL REQUIREMENTS:

A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required, as defined under the Permits subsection of the GENERAL CONDITIONS.

Permits by Owner	Status
Building Permit	*
Conservation Commission Order of Conditions and Certificate of Understanding (Ch. 131, s. 40)	(Attached)
Mass. DEP File # 239-09091 Superseding Order of Conditions	(Attached)
Trench Permit (520 CMR 14.00)(eff. date 3/1/09)	*
Mass. DEP Chapter 91 Waterways License (310 CMR 9.00)	(Attached)
Massachusetts Historic Commission Project Notification Form	(Attached)

*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will pay for and/or waive the permit application fee, if applicable.

1.04 CONSERVATION COMMISSION ORDER AND MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPERCEDING ORDER:

Newton's Conservation Commission has, under the authority of Massachusetts General Laws Chapter 131, Section 40, issued an Order of Conditions on the work under this contract. This Order, and Mass. DEP's Superseding Order referenced above, are to become a part of the Contract Documents and the Contractor shall perform all work in strict conformance with said Order. A copy of these Orders are attached in Appendix E.

1.05 MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION CHAPTER 91 LICENSE:

The Department of Environmental Protection has under the authority of Massachusetts General Laws Chapter 91, the Public Waterfront Act and its regulations 310 CMR 9.00 issued license no.15550 on the work under this contract. This license is to become a part of the Contract Documents and the Contractor shall perform all work in strict conformance with said license. A copy of this license is attached in Appendix E.

PART 2 – PRODUCTS - Not Used.

PART 3 – EXECUTION

3.01 PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS:

A. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.

B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and the Owner's Representative, through on-site inspection and submitting copies of permits or approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

SECTION 01 11 00

CONTROL OF WORK AND MATERIALS

PART 1 – GENERAL - Not used.

PART 2 – PRODUCTS - Not used.

PART 3 - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

A. The Contractor shall, at its own expense, handle and haul all materials furnished by it and shall remove any of its surplus materials at the completion of the work.

B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by it that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.

C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 EASEMENTS:

A. Unless approved by the Owner's Representative, the use of easements for ease of access to and egress from other areas of the project will not be permitted.

3.03 OPEN EXCAVATIONS:

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at its own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress.

B. Bridges provided for access to private property during construction shall be removed when no longer required.

C. The length of open trench will be controlled by the particular surrounding conditions but shall always be confined to the limits prescribed by the Owner's Representative.

D. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, then special construction procedures shall be taken, such as limiting the length of trench and prohibiting stocking excavated material in the street.

E. All street excavations shall be completely closed at the end of each work day. Backfilling or use of steel plates of adequate strength to carry traffic shall be used.

3.04 MAINTENANCE OF TRAFFIC:

A. Unless permission to close the street is received in writing from the proper authority, all excavated materials and equipment shall be placed so that vehicular and pedestrian traffic may be safely maintained at all times.

B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.

C. The Contractor shall at its own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. The Contractor shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner. See Section 01 56 00 CONSTRUCTION ZONE SAFETY PLAN.

D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Owner's Representative during construction.

E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.

F. Nothing contained herein shall be construed as relieving the Contractor of any of its responsibilities for protection of persons and property under the terms of the Contract.

3.05 CARE AND PROTECTION OF PROPERTY:

The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any

act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be promptly restored by the Contractor, at its expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Owner's Representative.

3.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

A. All existing utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Owner's Representative decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.

B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by Contractor.

C. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.

D. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

E. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.07 MAINTENANCE OF FLOW:

A. The Contractor shall at its own cost, provide for the flow of sewers and drains interrupted during the progress of the work, and shall immediately cart away and dispose of all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Owner's Representative well in advance of the interruption of any flow.

B. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, it shall repair the same within the same day.

C. At the conclusion of the work, the Contractor shall remove all silt in drainage structures caused by its operations as described in Section 01 74 13, CLEANING UP.

3.08 REJECTED MATERIALS AND DEFECTIVE WORK:

A. Materials furnished by the Contractor and condemned by the Owner's Representative as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor and shall not be made use of elsewhere in the work.

B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Owner's Representative.

C. The Contractor shall reimburse the Owner for any expense, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Owner's Representative, occurring previous to the final payment.

3.09 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Owner's Representative. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.10 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." The Contractor shall be familiar with the requirements of these regulations.

3.11 SITE INVESTIGATION:

The Contractor acknowledges that it has satisfied itself 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 itself with available information will not relieve it 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 on the basis of the information made available by the Owner.

3.12 HANGERS, PADS, AND SUPPORTS:

A. Unless otherwise indicated, hangers and supports shall be by the trade providing the supported item.

B. Except where detailed or specified, design of hangers and supports shall be the responsibility of the Contractor. All parts of such hangers or supports shall be designed in accordance with accepted engineering practice, using a factor of safety of at least 2½.

C. When proprietary hangers, etc., are supplied, satisfactory evidence of the strength of such items shall be furnished.

D. Hangers for items hung from steel and concrete shall be centered on the vertical center of gravity of the beam.

E. Locations and sizes of openings, sleeves, concrete pads, steel frames, and other equipment supports are indicated on the drawings for bidding purposes only. Final sizes and locations of such items shall be obtained from the shop drawings.

3.13 SLEEVES, HOLES, HANGERS, INSERTS, ETC.:

C. Nothing shall be suspended from the steel framing and no fastenings made to it, except with the prior permission of the Owner's Representative. Request for permission shall be accompanied by full details of the hanger or fastener, including the weight of the item to be suspended.

D. Nailers and other wood members attached to steel or masonry, for which fasteners are not indicated on the design drawings or in the specification, shall be fastened with the equivalent of ½-inch diameter bolts at 3 feet o.c.

3.14 WEATHER PROTECTION:

In conformance with Sections 44F and 44G of Chapter 149 of the General Laws of Massachusetts, the General Contractor shall install weather protection and shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the Director of Building Construction in the Executive Office for Administration and Finance.

3.15 ELECTRIC SERVICE:

A. The Contractor shall make all necessary applications and arrangements and pay for all fees and charges for electrical energy for power and light necessary for the proper completion of this contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.

B. There shall be sufficient electric lighting so that all work may be done in a workmanlike manner where there is not sufficient daylight.

END OF SECTION

SECTION 01 12 16

SCOPE AND SEQUENCE OF WORK

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. Levingston Cove is a 0.5-acre park property located along the shoreline of Crystal Lake, on Lake Avenue between Berwick Road and Lakewood Road (between 170 Lake Avenue and 230 Lake Avenue). The improvements contained within these Construction Documents include accessibility improvements, stormwater runoff management, protection and enhancement of wildlife habitat, overall recreational upgrades, and public safety improvements. Specific improvements include, but are not limited to the following:

a. Cantilevered deck with safety railing and terraced seating.
b. On-grade deck with terraced seat walls.
c. Accessible walkways.
d. ADA-compliant ramps and stairs with handrails.
e. New site furnishings to be furnished and installed by the Contractor and installation of new site furnishings to be furnished by the Owner.
f. New park signage and interpretive signage.
g. Wood guardrail along Lake Avenue.
h. Salvaged granite blocks relocated across the site for terraced seating and other uses.
i. New black vinyl chain link fencing.
j. New plantings for slope stabilization bioretention, and bank restoration. Rain gardens will be outfitted with area drains and piping for proper drainage.
k. Areas of turf restoration and reinforcement.
l. **BID ALTERNATE #1: CURBING MATERIAL CHANGE** – Where precast concrete curb is called for on the Construction Documents, the Contractor shall install vertical granite curb in its place.
m. **BID ALTERNATE #2: EXTENDED TEMPORARY ESTABLISHMENT PERIOD** – Furnishing, installing, and maintaining six-foot height temporary chain link fencing in the locations shown on the Construction Documents, for a period of two (2) years following plant installation and hydroseeding.
n. **BID ALTERNATE #3: STONE VENEER ON NEW AND EXISTING LAKE-SIDE RETAINING WALL** – Furnishing and installing the stone veneer on the lake-side face of the existing retaining wall and new concrete cheek wall pinned on top, to the limits shown on the Construction Documents.

1.02 RELATED WORK:

A. SECTION 01 11 00 – CONTROL OF WORK AND MATERIALS

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL:

A. The Contractor shall be responsible for scheduling its activities and the activities of any subcontractors involved, to meet the completion date, or milestones, established for the contract. Scheduling of the work shall be coordinated with the Owner and Owner's Representative.

B. The Construction Sequence Requirements shall be used by the Contractor to form a complete schedule for the project, which shall be coordinated with the Owner and Owner's Representative. Prior to performing any work at the site, the Contractor shall submit a detailed plan to the Owner's Representative for review. The plan shall describe the proposed sequence, methods, and timing of the work.

END OF SECTION

SECTION 01 14 00

SPECIAL PROVISIONS

PART 1 - GENERAL - Not used.

PART 2 – PRODUCTS - Not used.

PART 3 - EXECUTION

3.01 WATER FOR CONSTRUCTION PURPOSES:

A. In locations where water is in sufficient supply, the Contractor may be allowed to use water without charge for jetting backfill and other construction purposes. The express approval of the Owner shall be obtained before water is used. Waste of water by the Contractor shall be sufficient cause for withdrawing the privilege of unrestricted use.

B. If no water is available, the Contractor shall supply water at no additional cost to the Owner.

3.02 PIPE LOCATION:

Pipe shall be located substantially as indicated on drawings. The Owner reserves the right, acting through the Owner's Representative, to make such modifications as may be deemed desirable to avoid interference with existing structures or for other reasons.

3.03 DIMENSIONS OF EXISTING STRUCTURES:

Where the dimensions and locations of existing structures are of critical importance in the installation or connections of new work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

3.04 OCCUPYING PRIVATE PROPERTY:

The Contractor shall not enter upon nor occupy with men, equipment or materials any property outside of the Owner's easements, except with the written consent of the property owner or property owner's agent.

3.05 EXISTING UTILITY LOCATIONS – CONTRACTOR'S RESPONSIBILITY:

A. The location of existing underground services and utilities shown on the drawings is based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to excavating.

B. To satisfy the requirements of **Massachusetts law, Chapter 82, Section 40**, the Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays, prior to excavation in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "DIG SAFE" at telephone number: 1-888-344-7233.

C. The Contractor shall coordinate all work involving utilities and shall satisfy itself as to the existing conditions of the areas in which it is to perform his work. It shall conduct and arrange its work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

3.06 COORDINATION OF WORK:

The General Contractor shall be responsible for coordinating its own work as well as that of any subcontractors. It shall be responsible for notification of the Owner's Representative when each phase of work is expected to begin and the approximate completion date.

3.07 TIME FOR COMPLETION OF CONTRACT:

The time for completion of this contract is stipulated in the Form of/for General Bid. The Bidder shall base his bid on completing the proposed work by the completion date stipulated in the FORM FOR GENERAL BID.

3.08 MAINTENANCE OF TRENCH SURFACE:

After backfilling and compacting trenches, the Contractor shall be responsible for keeping the ground surface dry and passable at all times until the surface has been restored to its finished condition.

3.09 DESIGN OF MATERIALS / FURNISHINGS:

Attention is directed to the fact that the layout of certain materials and site furnishings is based on that of one manufacturer. If other items are submitted for approval, the Contractor shall prepare and submit for approval at its expense, detailed structural or other drawings, equipment lists, maintenance requirements, and any other data required by the Owner's Representative, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Such changes, if approved, shall be made at the expense of the Contractor.

3.10 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

A. The Contractor shall arrange for a qualified service representative, at a time suitable to the Owner's Representative, from the company manufacturing or supplying certain equipment as indicated on the detailed specifications, to perform the duties described herein.

B. After installation of the listed materials and items have been completed and the equipment is presumably ready for operation, but before others operate it the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:

1. Soundness (without cracks or otherwise damaged parts); completeness in all details, as specified; correctness in setting, alignment, and relative arrangement of various parts; adequacy and correctness of packing, sealing and lubricants.

2. The operation, testing, and adjustment shall be as required to prove that the materials are left in proper condition for satisfactory operation under the conditions specified.

3. On completion of its work, the Contractor shall submit in triplicate to the Owner's Representative the manufacturer's or supplier representative's complete signed report of the results of its inspection, operation, adjustments, and test. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall also include a certificate that the equipment conforms to the requirements of the contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

4. After the Owner's Representative has reviewed the reports from the manufacturer's representative, the Contractor shall make arrangements to have the manufacturer's representative present when the field acceptance tests are made.

3.11 WETLANDS PROTECTION SIGN:

A sign not less than two square feet in size shall be displayed at the site. The sign shall bear the words "Massachusetts Department of Environmental Protection, Wetland Division, File Number 239-0901"

3.12 PROJECT SIGN:

A. **The project sign shall be as shown on the drawing immediately following this section of the specifications.** The sign shall be erected within ten (10) days after the construction contract is awarded. The sign shall be fabricated, erected, and maintained by the Contractor.

B. The Contractor shall provide adequate support for the sign as determined by the Owner's Representative. All supports, trim, and back of sign shall be painted with at least two coats of exterior paint.

C. The project sign shall be maintained by the Contractor in good condition at all times for the duration of construction. The Contractor shall remove the sign upon completion of construction.

3.13 COMPLIANCE WITH PERMITS:

A. The Contractor shall perform all work in conformance with requirements of the Permits, which appear in Section 00 31 43 – PERMITS.

3.14 CUTTING, FITTING AND PATCHING:

A. The Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.

B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, save with the consent of the Owner's Representative.

C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly patched. All such holes shall be made completely watertight as approved by the Owner's Representative.

D. Size and locations of holes required in steel, concrete, or other structural or finish materials for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Owner's Representative prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Owner's Representative.

E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

3.15 CONNECTIONS TO EXISTING WATER SYSTEMS:

A. The Owner will, upon **72-hour** notice from the Contractor, assist the Contractor by locating and opening or closing any and all valves required for draining or admitting water to the various sections of the water main as required to perform the proposed work. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed.

B. Connections to the existing distribution system shall be made with the mains under pressure unless the lines can be temporarily taken out of service as approved by the Owner.

C. The Contractor will be required to make test excavations to ascertain that the proposed position of the connections will be clear of joints, fittings, or other obstructions.

D. If any failure occurs in connection to existing mains, service shall be restored in the shortest possible time, the Contractor working around the clock, if necessary. The Contractor shall cooperate with the Owner in notifying the consumers or supplying emergency water. If required by Owner, the Contractor shall make connections to water mains during night hours, on Sunday or at other times of off-peak demand for water.

3.16 PROTECTION OF AQUIFER:

The Contractor's attention is directed to the fact that the construction area is located within the watershed of the existing water supply. The Contractor shall take extra precautions to ensure that no pollutants enter the groundwater table from the construction area. The Contractor shall not store fuels or other hazardous materials or potential contaminants on the construction site. In the event of a spill, the Contractor shall immediately notify the Owner's Representative.

3.17 CONTRACTOR'S REPRESENTATIVE:

The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

3.18 HOURS OF CONSTRUCTION ACTIVITY:

A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.

B. The Owner will provide personnel for assistance in locating and operating valves at no cost to the Contractor during the Owner's normal working hours **(Monday through Friday 7:00 a.m. to 3:00 p.m.**). When this assistance is required by the Contractor outside of the Owner's normal working hours the cost will be incurred by the Contractor at the prevailing overtime rate of pay for the personnel providing the assistance. The Owner will bill the Contractor directly.

3.19 CONSTRUCTION CREWS:

The Contractor shall not increase the number of construction crews assigned to the work without providing one-week advance notice to the Owner's Representative.

3.20 MASSACHUSETTS DATA SECURITY REGULATIONS:

The Contractor is required to comply with data security regulations contained in 201 CMR 17.00 that have been established to safeguard personal information of Massachusetts residents contained in paper or electronic records. The Contractor shall not submit to the Owner's Representative or Owner documents in paper or electronic form that contain personal information (person's name combined with one or more of the following – Social Security Number, driver's license number or state-issued identification card number, financial institution account number, or credit or debit card number). Any document submitted to the Owner's Representative that violates this provision shall be returned to the Contractor and the Contractor shall remove personal information from the document prior to resubmitting it to the Owner's Representative. The Contractor shall require each Subcontractor to also comply with the MA data security regulations insofar as they involve submittal of personal information to the Owner's Representative and Owner.

END OF SECTION

SECTION 01 14 19.16

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

This section of the specification covers the control of dust via calcium chloride and water, complete.

PART 2 - PRODUCTS

2.01 CALCIUM CHLORIDE:

A. Calcium chloride shall conform to the requirements of AASHTO-M 144, Type I or Type II and Specification for Calcium Chloride, ASTM D98. The calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.

B. Calcium chloride failing to meet the requirements of the aforementioned specifications or that which has become caked or sticky in shipment, may be rejected by the Owner's Representative.

2.02 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Calcium chloride shall be applied when ordered by the Owner's Representative and only in areas which will not be adversely affected by the application. See Section 01 57 19, ENVIRONMENTAL PROTECTION.

B. Calcium chloride shall be uniformly applied at the rate of 1-1/2 pounds per square yard or at any other rate as required by the Owner's Representative. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be determined by the Owner's Representative.

C. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.

D. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

SECTION 01 31 19.23

CONSTRUCTION MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section specifies requirements for project meetings including but not limited to Pre-Construction Conference and Progress Meetings.

B. It shall be the responsibility of the Contractor to coordinate work between all subcontractors, sections, and trades required for the proper completion of the Work.

1.02 PRE-CONSTRUCTION CONFERENCE:

A. After the bids have been opened but prior to the start of the construction there will be a pre-construction conference to discuss the phasing and scheduling of the Project. The specific time and place of the conference shall be arranged by the Owner's Representative after the Contract has been awarded.

B. This pre-construction conference is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by subcontractors.

C. Authorized representatives of the Owner, Owner's Representative and their consultants, the Contractor, its Superintendent and Site Foreman, and all others invited by the Contractor, shall attend the pre-construction conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

D. Discuss items of significance at the pre-construction conference that could affect progress including at least the following:

1. Tentative construction schedule
2. Critical Work sequencing
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Review of Davis Bacon and other federal requirements
7. Distribution of Contract Documents

8. Submittal of Shop Drawings, Product Data and Samples
9. Preparation of record documents
10. Use of the premises
11. Office, work and storage, and laydown areas
12. Equipment deliveries
13. Construction safety procedures
14. Environmental health and safety procedures
15. First aid
16. Security
17. Housekeeping
18. Working hours
19. Traffic Control
20. Emergency Vehicle Access to and around work site
21. Environmental protection measures for construction site

1.03 PROGRESS MEETINGS:

A. During the course of the Project, the Contractor shall attend weekly progress meetings as scheduled by the Owner. The Owner, based on work progress and activities, may adjust the progress meetings to biweekly or other. The attendance of subcontractors may be required during the progress of the Work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:

1. Progress of Work/Critical Work Sequencing in relation to Contract Schedule.
2. Proposed Work activities for forthcoming period.
3. Resources committed to Contract.
4. Coordination of Work with others.
5. Status of procurement of equipment and materials.
6. Status of Submittals.
7. Outstanding actions, decisions, or approvals that affect Work activities.
8. Site access and/or security issues
9. Hazards and risks
10. Housekeeping
11. Quality issues
12. Potential Claims
13. Change Orders
14. Costs, budget, and payment requests

B. The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be submitted to the Owner’s Representative and Owner.

PART 2 – PRODUCTS - Not used.

PART 3 – EXECUTION - Not used.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULING

PART 1- GENERAL

1.01 PROGRAM DESCRIPTION:

A. A Critical Path Method (CPM) construction schedule shall be used to control the work of this Contract and to provide a definitive basis for determining job progress. The Contractor shall prepare the construction schedule. All work shall be done in accordance with the established CPM schedule and the Contractor and his subcontractors shall be responsible for cooperating fully with the Owner's Representative and the Owner in effectively utilizing the CPM schedule.

B. The CPM schedule to be prepared and submitted by the Contractor shall consist of a CPM network (diagram of activities) and a computer-generated schedule (print-out) as specified herein. The format shall be the activity-on-node precedence network.

C. The Contractor shall develop his own outline of the work and prepare his proposed CPM schedule. The computer-based schedule shall be the product of a recognized commercial computer software producer and shall meet all of the requirements defined herein.

1.02 QUALIFICATIONS:

A. The Contractor shall have the capability of preparing and utilizing the specified CPM scheduling technique. A statement of CPM capability shall be submitted by the Contractor in writing to the Owner's Representative **within 10 days after the issuance of the Notice to Proceed** to verify that either the Contractor's organization has in-house capability qualified to use the technique or that the Contractor employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the Contractor or his consultant has successfully applied the CPM scheduling technique and which were controlled throughout the duration of the project by means of systematic use and updating of a computer-based CPM schedule. The submittal shall include the name of the individual on the Contractor's staff who will be responsible for the CPM schedule and for providing the required updating information.

1.03 SUBMITTALS:

A. Submit under provisions of Section 01 33 23, SUBMITTALS.

B. Within 10 days following the issuance of the Notice to Proceed, the Contractor shall submit the CPM Schedule to the Owner's Representative for review and acceptance. The Contractor shall submit to the Owner's Representative a preliminary network defining the planned operations during the first 60 calendar days after the issuance of the Notice to Proceed. The Contractor's general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the complete network shall be included.

1.04 APPROVED CPM SCHEDULE:

A. Following review by the Owner's Representative, the Contractor shall incorporate the Owner's Representative's comments into the network and submit the revised network and computer-generated schedule. This final submittal shall be delivered to the Owner's Representative within 60 days after the issuance of the Notice to Proceed.

B. CPM schedules, which contain activities showing negative, float or which extend beyond the contract completion date in the computer-generated schedule will not be approved.

C. The approved network shall then be the approved CPM schedule to be used by the Contractor for planning, organizing and directing the work, and reporting progress.

D. Approval of the CPM activity network by the Owner's Representative is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Approval by the Owner's Representative in no way makes the Owner's Representative an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of approval by its agent, the Owner's Representative, of the CPM schedule.

E. The CPM activity network shall be submitted on sheets 24-in by 36-in and may be divided into as many separate sheets as required. An electronic file in PDF format shall be submitted concurrent with the hard copy schedule.

PART 2 – PRODUCTS – Not used.

PART 3 – EXECUTION

3.01 NETWORK REQUIREMENTS:

A. The network shall show the order and inter-dependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The **basic concept of a network analysis diagram** shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

B. Detailed network activities shall include: construction activities, the submittal and approval of shop drawings, the procurement of materials and equipment, fabrication of materials and equipment and their delivery, installation and testing, start-up and training. The Contractor shall break the work into activities with durations no longer than twenty working days each, except as to non-construction activities (such as procurement of materials and delivery of equipment) and any other activities for which the Owner's Representative may approve the showing of longer duration. To the extent feasible, **activities related** to a specific physical area of the work should be grouped on the network for ease of understanding and simplification.

C. Separate activities shall be provided for each significant identifiable function in each trade area in each facility. Activities shall be so identified that there will be no reasonable doubt as to how much work remains on each. Specific activities which shall be included are: all subcontract work, all interface work between subcontractors and between the Contractor and subcontractors, leakage tests of pipelines, electrical connections to each item of equipment, supplier and manufacturer technical assistance, mechanical connections to each item of equipment, all tests, concrete finishing, each item of site work, (including restraints on other activities) and all utilities, fuels and chemicals.

D. Each activity on the network shall have the following indicated on the NODE representing it.

1. A single duration (i.e., the single best estimate of elapsed time considering the scope of the work involved in the activity and the resources planned for accomplishing the activity) expressed in working days.

2. A five character (or less) code indicative of the party responsible for accomplishing the activity.

3. A cost estimate for each activity which, when accumulated with the cost of all activities, equals the total contract cost. Estimated overhead and profit shall be prorated throughout all activities. Materials costs shall be assigned to delivery activities.

4. A brief description of the activity.

E. The selection and number of activities shall be subject to the Owner’s Representative's approval. The detailed network need not be time scaled but shall be drafted to show a continuous flow from left to right with no flow from right to left. In addition to the brief description, the Contractor shall submit a separate list of all activities containing a detailed narrative of the scope of each activity, including the trades, subcontractors involved, and number of man-hours estimated.

F. To the extent that the network or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Owner’s Representative. Failure to include on a network any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the review of the network by the Owner’s Representative.

G. Except where earlier completions are specified, CPM schedules, which show completion of all work prior to the contract completion date, may be approved by the Owner’s Representative but in no event shall they be acceptable as a basis for claim for delay against the Owner by the Contractor.

3.02 COMPUTER-GENERATED SCHEDULE REQUIREMENTS:

A. Each computer-generated schedule submittal from the CPM activity network shall include the following tabulations: a list of activities in numerical order, a list of activity precedence's, a schedule sequenced by Early Start Date and a schedule sequenced by Total Float. Each schedule shall include the following minimum items:

1. Activity numbers

2. Estimated duration

3. Activity description

4. Early start date (calendar dated)

5. Early finish date (calendar dated)

6. Latest allowable start date (calendar dated)

7. Latest allowable finish date (calendar dated)

8. Status (whether critical)

9. Estimated cost of the activity

10. Total float and free float

B. In addition, each schedule shall be prefaced with the following summary data:

1. Contract name and number

2. Contractor's Name

3. Contract duration

4. Contract schedule

5. The effective or starting date of the schedule.

C. The workday to calendar date correlation shall be based on an 8-hour day and 40-hour week with adequate allowance for holidays, adverse weather and all other special requirements of the work.

3.03 PROGRESS REPORTING:

A. Progress under the approved CPM schedule shall be evaluated weekly by the Contractor. Not less than three days prior to each construction meeting, the Contractor shall evaluate the status of each activity on which work has started or is due to start, based on the preceding CPM schedule; to **show actual progress,** to identify those activities started and those completed during the previous period, to show the estimated time required to complete or the percent complete of each activity started but not yet

completed and to reflect any changes indicated for the network. Activities shall not be considered complete until they are, in fact, 100 percent complete.

B. At each progress meeting the Contractor shall submit a narrative report based on the CPM schedule evaluation described above, in a format agreed upon by the Contractor and the Owner's Representative. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed. This report, as well as the CPM Status Report, will be discussed at each progress meeting.

3.04 RESPONSIBILITY FOR SCHEDULE COMPLIANCE:

A. Whenever it becomes apparent from the current CPM schedule and narrative report that delays to the critical path have resulted and the contract completion date will not be met, the Contractor shall take some or all of the following actions at no additional cost to the Owner. They shall submit to the Owner's Representative for approval, a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the approved schedule.

3.05 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME:

A. If the Contractor desires to make changes in his method of operating which affect the approved CPM schedule, he shall notify the Owner's Representative in writing stating what changes are proposed and the reason for the change. If the Owner's Representative approves these changes, the Contractor shall revise and submit for approval, without additional cost to the Owner, all the affected portions of the CPM network. The Contractor shall adjust the CPM schedule only after prior approval of his proposed changes by the Owner's Representative.

B. If the completion of any activity, whether or not critical, falls more than 100 percent behind its approved duration, the Contractor shall submit for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

C. Shop drawings which are not approved on the first submittal or within the schedule time and equipment which do not pass the specified tests shall be immediately rescheduled.

D. The contract time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, he shall furnish such justification and supporting evidence as the Owner's Representative may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner's Representative will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Owner's Representative finds that the Contractor is entitled to any extension of any contract completion date, the Owner's Representative's

determination as to the total number of day's extension shall be based upon the currently approved CPM schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities, which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network, will not be the basis for a change therein.

E. Each request for change in any contract completion date shall be submitted by the Contractor to the Owner's Representative within 30 days after the beginning of the delay for which a time extension is requested but before the date of final payment under this Contract. No time extension will be granted for requests, which are not submitted within the foregoing time limit.

3.06 COORDINATING SCHEDULES WITH OTHER CONTRACT SCHEDULES:

A. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Contractor's CPM Schedule shall be coordinated with the schedules of the other contracts. The Contractor shall obtain the schedules of the other appropriate contracts from the Owner for the preparation and updating of his CPM schedule and shall make the required changes in his schedule when indicated by changes in corresponding schedules.

B. In case of interference between the operations of different contractors, the Owner will determine the work priority of each Contractor and the sequence of work necessary to expedite the completion of the entire project. In all such cases, the decision of the Owner shall be accepted as final. The temporary delay of the Contractor's work due to such circumstances shall not be considered as justification for claims for additional compensation.

END OF SECTION

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers construction progress photographs to be furnished by the Contractor on the project.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS:

A. Digital photographs shall be in .gif, .jpeg, .bmp or .tif format.

B. Prints shall be 8 x 10 full color on single weight, white base, and glossy paper, mounted with binder tabs.

C. Photographs shall be taken using a digital camera before groundbreaking, monthly throughout the Work, and on final acceptance of the project.

D. Before the Contractor commences any work at the Site, and on the first work day of each month thereafter until Substantial Completion of the Work, the Contractor shall, at his/her expense, have digital photographs with disc storage taken by a competent photographer from different viewpoints, as directed by the Owner or Owner's Representative. The Owner and Owner's Representative shall have the right to increase or decrease the number of photographs required at each period, maintaining an overall average number of exposures per period.

PART 3 - EXECUTION

3.01 USB DRIVE DELIVERY:

A. A minimum of twenty-four views shall be delivered to the Owner's Representative on a USB Drive within six days of exposure.

B. USB drives turned over to the Owner's Representative shall be retained by the Owner's Representative for future reference during the project.

C. If the Contractor fails to provide the photographs as required by the Contract Documents, the City shall be entitled to a corresponding cost set-off against the Contractor's next Application for Payment, or may choose to have the photograph taken by another photographer, and correspondingly charge those associated costs to the Contractor.

END OF SECTION

SECTION 01 33 23

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide the Owner's Representative with submittals as required by the contract documents.

1.02 RELATED WORK:

A. Divisions 1 – 33 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.

B. The Contractor shall submit the shop and working drawing submittals electronically.

3.02 ELECTRONIC SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Owner's Representative by email (Cassie Bethoney, bethoneyc@wseinc.com) one electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each electronic copy of the shop or working drawing shall be accompanied by the Owner's Representative's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

C. The Contractor shall receive a shop drawing memorandum with the Owner's Representative's approval or comments via email.

3.03 SHOP AND WORKING DRAWINGS:

A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.

B. All shop and working drawings shall be submitted to the Owner's Representative by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Owner's Representative's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.

C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Owner's Representative, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Owner's Representative. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Owner's Representative. Shop drawings submitted to the Owner's Representative without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Owner's Representative, as required in this section of the specifications and General Conditions.

D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.

E. The Owner's Representative will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that

of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Owner's Representative will review submittals two times: once upon original submission and a second time if the Owner's Representative requires a revision or corrections. The Contractor shall reimburse the Owner amounts charged to the Owner by the Owner's Representative for performing any review of a submittal for the third time or greater.

F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.

G. No material or equipment shall be purchased or fabricated especially for this Contract nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Owner's Representative as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.

H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.04 SAMPLES:

A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Owner's Representative or Owner for independent inspection and testing, as applicable to the work.

B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.

C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.05 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Owner's Representative for review in accordance with the instructions

furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Owner's Representative prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.

B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

SECTION 01 45 23

STRUCTURAL TESTS AND INSPECTIONS

PART 1 -GENERAL

1.01 WORK INCLUDED:

A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Obtaining, coordinating, and providing notifications to the Owner and Owner's Representative.
2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.
3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

A. The Massachusetts State Building Code, Latest Edition, 780 CMR, requires the Structural Engineer of Record (SER) to provide a program of structural tests and inspections for this project.

B. Attachment A, Program of Structural Tests and Inspections, shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.

C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or

inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

B. The Contractor shall give reasonable notice to the Owner and the Owner's Representative of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Owner's Representative a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 -– PRODUCTS – Not used.

PART 3 -EXECUTION – Not used.

ATTACHMENT A

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Lightweight Fill
3. Cast-In-Place Concrete
4. Masonry
5. Structural Steel

Abbreviation	Agent
SER	Structural Engineer of Record
ITA	Contractor – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA	Review Contractor's field quality control procedures.
2. General Excavation	ITA	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

Controlled Lightweight Fill

Item	Agent	Scope
1. Controlled Lightweight Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of lightweight fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications
4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

Masonry Construction

Item	Agent	Scope
1. Masonry Construction QC Review	SER	Review Contractor's field quality control procedures
2. Materials	SER	Review material certifications for conformance to specifications.
3. Evaluation of Masonry Strength	SER	Verify strength in accordance with the specifications.
4. Proportioning, Mixing, and Consistency of Mortar and Grout	ITA	Inspect field mixing procedures for conformance to the specifications.
5. Installation of Masonry	ITA	Inspect placement for conformance to the specifications. Verify cleanout hole locations (high lift grouting). Verify the installation of bond beams and special shapes.
6. Reinforcement Installation	ITA	Inspect reinforcing steel for size, quantity, condition and placement for conformance to approved submittals and Contract Documents.
7. Grouting Operations	ITA	Inspect grouting procedures for conformance with the specifications. Inspect cells prior to grouting. Assure observation holes have been installed prior to high lift grouting.
8. Weather Protection	ITA	Inspect protection for cold and hot weather for conformance with the specifications.
9. Anchorage	ITA	Inspect anchorage of masonry to other construction for conformance to the Contract Documents.

Structural Steel

Item	Agent	Scope
1. Fabricator Certification/Quality Control Procedures	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Fabricator Certification/Quality Control Procedures	SER	Review each Fabricator's quality control procedures.
3. Fabricator Inspection	SER	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
4. Materials	SER	Review materials certifications for conformance to the specifications.
5. Anchor Rods	SER	Review Contractor's as-built survey.
6. Anchor Rods	ITA	Verify that all anchor rods have been properly torqued and have adequate fit-up.
7. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
8. Welding	ITA	Check welder qualifications. Visually inspect fillet welds and test full penetration field welds in accordance with specifications
9. Shear Connectors	ITA	Inspect for size and placement. Test for proper weld attachment
10. Structural Framing, Details, and Assembly	ITA	Inspect for size, grade of steel, camber, installation and connection details. Check against Contract Documents and approved shop drawings.
11. Open Web Steel Joists	ITA	Inspect for size, placement, bridging, bearing and connection to structure. Visually inspect all welds of a minimum of 5% of the joists randomly selected.

12. Expansion and Adhesive Anchors	SER	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.
13. Metal Decking	ITA	Verify gage, width, and type. Inspect placement, laps, welds, side laps attachment and screws or other mechanical fasteners. Check welder qualifications.
14. Field Correction of Fabricated Items	ITA	Review documentation of approved repairs and verify completion of repairs.

END OF SECTION

SECTION 01 55 26.13

SIGNAGE (TRAFFIC CONTROL)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing and installing traffic control signs and other devices.

1.02 SYSTEM DESCRIPTION:

The Contractor shall furnish and install all construction signs deemed necessary by and in accordance with the latest edition of Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) as published by the U.S. Department of Transportation.

PART 2 - PRODUCTS

2.01 TRAFFIC WARNING AND REGULATING DEVICES:

Contractor shall provide warning signs, barricades and other devices in accordance with the specifications provided in the MUTCD. Size of signs, lettering, colors, method of support and other factors prescribed in the MUTCD shall be adhered to.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Contractor shall erect barricades, barrier fences, traffic signs, and other traffic control devices as required by the MUTCD, or as required by the Owner's Representative, to protect the work area from traffic, pedestrians, and animals.

B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses.

C. Unless extended protection is required for specific areas, when the work has been completed, all temporary warning and regulatory devices used by the Contractor shall be removed so that traffic can move unimpeded through the area.

END OF SECTION

SECTION 01 56 00

CONSTRUCTION ZONE SAFETY PLAN

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers the provisions for complying with Commonwealth of Massachusetts requirements for construction zone safety plans on public works projects.

1.02 DESCRIPTION:

A. The Contractor shall implement traffic safety and control measures through the construction zone through road closures and detours and mitigate impacts on traffic outside of the construction zone in accordance with these contract documents.

1.03 RELATED WORK:

A. SECTION 01 11 00, CONTROL OF WORK AND MATERIALS

B. SECTION 01 55 26.13, SIGNAGE (TRAFFIC CONTROL)

1.04 REFERENCES:

Massachusetts Department of Transportation Standard Specifications for Highways and Bridges – latest edition

PART 2 - PRODUCTS

2.01 Traffic control devices utilized by the Contractor shall meet the requirements of these contract documents and the latest Massachusetts Department of Transportation (MassDOT) Standard Specifications and Manual on Uniform Traffic Control Devices (MUTCD).

PART 3 - EXECUTION

3.01 OPERATION:

A. Contractor shall be responsible for providing all temporary traffic control devices including barricades, barrier fences, signs, drums, cones, impact attenuators and other traffic control devices in accordance with typical traffic management plans and details shown on the drawings or as required by the Owner's Representative.

B. The Contractor shall prepare temporary traffic management plans and details that deviate significantly from the typical plans shown on the drawings and submit to the Owner's Representative for review and approval prior to start of the work.

C. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses as required by the Owner's Traffic Control Officer or the Owner's Representative.

END OF SECTION

SECTION 01 56 26

TEMPORARY CHAIN LINK FENCE

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide all labor, materials and appurtenances necessary for the installation, maintenance and dismantling of 6-foot temporary fencing.

B. The Contractor shall be responsible for securing the site from trespassers. Existing fencing exists on portions of the site as shown on the Contract Drawings; it will be at the discretion of the Contractor to determine whether the existing fence is suitable for site safety and security. The Contractor shall install temporary fencing across lengths of damaged/unsuitable fencing to secure the site and prevent trespassers.

C. Under Bid Alternate #2 (EXTENDED TEMPORARY ESTABLISHMENT PERIOD), the Contractor shall furnish, install, and maintain the temporary chain link fencing in the locations shown on the Constract Drawings, for a period of two (2) years following plant installation and hydroseeding, whichever is later.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer’s literature of the materials specified herein.

B. Shop drawings of the temporary chain link fence and gates.

1. Shop drawings shall indicate layout of temporary fencing, location and size of gates, existing pavement and roads, and other site-specific conditions. Prepare drawing after site observation and verification of existing conditions.

PART 2 - PRODUCTS

2.01 TEMPORARY CHAIN LINK FENCING

A. Unless otherwise indicated, type of 8-foot temporary chain link fencing shall be Contractor's option. Following types are acceptable:

1. New materials or previously used salvaged chain link fencing in good condition.

2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.

3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be

wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

B. Gates: Provide gates of the quantity and size indicated on the Contract Drawings or required for functional access to Site.

1. Fabricate of same material as used for fencing.

2. Vehicle gates:

a. Minimum width: 20 feet to allow access for emergency vehicles.
b. Capable of manual operation by one person.

D. Construction Privacy Windscreen:

1. Fabric: 100% knitted polyethylene / open mesh

2. Opacity: 85%

3. 5.1 oz per square yd.

4. Tensile Strength: 300 x 205

5. Fabrication: 4 ply reinforced hems with #2 brass grommets placed at 2-foot intervals

6. Color to be selected by Owner or Owner's Representative.

7. Product manufactured by Midwest Cover Inc., 6463 Waveland Avenue, Unit A, Hammond, IN 46320 (800-594-0744, www.midwestcover.com) or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The fence and gates shall be erected by skilled mechanics in accordance with the recommendations of the manufacturer and these specifications. These specifications shall take precedence over the recommendations of the manufacturer if any discrepancy exists between them.

B. Posts

1. Maximum post spacing shall be 10-feet. Post spacing shall be uniform and posts shall be plumb.

2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.

3. For soft and unstable ground conditions, cast concrete plug around post.

4. Posts over pavement: Use steel post plates or precast concrete blocks.

5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.

6. Temporary terminal posts shall be securely connected to existing fence posts to prevent site access/trespassing.

C. Securely attach wire fabric to posts. Maximum area of unbraced fence fabric shall not exceed 1,500 square feet.

D. Install with required hardware.

E. Fabric shall be stretched taut, with the bottom edge following the existing grade, and shall be a continuous mesh between terminal posts. Each span of fabric shall be attached independently at terminal posts. Where terminal posts do not have provisions for weaving fabric to posts, stretcher bars shall be placed through the end weave of the fabric and secured to the post with bar bands spaced not more than 15-inches apart on the post. Temporary terminal posts shall be secured to existing fence posts to prevent Site access/trespassing.

F. Fabric shall be attached with ties to line posts at intervals of not more than 14-inches (and to the top railing and braces at intervals not exceeding 24-inches).

G. The bottom tension wire shall be interlaced in the weave of the fabric, pulled taut and fastened to terminal posts.

H. Construction privacy windscreen shall be affixed to the fencing with zip ties in each grommet.

3.02 MAINTENANCE AND REMOVAL

A. Maintain fencing in good condition. If damaged, immediately repair.

B. Remove temporary fencing upon completion of Work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

END OF SECTION

SECTION 01 57 19

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to cross-country areas, river and stream crossings, and construction in and adjacent to wetlands, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00 31 43, PERMITS.

D. Prior to commencement of work, the Contractor shall meet with the Owner and the Owner's Representative to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 14 19.16, DUST CONTROL

C. Section 01 33 23, SUBMITTALS

D. Section 31 00 00, EARTHWORK

E. Section 31 11 00, CLEARING AND GRUBBING

F. Section 31 23 19, DEWATERING

1.03 SUBMITTALS:

A. The Contractor shall submit details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 SILT FENCE:

A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a mesh backing, and stapled to preweathered oak posts installed as shown on the drawings. The oak posts shall be 1-1/4-inches by 1-1/4-inches (Minimum Dimension) by 48-inches and shall be tapered. The bottom edge of the silt fence shall be buried as shown on the drawings.

B. The silt fence shall be DOT Silt Fence PPDM3611, as manufactured by U.S. Silt & Site Supply/Getsco, Concord, NH, or approved equal.

C. Silt fence properties:

Physical Properties	**Test Method**	**Minimum Value**
Grab Strength, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15
Mullen burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4533	65
UV Resistance2, %3	ASTM-D-4355	80@500 hrs.
AOS, US Sieve No.	ASTM-D-4751	30
Flow Rate, gal/min/sq ft	ASTM-D-4491	10
Permittivity,(1/sec)gal/min/sq ft	ASTM-D-4491	0.05 sec^{-1}

2.02 STRAW BALES:

A. Straw bales shall consist of certified seed free stems of agricultural grain and cereal crops and shall be free of grasses and legumes. Standard bales shall be 14-inches high, 18- inches wide and 36- to 40-inches long tied with polypropylene twine and weigh within 5 percent of 7 lbs. per cubic ft.

2.03 COMPOST SOCK:

A. Compost sock shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by GEI Works, Sebastian, Florida (Phone: 772-646-0597; website: www.erosionpollution.com), or approved equal.

2.04 SILT FENCE:

A. The silt fence shall be a Type-1-Silt-Barrier consisting of 18-ounce vinyl fabric skirt with a 6-inch marine quality floatation device. The skirt shall be ballasted to hang vertical in the water column by a minimum 3/16-inch galvanized chain. The silt fence shall extend into the water as shown on the drawings. If necessary, join adjacent ends of the silt fence by connecting the reinforcing grommets and shackling ballast lines.

2.05 CATCH BASIN PROTECTION:

A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Owner's Representative.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Owner's Representative will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Owner's Representative until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands or within 100-feet of wetland resource areas. Total easement widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the

condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations outside of the trench limits. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

D. In areas designated as wetlands, the Contractor shall carefully remove and stockpile the top 24 inches of soil. This topsoil material shall be used as backfill for the trench excavation top layer. The elevation of the trench shall be restored to the preconstruction elevations wherever disturbed by the Contractor's operation.

E. The Contractor shall use a trench box, sheeting or bracing to support the excavation in areas designated as wetlands.

F. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Owner's Representative.

G. The use of a temporary gravel roadway to construct the pipeline in the wetlands area is not acceptable. The Contractor will be required to utilize timber or rubber matting to support his equipment in these areas. The timber or rubber matting shall be constructed in such a way that it is capable of supporting all equipment necessary to install the pipeline. The timber or rubber matting shall be constructed of materials and placed in such a way that when removed the material below the matting will not be unduly disturbed, mixed or compacted so as to adversely affect recovery of the existing plant life.

H. Bentonite dams shall be placed in wetlands to prevent drainage. Locations for dams are as indicated on the drawings or as required by the Owner's Representative.

I. During construction, easements within wetlands shall be lined with a continuous straw bale/siltation fence barrier or line of compost sock (aka compost filter tube, silt/filter sock, straw wattles).

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to ensure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Owner's Representative.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Owner's Representative. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Owner's Representative.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Owner's Representative may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Owner's Representative. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Owner's Representative. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Owner's Representative, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Owner's Representative may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Owner's Representative will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 31 11 00,

CLEARING AND GRUBBING.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled hay, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.00 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Owner’s Representative decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01 14 19.16, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.10 SEPARATION AND REPLACEMENT OF TOPSOIL:

A. Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as required. The topsoil shall be stored in an area acceptable to the Owner’s Representative and adequate measures shall be employed to prevent erosion of said material.

3.11 BALED STRAW:

A. To trap sediment and to prevent sediment from clogging drainage systems, baled straw shall be used where shown on the drawings. Care shall be taken to keep the bales from breaking apart. The bales should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically. Straw bales shall not be placed within a waterway during construction of the pipeline crossing.

3.12 ERECTION AND MAINTENANCE OF SILT FENCE:

A. Where indicated on the drawings or where required by the Owner's Representative, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.13 SURFACE RESTORATION OF CROSS COUNTRY AREAS:

A. Plantings detailed in Section 32 93 00 shall be conducted when construction of the pipeline has been completed within the areas designated. A one-year guarantee of maintenance will be required on these plantings to ensure that they establish in the area.

3.14 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Owner's Representative, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sack shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sack from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional cost to the Owner.

B. All catch basin protection shall be removed by the Contractor after construction is complete.

3.15 COMPOST SOCK:

A. The compost socks will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

B. The compost socks shall be regularly inspected and before and after every forecasted major weather event. All deposited sediment shall be removed and not allowed to

accumulate to the top of the compost socks. Socks damaged during construction shall be repaired or replaced as required by the Owner's Representative at no additional cost to the Owner.

C. The Contractor shall remove all compost socks after construction is completed.

END OF SECTION

SECTION 01 74 13

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Owner's Representative provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Owner's Representative.

1.02 RELATED WORK:

A. Section 00 72 00 GENERAL CONDITIONS

B. Section 01 11 00 CONTROL OF WORK AND MATERIALS

C. Section 01 14 00 SPECIAL PROVISIONS

D. Section 01 57 19 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Owner's Representative, the Contractor shall within 24 hours clean up those areas, which in the Owner's Representative's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Owner's Representative, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

3.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

3.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Owner's Representative.

3.05 FINAL CLEANUP:

A. 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 Owner's Representative shall approve the condition of the site.

END OF SECTION

SECTION 01 78 00

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:

1. Project as-built documents

2. Checkout and Certification

3. Final Cleaning

4. Substantial Completion

5. Closeout Procedures

6. Final Completion

7. Correction/Warranty Period

B. Closeout checklist to be completed by the Owner's Representative.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Section 01 74 13, CLEANING UP

C. Division 2 through Division 33.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Written interpretations and clarifications.

7. Field Orders.

8. Field test reports properly verified.

B. The completed set of as-built documents shall be submitted to the Owner's Representative with the final Application for Payment.

1.04 CHECKOUT AND CERTIFICATIONS:

A. Prior to checkout and certifications, the following tasks shall be completed:

1. Construction shall be complete. For this purpose, completion of construction is defined as follows:

a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.

b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.

2. All shop drawings shall have final approval.

3. All shop tests shall be complete and approved test results submitted to the Owner's Representative.

1.05 FINAL CLEANING:

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.

2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Owner's Representative.

3. Comply with requirements of Section 01 74 13 CLEANING UP.

1.06 SUBSTANTIAL COMPLETION:

A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Owner's Representative. This date will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.

2. All field tests have been satisfactorily completed and reports forwarded to the Owner's Representative.

3. All final training has been completed by the manufacturers' representatives.

4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.07 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and is complete in accordance with Contract Documents and ready for Owner's Representative's and Owner's inspection.

B. Accompany Owner's Representative and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Owner's Representative and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Owner's Representative will develop a definitive punch list for the use of the Contractor.

C. Provide submittals to Owner's Representative that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment,

Release and Waiver of Liens and Claims (SECTION 01 78 00 – ATT. A), Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.08 FINAL COMPLETION:

A. Prior to final completion, the following tasks shall be completed:

1. All items in the punch list shall be completed.

2. All Contract closeout documentation shall be submitted to and accepted by the Owner's Representative.

1.09 CORRECTION/WARRANTY PERIOD:

A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.

B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.

C. Corrective work will be identified by the Owner's Representative or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.

D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Owner's Representative and shall then work continuously until the deficiency is corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Owner's Representative describing the deficiency and the corrective action that was taken.

E. The Contractor shall coordinate all corrective work with the Owner's Representative and/or the Owner.

1.09 COMPLETION CHECKLIST:

A. The Project Completion Checklist, which follows, *shall be modified as required for the project* and shall be completed as the project nears completion. When the project has been fully completed, Final Payment can be approved.

PROJECT COMPLETION CHECKLIST

Owner _____ Job No.

Project

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated into a Fully Operational System		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Owner's Representative Inspector		
2. Inspection by Owner, Owner's Representative, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contract Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		
9. Affidavit of Payment of Debts and Claims Submitted		
10. Warranties/Guarantees Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
11. Other Required Releases and Waivers Submitted (List Them)		
12. Permits Submitted (List Them)		
13. Weekly Payrolls Submitted as Required by Law		
FINAL COMPLETION		
1. All Items in Punch List Completed		
2. All Other Required Documentation Submitted (List It)		
CORRECTION/WARRANTY PERIOD		
1. Correction Period Start Date: _____ End Date: _____		
2. Specific Warranties Provided Item Warranty Duration		

Full name of persons signing their initials on this checklist:

_____

_____

_____

_____

_____

END OF SECTION

SECTION 01 78 39

PROJECT AS-BUILT RECORD DRAWINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers the Contractors As-Built Record drawings for the project. The As-Built Record drawings for the project shall include, but are not limited to:

A. The Contractors construction coordination drawings for all the project disciplines. The Contractors construction coordination drawings for the project disciplines shall be submitted to the Owner's Representative prior to Construction of the said discipline. The Contractors construction coordination drawings for the project disciplines shall include but are not limited to the following:

1. Landscape Architectural
2. Structural

B. Draft Record Documents Review

Upon completion of the project construction the Contractor shall submit a complete copy of 24- by 36-inch Record Drawings to the Owner and the Owner's Representative for review. The Owner and the Owner's Representative shall jointly review the Record Drawings and provide comments to the Contractor. The Contractor shall modify the Record Drawings as necessary based on the comments provided by the Owner and the Owner's Representative.

C. Final Record Documents

Upon incorporation and acceptance of the Draft Record Drawings comments from the Owner and the Owner's Representative, the Contractor shall submit the Final Record Drawings and documentation. The Contactor shall submit two sets of 24- by 36-inch Record Drawings to the Owner and an additional two sets of 24- by 36-inch Record Drawings to the Owner's Representative for their records. The Contractor shall also submit to the Owner's Representative a minimum 20 gigabyte flash drive with the electronic Record Drawing files. The electronic Record Drawing files shall be obtained from the Owner (the Owner's Representative shall provide on behalf of the Owner if the Owner's Representative was the project designer) and developed in AutoCAD 2010/Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG/Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD/Revit shall be coordinated with the Owner's Representative.

D. Pre- and Post-Construction Survey

The Contractor shall perform a pre- and post-construction survey of the entire project area. The topographic survey shall be performed by or under the supervision of and certified by a Registered Land Surveyor in the State of Massachusetts. The Contractor shall also submit to the Owner's Representative a minimum 20 gigabyte flash drive with the electronic pre- and post-construction survey files. The Contractor shall send the electronic pre- and post-construction survey files to the Owner's Representative which shall be developed in AutoCAD 2010/ Revit 2017 (or later) and the submittal shall include the Final AutoCAD DWG / Revit RVT file documents, drawing line types, blocks, etc. The actual version of AutoCAD / Revit shall be coordinated with the Owner's Representative. The Contractor shall notify the Owner and Owner's Representative at least 48-hours in advance of each survey.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Division 02 through Division 33.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one complete set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Written interpretations and clarifications.
7. Field Orders.
8. Field test reports properly verified.

B. The completed set of documents shall include but are not limited to:

1. Significant deviations of any nature made during construction.

C. The completed set of as-built documents shall be submitted to the Owner's Representative with the final Application for Payment.

PART 2 – MATERIALS - Not used.

PART 3 - EXECUTION - Not used.

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Work under this Section shall consist of the careful removal, storage for reuse, transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to a minimum of three feet below finished grade, and the removal and disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and Owner's Representative's requirements. Provide all labor, equipment, materials and transportation necessary to complete the work.

B. Items plan referenced to be removed and stored shall be carefully removed and stored on site in a manner and location designated by the Owner's Representative for reinstallation later as shown on the plans or as indicated by the Owner's Representative.

C. Items plan referenced, or as indicated by the Owner's Representative to be removed and disposed of shall be removed from the site and properly and legally disposed of by the Contractor.

D. Items indicated on the contract drawings or in the specifications to be removed and salvaged, or other items required to be removed by the Owner's Representative, shall be transported to a municipal storage facility, located within the City confines, and unloaded and stacked as required by the Owner's Representative.

E. Items indicated on the contract drawings or in the specification to be removed and reset shall be carefully removed and reset in the same location as existing according to the specification and details.

F. The following scope describes the general work/demolition requirements of this Section.

1. Sawcutting and removal of cement concrete pavement
2. Removal and demolition of crushed stone surfacing
3. Removal and demolition of handrails
4. Removal and demolition of existing guardrail
5. Salvage of granite boulders and blocks for reinstallation
6. Protection of existing concrete retaining wall
7. Stripping and stockpiling of topsoil
8. Other features as indicated on the drawings

1.02 PROTECTION:

A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition.

B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel and the general public during performance of all work.

C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

1.03 SPECIAL REQUIREMENTS:

A. The Contractor shall salvage items label to be demolished and transport these to the **Owner's City Yard – 70 Crescent Street, Auburndale, MA 02466 -** unless these are called for to be reused or required by the Owner's Representative to be disposed of.

B. Install erosion controls to protect adjacent areas from eroded materials likely to enter wetlands, resource areas, or drainage ways/systems, downstream of areas disturbed by work activities.

C. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Owner's Representative at no additional cost to the Owner.

1.04 REFERENCES:

A. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges – latest edition.

PART 2 - PRODUCTS

2.01 BACKFILL:

A. The Contractor shall provide suitable backfill as specified under Section 31 00 00 of these Specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.

B. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match

the line and grades of adjacent surfaces.

PART 3 - EXECUTION

3.01 SALVAGEABLE MATERIAL:

A. Frames, grates and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.02 ABANDONED STRUCTURES:

A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.

B. The Owner's Representative shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.03 ABANDONED PIPES OR CONDUITS:

A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8) inches in thickness.

B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Owner requirements.

C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

END OF SECTION

SECTION 03 05 00

FIELD CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers concrete and all related items necessary to place and finish the concrete work.

B. Concrete thrust, and anchor blocks, to be provided at all water main bends, tees, plugs and wyes and at other locations required by the Owner's Representative shall be installed in accordance with the details shown on the drawings and as specified in this section.

C. Concrete encasement for piping with shallow cover and for encasement of telephone, and electrical duct bank when specified shall be installed in accordance with the details shown on the drawings and as specified in this section.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK

1.03 REFERENCES:

A. The following standards form a part of this specification:

American Concrete Institute (ACI)

ACI 304	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
ACI 305	Recommended Practice for Hot Weather Concreting
ACI 306	Recommended Practice for Cold Weather Concreting
ACI SP-66 ACI	Detailing Manual
ACI 318	Building Code Requirements for Reinforced Concrete

American Society for Testing and Materials (ASTM)

ASTM A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C33	Concrete Aggregates

ASTM C94 Ready-Mixed Concrete

ASTM C143 Test for Slump of Portland Cement Concrete

ASTM C150 Portland Cement

ASTM C260 Air Entraining Admixtures for Concrete

ASTM C494 Chemical Admixtures for Concrete

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

Statement of materials constituting the design of mixes for each size aggregate as required by ASTM C94 shall be submitted to the Owner's Representative within one week following award of the Contract.

PART 2 - PRODUCTS

2.01 CONCRETE:

A. All concrete, reinforced or non-reinforced shall have a 28 day compressive strength of 3000 psi unless otherwise noted on the design drawings. A minimum of 5.5 sacks of cement per cubic yard and a maximum water cement ratio of 6.9 gallons per sack shall be used.

B. Concrete shall conform to ASTM C94. The Contractor shall be responsible for the design of the concrete mixtures. Slump shall be a maximum of 4-inches and a minimum of 2-inches, determined in accordance with ASTM C143.

C. Admixtures shall be as specified in subsection 2.05. No additional admixtures shall be used unless approved by the Owner's Representative.

D. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Owner's Representative.

2.03 CEMENT:

The cement shall be an approved brand of American manufactured Portland Cement, Type II conforming to the applicable requirements of ASTM C150.

2.04 AGGREGATES

A. Except as otherwise noted, aggregate shall conform to the requirements of ASTM C33.

B. Maximum size aggregate shall be 3/4-inch.

2.05 ADMIXTURES:

A. All concrete (unless otherwise directed) shall contain an air entraining agent. Air entrained concrete shall have air content by volume of 4 to 8 percent for 3/4-inch aggregate.

B. Air entraining agent shall be in accordance with ASTM C260 and shall be Darex AEA, as manufactured by W.R. Grace & Company; Placewel (air entraining Type), as manufactured by Johns Manville; Sika AER as manufactured by Sika Chemical Company; or an approved equal product.

C. Water reducing agent shall be WRDA, as manufactured by W.R Grace & Company; Placewel (non-air entraining Type), as manufactured by Johns Manville; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

D. Water reducing agent-retarder shall be "Daratard," as manufactured by W.R. Grace & Company; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

2.06 WATER:

A. Water for concrete shall be potable, free of deleterious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.07 CONCRETE FORMS:

A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Owner’s Representative.

B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.

C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.

D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete

PART 3 - EXECUTION

3.01 PREPARATION:

A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or the material which would tend to reduce the bond.

B. Earth, concrete, masonry, or other water permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed.

C. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Owner's Representative.

3.02 THRUST AND ANCHOR BLOCKS:

A. Minimum bearing areas for thrust blocks and dimensions of anchor blocks shall be as shown on the drawings.

B. Concrete for thrust and anchor blocks shall be placed against undisturbed earth, and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints.

3.03 FILL CONCRETE:

A. Fill concrete shall be placed in those locations as indicated on the design drawings. Fill concrete shall consist of materials as previously specified, with a minimum 28-day compressive strength of 3000 psi.

B. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before grout has dried or set.

C. Fill concrete shall be brought to lines and grades as shown on the design drawings.

3.04 CONCRETE PLACING DURING COLD WEATHER:

A. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when temperature is below 40°F, or is expected to fall to below 40°F, within 73 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval of the Owner's Representative. All procedures shall be in accordance with provisions of ACI 306.

3.05 CONCRETE PLACING DURING HOT WEATHER:

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing, shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays, which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (90°F or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement, will not be acceptable, and will be rejected.

3.06 FIELD QUALITY CONTROL:

A. Concrete inspection and testing shall be performed by the Owner's Representative or by an inspection laboratory, designated by the Owner's Representative, engaged and paid for by the Owner. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel. Full assistance and cooperation, concrete for samples, and such auxiliary personnel and equipment as needed shall be provided by the Contractor.

B. At least 4 standard compression test cylinders shall be made and tested and 1 slump test from each day's placement of concrete. A minimum of four compression test cylinders shall be made and tested for each 100 cubic yards of each type and design strength of concrete placed. One cylinder shall be tested at 7 days, and two at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has been received. If the average compressive strength of the two 28 day cylinders do not achieve the required level, the Owner's Representative may elect to test the fourth cylinder immediately or test it after 56 days. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.

C. The Owner's Representative shall have the right to reject concrete represented by low strength tests. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Owner's Representative as to whether substandard concrete is to be accepted or rejected shall be final.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specifications covers the furnishing and installation of forms for cast-in-place concrete.

1.02 RELATED WORK:

A. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 21 00, CONCRETE REINFORCEMENT

C. Section 03 30 00, CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

The following standards form a part of this specification:

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 Standard Specifications for Structural Concrete

ACI 347 Recommended Practices for Concrete Formwork

U.S. ARMY CORPS OF ENGINEERS (CE)

CE 03300 Cast-in-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Owner's Representative.

B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.

C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.

D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete.

PART 3 - EXECUTION

3.01 PREPARATION:

Surfaces of forms to be in contact with concrete shall be greased with nonstaining form release compound. Wetting will not be accepted as a substitute. Approval of the Engineer shall be obtained before use of coated materials or liners in lieu of form release compound, except as modified herein.

3.02 CONSTRUCTION:

A. For concrete surfaces which will be visible after completion of the structure, painted or unpainted, the type and the precise location of form ties, nails joints between form members, and any other features which will leave a visible trace in the finished concrete, will be subject to the approval of the Owner's Representative.

B. Formwork shall be so constructed, braced, or tied that the formed surfaces of the concrete will be perfectly true, smooth, and to the dimensions shown on the drawings. All forms used for circular sections shall be true arcs as indicated on the drawings. Short chords will not be acceptable. Form line shall present an uninterrupted surface conforming to radii indicated on the drawings.

C. Forms shall be sufficiently tight to prevent leakage of mortar, and when necessary shall have temporary openings as required for thorough cleaning, and as required for introduction of concrete to avoid excessive free fall. Panels damaged in stripping or otherwise shall not be reused.

D. Unless otherwise noted on the design drawings, forms shall be filleted and chamfered at all sharp corners, and exposed edges with a 3/4-inch chamfer. Chamfer shall not be used where masonry or other material will subsequently be installed flush with one of the adjacent surfaces of the concrete. Where a wash or slope is indicated on the drawings no additional chamfer is required.

3.03 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Owner's Representative, forms shall not be removed before the concrete has attained a strength of at least 30 percent of the ultimate strength prescribed by the design and not before reaching the following number of day-degrees [whichever is the longer]:

Forms for	Day-Degree*
Beams and Slabs	500
Walls and vertical surfaces	200

* Day-Degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily weighted average temperature of 60 deg F equals 300 day-degrees. Temperatures below 50 deg F are not to be considered in determining Day-Degree.

B. Where beams, girder, columns, walls and similar vertical forms are adequately supported on shores, the side forms may be removed after 24 hours of cumulative curing time provided the side forms support no loads other than the lateral pressure of the plastic concrete. Cumulative curing time represents the sum of time intervals, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 deg. F in accordance with American Concrete Institute standards.

C. Shoring shall not be removed until the concrete has attained at least 70 percent of the specified strength and sufficient strength to support safely its own weight and the construction live loads upon it.

D. Forms shall be removed in such a manner as not to impair safety and serviceability of the structure. Concrete exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

END OF SECTION

SECTION 03 21 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specification covers the furnishing and installation of reinforcement for cast-in-place concrete.

1.02 RELATED WORK:

A. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 11 00, CONCRETE FORMWORK

C. Section 03 30 00, CAST-IN-PLACE CONCRETE

1.03 SYSTEM DESCRIPTION:

Materials and construction shall conform to ACI 3l8 and ACI 350 unless otherwise noted on the design drawings or modified herein.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. The Contractor shall furnish to the Owner's Representative with complete checked, reinforcing steel shop drawings and bar lists. Shop drawing shall include grade of steel used as well as splice lengths.

B. Mill test reports shall accompany drawings. Fabrication shall not commence until the drawings and mill test reports have been released by the Owner's Representative.

C. When fiber reinforcement is used, contractor shall submit manufacturer's data confirming that material meets the specification.

1.05 REFERENCES:

A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

ACI 3l8 Building Code Requirements for Concrete

ACI 347 Recommended Practice for Concrete Formwork

ACI 350 Environmental Engineering Concrete Structures

ACI SP-66 ACI Detailing Manual

American Society for Testing and Materials (ASTM)

ASTM A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement

ASTM A497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement

ASTM A6l5 Deformed Billet-Steel Bars for Concrete Reinforcement

ASTM A775 Epoxy-coated Reinforcing Steel Bars

ASTM A884 Epoxy-coated Welded Wire Fabric

American Welding Society (AWS)

AWS 12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Steel reinforcing bars shall conform to ASTM A6l5, Grade 60, and A775 if epoxy-coated bars are specified.

B. Welded steel wire fabric shall conform to ASTM A185 or ASTM A497 and ASTM A884 if epoxy-coated fabric is specified. Gauge and spacing of wires shall be as indicated on the drawings.

C. Reinforcing steel shall be detailed in accordance with ACI SP-66 modified as applicable to conform to ACI 350.

D. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Bars shall be shipped to the site with bars of the same size and shape, fastened in bundles with securely wired-on metal identification tags listing both size and mark.

E. Any bar showing cracks after bending shall be discarded.

F. Steel failing to meet the requirements of this specification or the drawings will be rejected and shall be removed from the site immediately.

PART 3 - EXECUTION

3.01 STEEL INSTALLATION:

A. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings (including ice), that reduce or destroy bond. When there is a delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned as necessary.

B. After forms have been oiled, but before concrete is placed, all steel shall be securely wired in the exact position called for, and shall be maintained in that position until all concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Owner's Representative.

C. Concrete blocks having a minimum bearing area of 2-inches by 2-inches and equal in quality to that specified for the slab, shall be used for supporting reinforcing bars for slabs on grade. Wood blocks, stones, brick chips, etc., shall not be used to support reinforcement.

D. Metal supports shall be of types that will not penetrate the surface of formwork or slab and which will not show through or stain surfaces that are to be exposed to view, painted or unpainted.

E. Welding of reinforcing bars will be permitted only where permission of the Owner's Representative has been obtained in advance. Such welding shall be performed only under conditions established by the Owner's Representative, and in accordance with AWS 12.1.

F. Reinforcement, which is to be exposed for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout, if required by the Owner's Representative.

3.02 FIBER INSTALLATION:

A. Fibermesh fibers shall be used in concrete as indicated on the drawings or as specified and in strict accordance with the manufacturer's recommendations as to type and amount. The fiber manufacturer or approved distributor shall provide the services of a qualified employee for pre-job meeting and initial job start up.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all concrete and all related items necessary to place and finish the concrete work.

1.02 RELATED WORK:

A. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 11 00, CONCRETE FORMWORK

C. Section 03 21 00, CONCRETE REINFORCEMENT

D. Section 31 00 00, EARTHWORK

H. Items furnished under other Sections and installed under this Section include, but are not limited to:

Items embedded in concrete, including anchors, sleeves, floor drains, castings, frames for hatches, angles, nosings, and other miscellaneous metals.

1.03 REFERENCES:

A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

ACI 30l Structural Concrete for Buildings

ACI 302 Recommended Practice for Concrete Floor and Slab Construction

ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Replacing Concrete

ACI 305 Recommended Practice for Hot Weather Concreting

ACI 306 Recommended Practice for Cold Weather Concreting

ACI 318 Building Code Requirements for Reinforced Concrete

ACI 347 Recommended Practice for Concrete Formwork

ACI 350 Code Requirements for Environmental Engineering Concrete Structures

American Society for Testing and Materials (ASTM)

ASTM C33 Concrete Aggregates

ASTM C39 Compressive Strength of Cylindrical Concrete Specimens

ASTM C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C87 Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

ASTM C94 Ready-Mixed Concrete

ASTM C143 Standard Method for Slumps of Portland Cement Concrete

ASTM C150 Portland Cement

ASTM C171 Sheet Materials for Curing Concrete

ASTM C231 Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260 Air-Entraining Admixtures for Concrete

ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C494 Chemical Admixtures for Concrete

ASTM D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Shop drawings of the materials specified herein.

B. Statement of materials constituting the design of mixes which satisfy the specified strength for each size aggregate as required by ASTM C94 shall be submitted to the Owner's Representative within one week following award of the contract.

C. Provide one copy of the "Certificate of Delivery" for each load of concrete as it arrives on the site, under the provisions of ASTM C94.

PART 2 - PRODUCTS

2.01 CONCRETE:

A. Concrete conforming to the requirements listed below shall be used where indicated on the drawings. Unless otherwise indicated, concrete used as fill under foundations, and elsewhere approved by the Owner's Representative, shall be the 3,000 psi mix.

TABLE

Minimum Comp. Strength at 28 days (psi)	Maximum Water/Cement ratio (gallons per bag of cement)*	Cement Factor: 94 lb. Bags per cubic yard minimum**
3000	0.59 (6.9)	5.5
4000	0.48 (5.6)	6.5
5000	0.40 (4.7)	7.4

* Based on air-entrained concrete. If non-air-entrained concrete is called for, the listed maximum water/cement ratios may be increased slightly, as approved by the Owner's Representative. The water is the total water in the mix, including free water on the aggregate.

** These are minimum amounts; increase as necessary to meet mix requirements.

B. Concrete shall conform to ASTM C94. One copy of the Certificate of Delivery required by ASTM C94 shall be delivered to the Owner's Representative immediately upon arrival of each load of concrete at the site. The Contractor shall be responsible for the design of the concrete mixtures.

C. Standard compression tests of all proposed mixes shall be made by the testing laboratory or other satisfactory evidence shall be presented that the design mixes will attain the minimum strengths listed on the design drawings or called for herein, within the limitations of the ACI Code. No concrete shall be delivered to the job site until the Owner's Representative has approved the design mixes.

D. All concrete (unless otherwise directed) shall contain an air-entraining agent. Air entrained concrete shall have an air content by volume of 3 to 6 percent for l-l/2-inch aggregate and 4 to 8 percent for 3/4-inch aggregate. The air content shall be the responsibility of the testing laboratory and in accordance with ASTM C23l.

E. All concrete shall contain a mid-range water reducer to minimize cement and water content of the mix, at the specified slump, in accordance with ASTM C494.

F. Slump for all concrete shall be from 3-inch to 4-inch, except for concrete using a superplasticizer, when the maximum slump shall be 8-inches. Any concrete having a slump greater than 4-inches (8-inches with superplasticizer) shall be promptly removed from the site.

G. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixture other than those specified shall be used in concrete without the specific written permission of the Owner's Representative in each case.

H. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Owner's Representative.

I. All concrete shall contain 2 lbs. of lamp black per cubic yard.

2.02 CEMENT:

A. The cement shall be an approved brand of American manufactured Portland Cement, Type IIA conforming to ASTM Cl50. The brand name and type of cement proposed for use shall be submitted to the Owner's Representative for approval immediately following award of contract. Only one color of cement, all of the same manufacture, shall be used for the work.

B. When the use of high-early-strength Portland cement (Type IIIA) is permitted by the Owner's Representative the same strength requirements shall apply, but the indicated strengths shall be attained in 7 days instead of 28 days.

2.03 ADMIXTURES:

A. Air entraining agent shall be in accordance with ASTM C260.

B. Water reducing agent shall be a mid-range water reducer meeting ASTM C494, Type A.

C. Water reducing agent-retarder shall be in accordance with ASTM C494, Type D.

D. Superplasticizer agent shall be in accordance with ASTM C494, Type F or Type G and contain no more than 0.1% chloride ions. Product may be plant added or field added based on the best application considering distance, temperature and time.

2.04 AGGREGATES:

A. Except as otherwise noted, aggregate shall conform to the requirements of ASTM C33.

B. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33.

C. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33.

D. The following designated sizes of aggregate shall be the maximum employed in concrete.

2-inch for mass concrete
1½-inch for reinforced sections 18-inch and over in thickness
3/4-inch for reinforced and unreinforced sections less than 18-inch thickness.

2.05 WATER:

Water for concrete shall be potable, free from injurious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.06 GROUT:

Grout shall be mixed in the proportions of one part Portland Cement to 2 parts sand, by volume. Only sufficient water shall be used to enable grout to barely hold its shape when squeezed into a ball in the hand. Aggregate for grout shall conform to the requirements of the reference specification for concrete. Prior approval of the Owner's Representative shall be obtained for the use of proprietary grouts, and the instructions of the Owner's Representative shall be followed in their use.

2.07 CURING MATERIALS:

A. Curing compound shall be a curing/hardener compound such as Acurion by AntiHydro, Sikaguard Cure/Hard by Sika, Super Diamond Clear by Euclid or approved equal.

B. Curing paper shall be a fiber-reinforced laminated Kraft bituminous product conforming to the requirements of ASTM Cl7l.

2.08 JOINT FILLER:

1. Preformed joint filler strip shall conform to ASTM Dl75l or Dl752, having a thickness as indicated on the drawings.

2. Fillers shall be provided in pieces of the full thickness required. Use of multiple layers of thin pieces to make-up the full thickness will not be permitted.

2.09 JOINT SEALANT:

Joint sealant for construction and control joints shall be a two-part polysulfide base sealant conforming to Thiokol's Building Trade Performance Specification, Class A (self-leveling), Type II (hardness: 35-45 Shore A).

PART 3 - EXECUTION

3.01 GENERAL:

Under no circumstances shall concrete that has set or partially set before placing be used; and no retempering of concrete or grout will be permitted.

3.02 PREPARATION:

A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or other material which would tend to reduce the bond.

B. Unless otherwise indicated, a moisture barrier shall be used under all slabs placed on the ground in accordance with ACI 302.1R. The moisture barrier shall be fungi-resistant and shall have a vapor permeance rating not exceeding 0.01 perms (Perms [grains/ft^2*hr*in. Hg]) per ASTM F1249 or ASTM E96) and 10 mils thickness (49 lbs/MSF). The moisture barrier shall be a high-performance underslab vapor retarder made from polyethylene resins that exceed ASTM E1745, Class A. Sheets shall be lapped 6-inches at joints and sealed with 2-inch wide tape or as recommended by the manufacturer. The vapor barrier should have all laps, seams, penetrations and terminations sealed and should carry across footings.

C. When no moisture barrier is used, the earth, concrete, masonry, or other water-permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Owner's Representative.

D. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned by chipping and washing off all dirt and scum and laitance. It then shall be moistened prior to placing new concrete.

E. Concrete surfaces that act as a seat for structural members (other than those resting on grout) shall be troweled to an extremely flat and level surface. If necessary, such surfaces shall be ground off to achieve the required flatness and level.

F. Fill concrete on top of concrete shall be placed in the locations indicated on the drawings or designated by the Owner's Representative. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before grout has dried or

set. Fill concrete shall be brought to the lines and grades shown on the drawings or approved by the Owner's Representative.

G. Concrete for thrust and anchor blocks shall be placed against undisturbed earth and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints. Minimum bearing areas and dimensions shall be as shown on the drawings.

3.03 MIXING:

A. Concrete shall be ready-mixed, or transit-mixed, as produced by equipment acceptable to the Owner's Representative. No hand-mixing will be permitted. Adding water in controlled amounts during the mixing cycle shall be done only with the express approval of, and in the presence of the Owner's Representative.

B. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.

C. All central plant and rolling stock equipment and methods shall conform to the latest Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready-Mixed Concrete Association, as well as ACI 304 and ASTM C94.

D. Attention is called to the importance of dispatching trucks from the batching plant so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

3.04 INSTALLATION/APPLICATION/ERECTION:

A. Placing

1. No concrete shall be placed by pumping methods without the prior written approval of the Owner's Representative. Should the Contractor be allowed to place concrete by pumping methods, procedures, mix design of concrete, and all other precautions

shall be in accordance with ACI 304.2R and as approved by the Owner's Representative.

2. Concrete shall be placed in alternate areas, as defined by the construction and control joints indicated on the design drawings. A minimum of 3 days shall elapse between placement of adjacent sections.

3. Segregation of the concrete shall be prevented during handling; should any segregation occur, the concrete shall be remixed before it is placed. Concrete shall be placed in the forms in horizontal layers not over l to 2 feet thick. Concrete shall not be allowed to drop freely more than 4 feet. If the free drop to the point of placement must exceed 4 feet, the Contractor shall obtain the approval of the Owner's Representative for the proposed method of depositing the concrete. The concrete shall not be required to flow over distances greater than 3 feet in any direction in the forms or on the ground, unless otherwise permitted by the Owner's Representative.

4. Unless otherwise noted, the work begun on any day shall be completed in daylight of the same day.

5. "Cold Joints" are to be avoided, but if they occur, they are to be treated as bonded construction joints.

6. Chutes for conveying concrete shall be of U-shaped design and sized to insure a continuous flow of concrete. Flat (coal) chutes shall not be employed. Chutes shall be metal or metal-lined, and each section shall have approximately the same slope. The slope shall not be less than 25 nor more than 45 degrees and shall be such as to prevent segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate or spout to prevent segregation. If the discharge end of the chute is more than 5 feet above the surface of the concrete in the forms, a spout shall be used and the lower end maintained as near the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. Chutes shall be thoroughly cleaned before and after each run, and the debris and any water shall be discharged outside the forms. Concrete shall not be allowed to flow horizontally more than 5 feet.

7. Concrete during and immediately after depositing shall be thoroughly compacted by means of suitable tools. Internal type mechanical vibrators shall be employed to produce the required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on long enough to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents or "pumping" or migration of air. All vibrators shall be supplemented by proper wooden spade puddling adjacent to forms to remove included bubbles and honeycomb. This is essential for the top lifts of walls. All vibrators shall travel at least 10,000 rpm and be of adequate capacity. At least one

vibrator shall be used for every 10 cubic yards of concrete per hour. In addition, one spare vibrator in operating condition shall be on the site.

8. Concrete slabs on the ground shall be well-tamped into place and foundation material shall be wet, tamped, and rolled until thoroughly compacted prior to placing concrete.

9. Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the drawings or approved by the Owner's Representative.

10. Chutes, hoppers, spouts, adjacent work, etc., shall be thoroughly cleaned before and after each run, and the water and debris shall not be discharged inside the form.

B. Concrete Placing During Cold Weather

1. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40°F, or is expected to fall to below 40°F, within 72 hours, and the concrete after placing shall be protected by covering, heat, or both. No accelerant shall be used to prevent freezing.

2. The temperature of concrete surfaces shall not be permitted to drop below 50ºF. for at least 7 days after placement of the concrete.

3. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Owner's Representative. All procedures shall be in accordance with provisions of ACI 306.

C. Concrete Placing During Hot Weather

1. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays that will result in excessive mixing of the concrete after arrival on the job.

2. During periods of excessively hot weather (90°F, or above) ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement will not be acceptable, and will be rejected.

3. Temperature records shall be maintained throughout the period of hot weather

giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. The record shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

D. Pipes And Embedded Metals

1. Special care shall be taken to bring the concrete into solid contact with pipes and iron work embedded in the walls and floors, particularly underneath and around all pipes where a head of water exists, making watertight joints.

2. In general, such embedded items are not shown on the structural design drawings. Design drawings of the other trades shall be consulted for their location and details.

3. Anchor bolt location, size and details shall be verified with the equipment manufacturer's certified drawings before installation.

4. Anchor bolts, reglets, sleeves, edge angles and similar embedded items will be provided, delivered to the site under other Sections of the specification, for installation under this Section.

5. Where edge angles, etc., have nuts welded on to receive machine screws, the threads of the nuts shall be protected from concrete, and the concrete shall be excluded from the space to be occupied by the screw, by the use of wood plugs or other effective means.

6. Inserts required for hanging mechanical and electrical items shall be provided and installed in the forms under the mechanical and electrical sections of the specification.

7. Should the Contractor be allowed to leave openings in the concrete for pipes or ironwork, to await the arrival of items that would delay the prosecution of the work, the openings shall be subject to the approval of the Owner’s Representative. Appropriate construction joints shall be provided. In filling any such openings with concrete, a mixture of l: l-l/2 : 3 shall be used and a watertight bond shall be secured between the old and new concrete.

8. In bolting miscellaneous items to concrete after the concrete has set, expansion bolts of an approved pattern and type shall be used. The Contractor shall submit to the Owner’s Representative, for approval, the types of expansion bolts. Expansion bolts shall not be used until they are approved.

E. Curing

1. Concrete curing shall be performed as specified in ACI 30l and as stated herein. All curing procedures shall have prior approval of the Owner's Representative.

2. Concrete Floors

Concrete floors which are to receive paint, concrete fill, mortar setting beds, grout fill, or any other subsequent finish shall be cured by one of the following procedures immediately after completion of placement and finishing:

a. Ponding or continuous sprinkling.

b. Application of absorptive mats or fabric kept continuously wet.

c. Application of sand kept continuously wet.

d. Application of waterproof sheet materials conforming to ASTM Cl7l.

e. Application of curing compounds conforming to ASTM C309, if it can be demonstrated to the Owner's Representative's satisfaction that the compound is applicable and that it will not prevent bonding of the subsequent finish to be received. Compound shall be placed at a rate of 200 square feet per gallon, in two applications perpendicular to each other.

3. Curing procedure shall be continued for at least 7 days.

a. Moisture loss from surface placed against metal or wood forms shall be minimized by keeping forms wet until removal.

b. Curing shall be continued for at least 7 days. When forms are removed during the curing period, surfaces shall be cured by spraying or by the use of a curing compound as previously specified.

c. Surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect the exposed surface.

F. Bracing And Supports

1. All concrete members shall be adequately and safely supported and braced until the permanent supports and braces are installed.

2. Backfilling against exterior walls shall not be done until supporting slabs are in place and have attained 70 percent of design strength, otherwise walls shall be braced against earth lateral pressure, using a system approved by the Owner's

Representative.

3. Backfilling against retaining walls shall not commence until the wall concrete has reached its 28-day strength.

G. Removing Forms And Supports

1. Removal of forms shall take place in accordance with ACI 347, Section 3.6. Except as otherwise specifically authorized by the Owner's Representative, forms shall not be removed until the concrete has aged for the following number of day-degrees or attained 50 percent strength. (Day-degrees equals the total of number of days times the average daily air temperature at the surface of concrete. For example, 5 days at a daily average temperature of 60°F. equals 300 day-degrees.)

Location	Day-Degrees
Beams and Slabs	500
Walls and Vertical Surfaces	200

2. Shores under beams and slabs shall not be removed until the concrete has attained at least 70 percent of the specified cylinder strength and also sufficient strength to support safely its own weight and the construction loads upon it.

H. Patching

1. Defective concrete and honeycombed areas as determined by the Owner's Representative shall be chipped down reasonably square and at least one-inch deep to sound concrete by means of hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly imbedded in the parent concrete, subject to Owner's Representative's final inspection. If honeycomb exists around reinforcement, chip to provide a clear space at least 1-inch wide all around the steel. For areas less than 1-1/2 inches deep, the patch may be made following the procedure for filling form tie holes, described in the subsection below, using adequately dry (non-trowelable) mixtures to avoid sagging. Thicker repairs will require build-up in 1-inch layers on successive days. Unless otherwise indicated, thicker repairs shall be made with Vertipatch mortar mixture blended with Acryl-Set, both by Master Builders, Inc., Cleveland, Ohio, or approved equal.

2. For concrete areas exposed to serious abrasion and/or impact forces, the Owner's Representative may order the use of grout with a non-shrink metallic aggregate

(Embeco by Master Builders, Inc.; Ironite by Fox Industries, Madison, IL; or approved equal) as an additive in the proportions listed below:

	Small Patches		Large Formed Patches	
Material	Volumes	Weights	Volumes	Weights
Cement	1.0	1.0	1.0	1.0
Metal Aggregate	0.15	0.25	0.2	0.33
Sand	1.5	1.5	1.5	1.0
Pea Gravel	--	--	1.5	1.5

I. Finishing Of Formed Surfaces

1. All concrete that is to be left exposed to view shall be scraped to remove projecting imperfections left by voids in the forms.

2. In addition to scraping, exterior exposed concrete shall be covered with a cement-base plaster mix. The mix shall consist of Thoroseal Plastic Mix and Acryl 60, as manufactured by Standard Drywall Products, Miami, FL, or approved equal. It shall be mixed and applied in accordance with the manufacturer's recommendations.

3. In addition to scraping, interior concrete surfaces which will be exposed to view and concrete surfaces which are to be prepared and painted as specified in Section 09 90 00, PAINTING, shall receive a smooth rubbed finish, in accordance with ACI 301 and as described below.

4. To permit satisfactory finishing, forms shall be removed from the vertical faces of the concrete as early as is possible without damaging the surface. Immediately after stripping forms, any fins or projections left by the forms shall be chipped off, and the surfaces rubbed smooth.

5. Form tie holes and other voids and faults shall be patched. Voids shall be cleaned out, roughened, thoroughly wetted, coated with neat cement paste, and filled with mortar of cement and sand in the same proportions, materials, and color as used in the concrete. The surface of the patch shall be flush with the surrounding surface after finishing operations are complete. Surface shall be kept continuously damp until patches are firm enough to be rubbed without damage.

6. Rubbing shall be performed while the surface is wet using a carborundum or cement sand brick, to achieve a smooth uniform, even textured finish. Patched and chipped areas shall be blended to match as closely as possible the appearance of the rest of

the surface. No cement wash or plastering will be permitted, and no mortar shall be used except as required above.

7. Where finishing is performed before the end of the curing period, concrete shall under no circumstances be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

J. Concrete Floor Finishing Requirements

Unless designated otherwise, concrete floors shall have a troweled finish as specified in Section ll.7 of ACI 30l. Troweled finishes shall conform to the requirements of "Class A Tolerances," Section ll.9 as specified in ACI 30l.

L. Testing

1. The Contractor shall provide all field testing and inspection services, and shall pay for all such services. The Owner's Representative shall approve the testing laboratory and shall inform the Contractor when samples are to be taken for testing. The Contractor shall forward all test results to the Owner's Representative as soon as they are available.

   a. The Testing Laboratory shall conform to the requirements of ASTM E-329 as modified in 780 CMR R1 in the MA State Building Code. The State Board of Building Regulations and Standards shall license them.

2. At least one slump test shall be performed from each truckload of concrete. The sample for slump shall be taken from the middle third of a truckload. Air content tests shall be made at the discretion of the Owner's Representative. If the measured slump or air content falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed the requirements of the specification and shall be immediately removed from the jobsite to be discarded.

3. The Contractor shall advise the Owner's Representative of his readiness to proceed with concrete placement at least one working day prior to each placement. The Owner's Representative will inspect the preparations for concrete, including the preparation of previously placed concrete, the reinforcing, and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Owner's Representative.

4. A minimum of four standard compression test cylinders shall be made and tested for **each 100 cubic yards or fraction thereof** for each type and design strength of concrete from each day's placement of concrete. One cylinder shall be tested at 7 days and two cylinders at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has

been received. The Owner's Representative reserves the right to require test cylinders to be made for each truckload of concrete if the nature of the project or project experience indicates such additional tests are required for proper control of concrete quality**.**

5. The strength level shall be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength f'c, and no individual strength test (average of two cylinders) result falls below the specified strength f'c by more than 500 psi.

6. In the event the average compressive strength of the two 28 day cylinders do not achieve the required level, the Owner's Representative may elect to test the fourth cylinder immediately or test it after 56 days.

M. Failure To Meet Requirements

1. The Owner's Representative shall have the right to reject concrete represented by low strength tests or to agree to further testing of the concrete. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Owner's Representative as to whether substandard concrete is to be accepted or rejected or additional tests shall be conducted shall be final. All direct and indirect costs associated with further curing and testing of the concrete shall be at the Contractor's expense. All costs associated with removing rejected concrete, placing new concrete, and conducting tests on new concrete shall be at the Contractor's expense.

2. If the Owner's Representative agrees to consider further curing and/or testing of the concrete before making a final decision, the Contractor shall submit a detailed plan to the Owner's Representative, including proposed criteria for acceptance of the concrete. The plan may include additional curing of the concrete, drilling and testing of cores, load testing of the structure, or a combination.

3. If additional curing is permitted before further inspection and testing, the Contractor shall provide any necessary materials and labor to further cure the suspect concrete.

4. If drilling and testing of cores is permitted, the Contractor shall be responsible for obtaining the cores, including provision of ladders, scaffolding, and such incidental equipment as may be required. If additional curing is permitted, cores shall be drilled after the curing period, and shall be in accordance with ASTM Methods C39 and C42. The Contractor shall repair all core holes to the satisfaction of the Owner's Representative.

5. The burden of proof, including, but not limited to the work of cutting and testing the cores, inspection, evaluation, engineering, repair of the holes, or removal and

replacement of the concrete in question, and all associated costs therefor, shall be at the expense of the Contractor.

6. If load testing of the concrete is permitted, and if not otherwise indicated, slabs or beams under load test shall be loaded with their own weights plus a superimposed load of 2 times the design live load. The load shall be applied uniformly over the portion being tested in the approved manner and left in position for 24 hours. The structure shall be considered satisfactory if deflection "D" in feet, at end of 24-hour period, does not exceed the following value:

D equals 0.001 (L x L)/t

in which "L" is span in feet, "t" is depth of slab, or beam in inches. If deflection exceeds "D" in the above formula, the concrete shall be considered faulty unless within 24 hours after removal of the load, the slab, or beam under test recovers at least 75 percent of the observed deflection.

7. If the suspect concrete still fails to meet specification requirements, the Owner's Representative shall have the right to reject the concrete, have it removed and replaced, in accordance with paragraph 5 above, or to require mechanical strengthening of the concrete to satisfy project requirements. The Contractor shall submit a removal and replacement plan for review by the Owner's Representative.

N. Test For Watertightness

1. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Owner's Representative.

2. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.

3. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Owner's Representative. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the

structure shall be repaired and retested until the leakage falls within the allowable limit.

4. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.

5. The Contractor shall pay all costs (including water) incurred in the testing for watertightness.

6. The Owner's Representative shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

SECTION 04050

STONE VENEER WALLS

PART 1 – GENERAL

1.01 SCOPE OF WORK

a. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to construct the required stone veneer walls. The walls are as detailed and specified elsewhere in the Contract Documents.

b. Under Bid Alternate #3, the Contractor shall add stone veneer to the lake-side face of the existing retaining wall to remain and new concrete cheek wall pinned on top, as shown in the Contract Drawings. Under the base bid, no stone veneer is included on these faces of wall.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

a. Reference to the standards, specifications and tests of technical societies, organizations, and governmental bodies is made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways, 1988 Edition, the Commonwealth of Massachusetts, Department of Public Works, (MassDOT) hereinafter referred to as "the MDPW Standard Specifications, "Section 685, as modified herein.

1.03 SHOP DRAWINGS AND SAMPLES

a. Samples of the stone are to show color, grain, and surface finishing and shall be submitted to the Owner's Representative for approval. Complete erection drawings shall be prepared and furnished to the Owner's Representative for approval prior to ordering, delivering, and construction of furnished materials for the walls.

PART 2 – MATERIALS

2.01 VENEER STONE

A. All veneer stone shall be of granite, hard and durable, free from seams, which

impairs structural integrity, and of smooth splitting character obtained from an approved quarry. Natural variations characteristic of the deposit will be permitted.

B. Veneer stones shall be generally flat with dimensions that range from 4 inches to 12 inches in length and 8 inches to 16 inch in height. Stone shall be 0.75 inches to 1.25 inches thick. All surfaces to be sawn (as applicable) shall have a maximum variation in their thickness of ± 1/4 inch. Corner veneer stones shall be provided as required. All other dimensions and surface finishes shall be as shown on the Contract Drawings. An image below represents the basic finished appearance of the walls. Veneer stones shall be 'Greenwich Gray Mosaic' as manufactured by Stoneyard, Littleton, MA, 978-742-9800, or approved equal.

C. The front face of all stones shall have no projections or depressions greater than 1/2 inch for the full length of the stone. Front faces of all stones shall have no visible split marks.

D. The stone shall be set with full mortar bedding of l/2-inch to l-inch on all horizontal and vertical joints.

E. Mortar joints shall be recess grooved joints approximately 3/4-inch deep. The exposed face of the wall shall be set vertical with ± l/2-inch tolerance.

F. Mortar shall conform to MDPW Standard Specification M4.02.15, and shall be composed of one (1) part Portland cement conforming to ASTM C150 and two (2) parts sand for cement mortar with sufficient water for forming a workable

mixture. Adjust color with light and dark cement to the satisfaction of the Owner's Representative.

2.02 CMU BLOCK

A. Concrete masonry units shall be moisture-controlled units designated as Grade N, Type 1, (N-1) conforming to ASTM C90. The minimum compressive strength of any individual Grade N-1 unit shall be 800 psi and for any three Grade N-1 units 1,000 psi as tested on average gross area. All special shapes shall be included.

B. Wall anchors, ties, joint reinforcing and other bonding devices shall be hot-dip galvanized.

C. Horizontal masonry joint reinforcing for walls and partitions shall be "Dur-O-Wall," "Bet-R-Wall," "Trus-Mesh," or approved equal, galvanized ladder-type reinforcing. Longitudinal wires shall be a minimum of number 9 gage.

D. Weep holes shall be l-inch PVC pipe spaced 3 feet on center.

E. Mortar for all concrete masonry units shall consist of l part portland cement, l/2 part hydrated lime, and 4 parts sand and a waterproofing admixture, or a premixed blend meeting ASTM C270 Type "S" and approved by the Owner's Representative. Color to be approved by Owner's Representative on approval of brick samples.

F. Grout shall consist of 1 part portland cement and 3 parts maximum of sand, conforming to ASTM C476, with a slump of 8- to11-inches.

G. Portland cement shall be any American Brand conforming to ASTM Cl50, Type II.

H. Sand shall conform to ASTM Cl44. Sand shall be natural sand, washed and cleaned, free from organic or other deleterious matter. When dry, l00 percent shall pass a No. 8 sieve, not more than 34 percent shall pass a No. 50 sieve, and not more than l0 percent shall pass a No. l00 sieve.

I. Water shall be potable.

J. Lime shall be an approved brand of Type A mason's hydrated lime conforming to the requirements of ASTM C207.

K. Waterproofing admixture for mortar shall be equal to one of the following: Hydratite Plus, W.R. Grace Company; Medusa Waterproofing, Medusa Portland Cement Company; or Omicron Mortarproofing, Master Builders Company.

L. Reinforcing steel bars shall conform to ASTM A615, Grade 60.

2.04 FOOTINGS

A. The cement concrete for the footings shall be in conformance with Section 03 30 00, CAST-IN-PLACE CONCRETE, of these Specifications and all relevant details.

2.05 GRANITE CAP

A. Granite cap shall be 12” wide 4” high, length shall vary as required. Finishes shall be as shown on the drawings. Granite cap material shall match granite curbing, refer to Specification Section 32 16 00, GRANITE CURBING.

PART 3 - EXECUTION

3.01 SAMPLE WALL:

A. Before masonry work has commenced, the Contractor shall build a sample wall for the approval of the Owner’s Representative. The wall shall be 4 feet long, and 2.5 feet high, and shall be constructed of concrete masonry units and stone veneer, which are selected for the work. The wall shall be constructed before masonry materials for the project are delivered to the job site. The panel shall show the stone veneer and CMU back-up work for the Owner’s Representative's approval of bond, spacing, color and jointing. The Contractor shall make any changes requested until the panel is approved by the Owner’s Representative. The panel shall remain until removal is ordered by the Owner’s Representative.

3.02 MORTAR MIXING REQUIREMENTS:

A. Mortar color for exposed masonry work will be selected by the Owner’s Representative from fully-cured mortar samples submitted for this purpose by the masonry subcontractor. For other masonry work, only one brand and color of cement and one color of sand, all from the same source, shall be used on the work.

B. For all exterior masonry, mortar waterproofing shall be added to the mortar in accordance with the manufacturer's directions.

C. Plasticity of mortar shall be maintained by retempering as required up to 2-1/2 hours after original mixing of mortar. Mortar requiring retempering to maintain proper workability after this period shall be discarded.

D. Mixers, mortar boxes, and all tools used with mortar shall be clean, and free from rust and any foreign material, particularly salt. No salt shall be permitted on the work.

E. Except as otherwise approved for small batches, all mortar shall be mixed in a mechanically operated batch mixer of the drum type in which the water can be

accurately and uniformly controlled. The mortar shall be thoroughly mixed for at least five minutes after all materials are in the mixer.

F. For exposed concrete masonry the cement used in the mortar shall show no signs of efflorescence when tested in accordance with provisions of ASTM C67.

3.03 MASONRY CONSTRUCTION:

A. Vertical joints in each course shall break halfway over the units of the course below. All joints shall be 3/8-inch. CMU block shall be laid with all contact surfaces fully embedded in mortar.

B. CMU masonry shall be laid to lines, built plumb, true, and square. Joints shall be of uniform thickness. Units shall be laid with common running bond, except where otherwise noted with vertical joints accurately centered relative to units above and below. Walls shall be laid to obtain the smoothest surface that the variation in thickness or the units will permit.

C. Masonry shall be protected from entrance of water and from other damage during construction. Any masonry built of cracked, pitted, chipped, stained, or otherwise injured or defaced units shall be taken down as far as the Owner's Representative requires and be rebuilt. Poorly tooled joints, and joints not uniform in color and texture, will be adequate grounds for rejection of the work. All masonry shall be covered at night and during bad weather with non-staining waterproof coverings.

D. Temporary bracing and shoring shall be introduced wherever necessary to support loads to which the masonry may be subjected. The supports shall be left in place as long as required for safety.

E. As work progresses, and before staging is raised or removed, all exposed masonry shall be pointed up, all holes and joints filled, loose mortar removed, and defective joints cut out and repointed if necessary. Completed joints shall be neat, true, uniform, and free of voids, mortar crumbs, and other defects. Only first class jointing will be acceptable on joints which will be exposed to view, in the completed work.

F. All masonry walls shall start on concrete footings except where otherwise noted on the drawings or specified herein.

G. Masonry shall be laid in courses as indicated on the drawings with joints of uniform thickness. All joints, both horizontal and vertical, shall be in proper alignment. When mortar becomes "thumb-print" hard, exterior and interior joints shall be thoroughly tooled so as to be slightly concave, and to have a glassy-hard, polished surface, free from drying cracks.

H. Masonry units shall be dry when laid. Masonry saws shall be used for cutting and fitting masonry units, to produce straight, true edges and joints of the same width

as the remainder of the work. Power masonry saws shall be used to facilitate close tolerance work.

I. All reinforced hollow vertical cells shall be filled with grout (not mortar). The grout shall be rodded and vibrated until well consolidated and all voids are filled.

J. Masonry shall not be laid overhand. Where necessary to avoid laying masonry overhand, staging shall be constructed on both sides of the wall.

K. Masonry at intersections of walls or corners shall be bonded with masonry or approved metal ties. Ties shall be spaced at not more than 16-inches o.c. unless otherwise noted on the Drawings.

L. No masonry work shall be done when the mean daily temperature is below 40 degrees F., or is expected to fall below 40 degrees within 72 hours, except with the permission of, and in accordance with the requirements of subsection entitled Masonry Work at Temperatures Below 40 degrees F. No salt or other anti-freeze or accelerator ingredients shall be used in the mortar.

M. All necessary weep holes and openings shall be cut and patched in accordance with the drawings and these specifications.

3.04 MASONRY WORK AT TEMPERATURES BELOW 40 DEGREES F.:

A. All materials shall be covered to prevent wetting, and shall be stored off the ground. At temperatures below 20 degrees F, all materials shall be stored in covered enclosures and kept at a temperature above 32 degrees F. Mortar shall be between 70 degrees F. and 120 degrees F. when used.

B. When temperature in the air is between 30 and 40 degrees F., either the water or the sand shall be heated to between 70 degrees F. and 160 degrees F. (Heating the sand is preferable, as it makes the mortar more workable and maintains workability longer than heating the water). When temperature of the air is between 10 degrees F. and 30 degrees F., both the sand and the water shall be heated to between 70 degrees F. and 160 degrees F. When the temperature of the air is or is expected to fall below 10 degrees F. within 24 hours, no masonry shall be erected.

C. Masonry work under construction shall be protected with canvas or other windbreak material. All such material shall be flame-proofed. Canvas shall completely enclose that portion of work requiring protection, but shall be held off to allow air circulation between canvas and masonry. Canvas shall be securely held, and lapped at edges to prevent heat loss.

D. Temperatures shall be recorded frequently, at least every hour, and artificial heat supplied as required to maintain 40 degrees F. under the canvas. Points at which temperature is measured shall be those designated by the Owner's Representative.

Care shall be taken that one side of masonry is not heated more rapidly than the other side; air circulation shall be provided as required to maintain even temperatures.

E. Covering shall be used on both completed and unfinished work. The warmed enclosure shall be kept on masonry for 72 hours after laying. Following the 72 hour period, the masonry shall be brought gradually to ambient temperature but shall not be allowed to drop faster than one degree F. per hour. The Contractor shall furnish and install maximum/minimum thermometers in an enclosure which contains a hasp and staple.

F. The Owner's Representative shall designate the number and location of the thermometers.

3.05 CLEAN-UP:

A. Mortar droppings on face of wall shall be allowed to set up and shall then be promptly removed with a trowel and by rubbing with a piece of block. Droppings shall not be allowed to remain on the wall until completion of the masonry. Walls shall be cleaned by brushing with a stiff brush. No acid cleaners shall be used.

B. Masonry surfaces to be left exposed, either painted or unpainted, shall be thoroughly cleaned. Spattering and staining of floors, finished surfaces, pipe, equipment, etc., shall be avoided, and all finished surfaces shall be left in clean and perfect condition. Suitable drop cloths or other adequate means of protection shall be provided as necessary.

PART 4 - GUARANTEE

4.01 Guarantee all materials and workmanship for a period of one (1) year from date of final acceptance.

END OF SECTION

SECTION 04 41 00

GRANITE BLOCKS AND BOULDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SCOPE OF WORK

A. The work of this Section shall consist of placing new and salvaged granite blocks and boulders, and placing new granite blocks for an etched park sign, as shown on the Drawings and as directed by the Owner's Representative.

The work includes, but is not limited to, the following boulder types:

1. Granite Blocks
2. Granite Boulders
3. Masonry Wall Engraved Lettering

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 03 05 00, FIELD CONCRETE
2. Section 31 00 00, EARTHWORK

1.04 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Owner's Representative's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.05 SCHEDULING

A. The Contractor shall submit to the Owner's Representative, for approval by the Owner, a progress schedule for all work as specified herein.

1.06 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:

1. ASTM: American Society for Testing and Materials
2. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications). AASHTO or AASHO
3. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

B. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

C. Layout: After staking out the work, and before beginning final construction, obtain the Owner's Representative's approval for layout. Contractor shall adjust as determined by the Owner's Representative. The Owner's Representative may make adjustments to layout as is required to meet existing and proposed conditions without additional cost to the contract price.

1.07 SUBMITTALS

A. Contractor shall submit six (6) samples of granite blocks samples, minimum size of 6-inch x 6-inch x 6-inch of all proposed granite blocks shall be submitted to the Owner's Representative for review. Samples shall represent the full range of the color variation, texture and finish that can be expected in the finish work to be approved by the Owner's Representative. Identify the quarry and fabricator (if different) for all the granite features specified herein.

B. Shop Drawings shall show all granite block dimensions and identify the individual blocks required to complete the work as designated on the drawings. No final sizing or finishing of granite blocks shall be done until the shop drawings for that part of the work have been approved.

PART 2 - MATERIALS

2.01 GRANITE BLOCKS AND GRANITE BOULDERS

A. All new granite used for granite blocks, granite boulders, and the granite block sign wall shall be of standard architectural grade, free of cracks, seams, or starts that may impair its structural integrity or function. Color or other visual characteristics indigenous to the particular material and adequately demonstrated in the sampling/submittal process will be accepted provided they do not compromise the structural or durability capabilities of

the material. Texture and finish shall be within the range of samples approved by the Engineer.

B. The Contractor shall furnish granite as supplied by United Stone & Site Inc. 26 Farm St. Canton, MA (781-575-1776) and 169 Munyan Rd. E. Putnam, CT (860-928-6559) or approved equal. The color shall match the existing granite blocks and boulders being salvaged and reinstalled on site. The basic parameters of the granite blocks shall be as summarized below:

1. Granite blocks are to be quarried, manufactured and installed, consistent with these specifications and all relevant details.

2. Granite block dimensions shall conform to the dimensions included on the drawings.

3. As a general description, the granite blocks shall be generally rectangular in shape allowing for normal irregularities associated with the split/rock or quarry face surfaces described below, and on the Contract Drawings:

    i. All engraved faces of the block are to receive a honed finish.

    ii. All non-engraved faces of the block are to exhibit a rock point or split face finish.

4. Blocks are to be set vertically on top of a dense grade crushed stone subbase as specified and detailed elsewhere.

5. Blocks shall contain no sharp corners or angular projections, to a fifteen (15) degree angle maximum, and shall be field approved by the Owner's Representative.

C. Approximately two (2) weeks prior to anticipated installation, the Contractor shall notify the Owner's Representative to field select each boulder to be placed. The Contractor shall coordinate with the Owner's Representative such that she/he is present while blocks are set. Granite blocks shall be of an approved size and shape with dimensions as noted below in the amounts shown on the drawings:

Length:	36-inch to 96-inch
Width:	12-inch
Height:	12-inch to 18-inch

D. The Contractor shall notify the Owner's Representative when site preparation is complete. Spacing and location of the boulders shall be as shown on the plans or as required by the Owner's Representative. Preliminary placement of boulders shall be "dry" (without visible mortar). The Contractor shall make adjustments in the block placement as required by the Owner's Representative. After the arrangement of boulders

is approved by the Owner's Representative, the Contractor shall set the blocks into grade on a compacted dense graded crushed stone base as necessary to set the boulders in a stable position and to prevent future removal or displacement of the boulders. The Contractor should expect to handle each stone a minimum of two times:

1. To mock-up in final location to ensure fit

2. To install in final location.

2.02 ENGRAVED LETTERING FOR THE GRANITE BLOCK SIGN WALL

A. All engraving shall be done by skilled Stone Carvers in a correct and artistic manner, in strict accordance with the spirit and intent of the approved shop drawing, or from models furnished or approved by the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor is responsible for installing them in their final location in accordance with the Contract Drawings.

B. The installer shall examine all work and conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

END OF SECTION

SECTION 05 12 33

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section consists of providing all labor, materials, and equipment required to furnish, fabricate, and erect the work of this Section including but not limited to:

1. Providing leveling plates, bearing plates, anchor bolts, beams, baseplates, bracing and connections, angles, channels, stiffeners, separator plates, clips, supports for steel deck at columns, openings, connections, welding filler material and electrodes, connection bolts, erection bolts, and any other structural steel called for on the Drawings.
2. Items of structural steel required to be built into concrete or masonry, as indicated or specified, shall be furnished to the respective trades at the proper time with complete instructions and template to facilitate inspection.
3. Design of bolted/welded connections.
4. Furnishing and installation of non-shrink grout under leveling and base plates.
5. Unless specifically excluded, providing all other items for structural steel work indicated on the Drawings, specified, or obviously needed to make the work of this Section complete.
6. All steel items shown or indicated on the Structural Drawings.
7. Furnishing any temporary bracing necessary for support and alignment of the work, and shop painting as herein specified.
8. Structural steel shall consist of all material as defined in Section 2, "Definition of Structural Steel," of the AISC Code, and accessory material called for, or reasonably implied by the drawings.

1.02 RELATED WORK:

A. Section 01 45 23 – STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 30 00 - CAST-IN-PLACE CONCRETE

C. Section 05 50 00 - MISCELLANEOUS METALS

D. Section 09 90 00 – PAINTING

1.03 REFERENCES:

A. The following standards from a part of these specifications as referenced:

1. American Institute of Steel Construction (AISC)
    a. Code of Standard Practice for Steel Buildings and Bridges
    b. Specification for Structural Steel for Buildings
    c. Manual of Steel Construction
    d. Specification for Structural Joints Using ASTM A325 or A490 Bolts
2. American Society for Testing and Materials (ASTM)
    a. ASTM A36 Structural Steel
    b. ASTM A307 Carbon Steel Externally and Internally Threaded Standard Fasteners
    c. ASTM A325 High Strength Bolts for Structural Steel Joints
    d. ASTM A490 Heat-treated Steel Structural Bolts, 150 ksi Min. Tensile Strength
    e. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
    f. ASTM A563 Carbon and Alloy Steel Nuts
    g. ASTM F436 Hardened Steel Washers
    h. ASTM A992 Standard Specifications for Structural Steel Shapes
3. American Welding Society (AWS)
    a. AWS D1.1 Structural Welding Code Steel
4. Steel Structures Painting Council (SSPC)
    a. SSPC-SP 6 Commercial Blast Cleaning
    b. SSPC-PA 2, Shop, Field and Maintenance Painting
5. Massachusetts State Building Code, Latest Edition.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Product Data: Provide manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts (each type), including certified copies of mill reports for nuts and washers; include direct tension indicators if used.
3. Structural steel primer paint.
4. Touch-up paint for galvanized steel.
5. Grout.
6. Headed Stud Anchors.
7. Adhesive/Expansion Anchors

B. As-built Survey: Submit to the Engineer an as-built survey showing the locations of the anchor bolts prior to installation of leveling and bearing plates. This submittal is for information and file record.

C. Standard Shop Details and Connection Design Calculations: Submit to the Engineer prior to submitting detailed shop drawings, design calculations and details for connections not shown on the Drawings. Calculations shall be prepared, signed, and sealed by a registered professional engineer. Calculations and drawings are subject to review by the Engineer. The Engineer reserves the right to require revisions to this work at no additional cost to the Owner.

D. Checked shop drawings shall be submitted to the Engineer for review and approval. Fabrication shall not begin until the Engineer has approved the shop drawings.

E. Shop drawings shall include detail drawings, erection drawings, certifications, schedules, and all other information necessary for the fabrication and erection of component parts of the structure. The shop drawings shall be checked and properly coordinated with other parts of the construction. The following shall be included in the shop drawings:

1. Type of steel for each member, location and identification mark of each member, dimensions, size and weight of members, location and size of cuts, copes, slots, holes and openings required by other trades, type and location of shop and field connections, type, size, and extent of all welds, joint welding procedures, welding sequence, and painting requirements.
2. All requirements such as temporary members required for erection, including connections.
3. Use standard welding symbols of the American Welding Society.

F. Except as otherwise noted, the approval of shop drawings will be for size and arrangement of primary and secondary components and strength of connections. Any error in dimensions shown on the shop drawings shall be the responsibility of the Contractor.

G. Submit manufacturer's certification of bolts, nuts, and filler metal for welding.

1.05 QUALITY ASSURANCE:

A. Testing and Inspection

1. Refer to Section 01 45 23 for Structural Testing and Inspections. Comply with the additional requirements specified in Section 01 45 23, Structural Tests and Inspections.
2. The inspection and testing services provided by the Independent Testing Agency do not relieve the Contractor, the steel fabricator and erector from the responsibility to provide supervision, testing, inspection, and quality control in order to assure conformance with these specifications.

B. The Contractor must utilize the services of a Professional Structural Engineer licensed in the State of Massachusetts to design, sign, and seal calculations and drawings for the following:

1. Connection designs indicated on the Drawings to be designed by the Contractor.
2. Weld repairs.
3. Welded and bolted connection repairs.
4. Revisions required because of erection misalignment, fabrication defects, damage from construction activities.

C. The Contractor is responsible for fit up and installation of all steel work and shall field verify all dimensions and conditions.

D. The fabricator shall possess a valid certificate, category I Conventional Steel Building Structures as issued through the AISC Quality Certification Program, or shall have a detailed Quality Control Plan subject to audit as indicated in Section 01450.

E. Welder, Tacker and Welding Operator Qualifications: Use welders, tackers and welding operators who are currently qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required. Headed stud welding operators shall also be qualified in accordance with AWS D1.1.

F. Welded connections shall be designed and detailed utilizing AWS prequalified joints.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store steel on platforms, skids, blocking or other supports to prevent dirt and debris contact. Protect from exposure to conditions that produce rust.

B. Handle steel so no parts are bent, broken or otherwise damaged and avoid damage to other material and work. Store beams with webs vertical. Exercise care to avoid scraping and overstressing the steelwork.

C. Ship small parts, such as bolts, nuts, washers, pins, fillers, and small connecting plates and anchors, in boxes, crates, or barrels. Pack separately each length and diameter of bolt and each size of nut and washer. Plainly mark an itemized list and description of the contents on the outside of each container.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS:

A. Rolled steel wide-flange shapes: ASTM A992.

B. Steel channels, angles, plates and bars: ASTM A36.

C. Structural Steel Tubing: ASTM A500 Grade B.

2.02 BOLTS, CONNECTORS, AND ANCHORS:

A. High-Strength Structural Steel Bolts, Nuts and Washers:

1. Bolts: ASTM A325.
2. Nuts: ASTM A563.
3. Washers: ASTM F436.
4. Where steel is indicated on the Drawings to be galvanized, bolts, nuts and washers shall be hot dip galvanized in accordance with ASTM A153.
5. Refer to the Drawings for bolt head style requirements.

B. Anchor Bolts: ASTM F1554. Grade 36, unless noted otherwise. Headed type unless otherwise noted. Provide suitable nuts in accordance with ASTM F1554 and ASTM A563 and washers in accordance with ASTM F436.

C. Beveled Washers: Square, smooth and sloped to make contact surface of bolt head and nut parallel.

D. Headed Stud Anchors: Embedment anchors shall be headed anchors with fluxed ends or approved equal. Stud size as indicated on the Drawings. Studs shall be

automatically end welded with suitable equipment in the shop or field on spacing's indicated on the Drawings. All welds shall be made in accordance with the stud manufacturer's requirements. Field installed anchors shall be classified as Structural Steel.

1. Mechanical Properties of Headed Anchors. Low Carbon Steel complying with ASTM A108 Physical Properties:
   a. Tensile (Minimum) 60,000 PSI (60KSI)
   b. Yield (Minimum) 50,000 PSI (50KSI) (0.2% Offset)
   c. Elongation (Minimum) 20% in 2-inches.

E. Adhesive Anchor Bolt Anchoring Systems: Composed of an anchor rod, nut, washer and an anchor rod adhesive cartridge.

1. Anchor Rod Assembly: Chamfered end, all thread steel anchor rod with nut and washer. Size and load capacity as indicated on the Drawings.
2. Adhesive Cartridge: Sealed capsule containing premeasured amounts of (resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.
3. Acceptable Manufacturers:
   a. Hilti Fastening Systems; HVA Adhesive System.
   b. Powers Fastening, Inc.; Rawl Fastening Systems.
   c. Or Approved Equal.

F. Welding Electrodes: E70XX in accordance with AWS Dl.l. Refer to the Drawings for special requirements at moment connections.

2.03 GROUT:

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.04 SHOP PRIMER PAINT:

A. Products to be used shall meet the regulations of jurisdiction for Volatile Organic Compounds (VOC) emissions.

B. Exterior Exposed Steel, Not Galvanized: Zinc-rich epoxy primer followed by an intermediate coat of epoxy paint.

C. Other Steel, Not Galvanized: Zinc-rich epoxy primer.

D. Shop primer paint shall be compatible with the specified finish paint system. Finish paints shall be in accordance with Section 09 90 00.

2.05 HOT-DIPPED GALVANIZING:

A. Hot-dip galvanized steel fabrications so designated herein and on the drawings and after fabrication in compliance with ASTM A 123.

B. Hot-dip galvanized iron and steel hardware shall be in accordance with ASTM A 153.

PART 3 - EXECUTION

3.01 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Provide camber in structural members where indicated.
2. Do not splice steel members unless given written approval by the Engineer.
3. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
4. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on the final shop drawings.

C. Cut, drill, and punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

D. Welding:

1. Provide quality control and qualification of welders and welding procedures and operations as specified under “Testing and Inspection” in this Section.
2. Shop Welded Process: Use shielded metal-arc, submerged arc, gas metal-arc, and flux cored-arc, or other process as approved by the Engineer.

3. Groove Welds: Provide complete penetration unless otherwise noted on the Drawings.
4. Fillet Welds: Where weld symbol is not shown or welds are not dimensioned, provide continuous fillet welds all around and on both sides as appropriate. Minimum dimension shall be as indicated in AISC Specification.
5. Base metal shall be checked by Contractor to insure absence of laminations or other defects. Welds shall be sound throughout and have no cracks.
6. Where structural joints are required to be welded, details of joints, technique of welding employed, appearance and quality of welds made, and methods used in correcting defective work shall conform to applicable requirements noted under References in this Section.
7. Prepare joint welding procedures and program of welding sequence (for each component and for welding jointing components to each other) and submit to Engineer for approval before any welding is done. After approval, welding procedures and sequences shall be followed without deviation unless specific approval for change is obtained from the Engineer. Engineer may require requalification's of these welding procedures by tests prescribed in AWS "Standard Qualification Procedures".
8. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp their identification symbol to each weldment completed, whether in shop or field.
9. Corrective Work: Structural steel elements having fabrication errors and/or which do not satisfy tolerance limits shall not be incorporated in finished work. Such elements may be corrected if permitted by the Engineer and/or Testing Agency. Submit to the Engineer drawings showing details of proposed corrective work. These drawings shall be approved by the Engineer prior to performing corrective work. Corrective work shall be performed in accordance with requirements of Contract Documents. Corrective work and any retesting which may be required shall be at the Contractor's expense.
10. Members scheduled to be fireproofed shall have surfaces prepared as required by the fireproofing material manufacturer.

3.02 SHOP PRIMER PAINTING:

A. General: Shop paint all structural steel, except as noted below:

1. Do not paint members which are to be galvanized.
2. Do not paint surfaces within two inches of any field weld (including shear connectors) or high strength bolted friction type connection.

3. Do not paint surfaces to be high-strength bolted with slip-critical connections, unless the paint is specifically compatible with slip-critical connections.
4. When members are to be partly embedded in concrete or mortar in the finished work, paint only the exposed portions and initial 2-inches of embedded areas. Do not paint members which will be entirely embedded in concrete or mortar in the finished work.
5. Do not paint surfaces to receive metal deck and/or shear connectors fastened by welding.
6. Do not paint surfaces to receive sprayed-on fireproofing.

B. Surface Preparation: At a minimum, clean steel in accordance with Steel Structures Painting Council (SSPC) as follows; except clean to more stringent surface preparation standard if required by primer manufacturer:

1. Steel to be primed with zinc-rich primer: Commercial Blast Clean (SSPC-SP6).
2. Comply with AISC requirements for slip-critical connections.

C. Painting

1. Immediately after surface preparation apply shop primer paint in accordance with manufacturer's recommendations.
2. Apply shop paint in accordance with SSPC-PA-2.
3. Minimum dry film thickness of shop paint shall be 4.0 mils.
4. Comply with AISC requirements for slip-critical connections.
5. Complete shop painting operations on completed shop welded connections after the connections have passed the specified structural tests and inspections.
6. Apply two coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

3.03 GALVANIZING:

A. General: Hot-dip galvanize all steel exposed to weather or corrosive environments and as indicated on the drawings.

B. Hot-dip galvanized steel shall be inspected for compliance with ASTM A 123 and shall be marked with a stamp that indicates the name of the galvanizer, the ASTM number, and the ounces of zinc per square foot of surface. A notarized Certificate of Compliance with all of the above shall be required from the galvanizer.

C. Hot-dip galvanized hardware shall comply with ASTM A 153.

D. Provide thickness of galvanizing specified in referenced standards.

E. Fill vent holes and grind smooth after galvanizing.

F. All hot-dip galvanized steel shall be safeguarded against embrittlement in conformance with ASTM A-143.

G. Finish color, if required, will be specified by the Engineer.

3.04 ERECTION:

A. Erect structural steel in accordance with the Drawings, the approved submittal documents, pertinent regulations, the referenced AISC standards and these Specifications.

1. Allow concrete foundations to reach a minimum of 14-day curing time before torqueing of anchor bolts.
2. Prior to installation of metal decking, clean the unpainted top flanges of structural steel members to be free of heavy rust, mill scale, dirt or such other substances detrimental to welding.
3. Comply with 29 CFR Part 1926 - Safety Standards for Steel Erection.

B. Surveys: Employ a licensed Land Surveyor or licensed engineer for accurate erection of structural steel. Check elevations on concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Engineer. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Engineer.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

D. Setting base and bearing plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of leveling and bearing plates.

1. Set loose and attached leveling plates and bearing plates for structural members on steel wedges, shims, leveling devices, or as shown on the Drawings.
2. Grout under the plates after they have been positioned, plumbed and leveled. Do not remove wedges or shims but, if protruding, cut off flush with top or edges of base plates, or both prior to packing with grout.

3. Pack grout solidly between bearing surfaces and bases or plates to ensure no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
4. For proprietary grout materials, comply with manufacturer's instructions.

E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of the complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.
2. Establish required leveling and plumbing references with respect to expected mean service operating temperature inside the building. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

F. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

G. Splice members only where indicated and accepted on shop drawings.

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

3.05 FIELD CONNECTIONS:

A. General: Beams shall have framed connections using ¾-inch diameter, minimum, high strength bolts in accordance with the requirements of AISC "Manual of Steel Construction" and Contract Drawings.

B. High-Strength Bolts: Install high-strength steel-bolts in accordance with RCSC's "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless indicated otherwise on the drawings or where pretension or slip critical joints are recommended or required by RCSC or AISC.
2. Do not enlarge holes in members by burning or by using drift pins. Ram holes that must be enlarged to admit bolts.

C. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

D. Adhesive Anchor Bolt Anchoring System Installation:

1. General: Install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.
2. Drilling Holes: Use rotary hammer-type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed,
    a. Prior to setting cartridge and anchor rod clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air and cover hole until actual use.
3. Anchor Rod Installation: Following cartridge installation in prepared drill holes, set anchor rod to the required depth. Set anchor rods truly perpendicular (normal) to the base plate of item being anchored.

E. Headed Stud Anchors:

1. Welding Specifications: All materials shall be clean, dry and free of paint, rust, oil or other contaminants. Test welding should be done in the same position being used for production. Test welds, after cooling, should be bent by hammer 45° from the vertical position without failure. Non-failure of two studs indicates that the weld setup is satisfactory and production welding may be started.

2. Inspection Requirements: After welding, the ceramic ferrule should be removed from each stud and the weld fillet visually inspected. A fillet of less than 360° is cause for further inspection. Such studs should be hammer tested, bending the stud 15° from the vertical toward the closest end of the embedment plate or steel member. Bending without failure indicates a satisfactory weld. Bent studs may be left bent unless stud projects into concrete cover or obstructs other materials. All bending and straightening when required shall be done without heating before completion of the production stud welding operation.

3. Do not weld studs to steel plates or members with temperatures below 32° F. Welding shall not be done when the steel surface is wet or exposed to rain or snow.

4. The Engineer reserves the right to require the Contractor to repair any welds, which are not a complete 360°, weld at no additional cost. The Engineer also reserves the right to require replacement of studs and the repair of the base metal at no additional cost. Any additional testing and inspection required will be at no additional cost to the Owner.

3.06 FIELD QUALITY CONTROL:

A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to inspect field welds and high-strength bolted connections.

1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations there from.
2. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
3. Testing agency may inspect structural steel at plant before shipment.

B. Bolted Connections: Field and shop-bolted connections will be inspected according to RSCS's "Specification for Structural Joints Using ASTM A325 or A490 Bolts.

C. Welded Connections: Inspect and test during erection of structural steel as follows:

1. Review welder's certifications and certify welders if required. Conduct inspections and tests as required. Record types and locations of defects found in the work. Record work required and performed to correct deficiencies.
2. All field welds will be visually inspected according to AWS D1.1.
3. Test all full penetration welds using ultrasonic inspection methods in accordance with ASTM E164.
4. Perform magnetic particle inspection in accordance with ASTM E709 on at least 20% of fillet welds. Magnetic particle inspection shall be performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

D. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

3.07 FIELD TOUCH-UP PAINTING OF SHOP PRIMER PAINTED STEEL AND GALVANIZED STEEL:

A. General: Immediately after erection, clean field welds, bolted connections, and other surfaces required to be painted. Apply paint to areas required to be painted using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness specified in Part 2 of this Section for the shop-applied coat.

B. Touch-up paint welded connections after the connections have passed the specified structural tests and inspections.

C. Do not paint when ambient temperature is below 40 degrees F, or when conditions differ from paint manufacturer's recommendations, as approved by the Engineer.

D. Touch up damaged galvanizing with zinc-rich paint in accordance with ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 05 31 23

STEEL DECK

PART 1 -GENERAL

1.01 WORK INCLUDED:

A. Provide labor, materials and equipment necessary to complete the work of this Section, complete-in-place, including but not limited to the following:

1. Furnishing and installing steel roof deck.
2. Furnishing and installing composite steel floor deck and non-composite steel floor deck.

1.02 RELATED WORK:

A. Section 01 45 23 – STRUCTURAL TESTS AND INSPECTIONS

B. Section 03 30 00 – CAST-IN-PLACE CONCRETE

C. Section 05 12 33 - STRUCTURAL STEEL

D. Section 09 90 00 - PAINTING

1.03 REFERENCES:

A. The following standards from a part of these specifications as referenced:

1. The American Iron & Steel Institute: (AISI)
   a. AISI Standard – North American Specification for the Design of Cold-Formed Steel Structural Members 2001 Edition with Supplement 2004.
   b. American Society for Testing and Materials (ASTM)
   c. ASTM A653 Structural Quality, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   d. ASTM A924 Standard Specification for General requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
2. American Welding Society (AWS)
   a. AWS D1.3 Structural Welding Code Sheet Steel
3. Steel Deck Institute (SDI)
   a. SDI Manual of Construction with Steel Deck
   b. SDI Standard Practice Details

c. SDI 31 - Design Manual for Composite Decks, Form Decks, and Roof Decks.

d. SDI Diaphragm Design Manual

4. Massachusetts State Building Code, Latest Edition.

5. American Society of Civil Engineers Standards:

a. Standard for the Structural Design of Composite Slabs - ANSI/ASCE 3.

b. Standard Practice for Construction and Inspection of Composite Slabs - ANSI/ASCE 9

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop Drawings and Product Data: For each type of decking specified, show large scaled cross-sectional details of decking, profiles, deck gages, form deck thicknesses, accessory gages, physical dimensions and properties of materials, accessories, finishes, layout of decking, penetrations, openings, accessories, various connections, bearing on structural supports, methods of welding and attachment of accessories, and methods of attachment of decking to structural supports.

1. Submit manufacturer's product catalogs for all materials and products.

B. Submit certified written evidence of qualification test records of welders, tackers and welding operators.

C. Submit documentation of testing conformance for composite slab construction.

D. Submit catalog data indicating capacities of the specified composite slab assemblies.

E. Submit manufacturer's catalogs and load tables for mechanical fasteners.

1.05 QUALITY ASSURANCE/QUALITY CONTROL

A. Applicator Qualifications: Use welders, tackers and welding operators who are currently qualified by tests as prescribed in Welding Sheet Steel in Structures, AWS D1.3 of the American Welding Society to perform type of work required.

B. Manufacturer of deck units must be a member of the Steel Deck Institute.

C. Provide supervision, testing and inspection, and quality control in order to assure conformance with these specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage: Store decking on platforms, skids, blocking or other supports with one end elevated and protect from weather with nonasphaltic waterproof covering, adequately ventilated to prevent condensation. Protect from corrosion, deformation, and any other damage.

B. Protection: Exercise care so as not to damage decking during handling or rigging.

1. Do not use decking for storage or as a working platform for other construction materials. This requirement applies to bulk storage.
2. Exercise care so as not to overload decking during installation and during the entire construction period.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Composite Steel Floor Form Deck and Accessories: Sheet steel for deck and accessories shall conform to ASTM A653 Structural Quality with minimum yield strength of 40 KSI.

1. Galvanizing shall conform to ASTM A924 with a coating class of G90 as defined in ASTM A653.
2. Deck shall be a minimum of 3 spans unless otherwise indicated on the drawings and not require shoring during the concrete placement procedure.
3. Deck shall be of the type indicated on the Drawings. Thickness shall be as indicated on the Drawings.
4. Published capacities of composite slab construction shall be based on tests conducted in accordance with ANSI/ ASCE 3.

B. Accessories:

1. Provide ridge and valley plates, steel cant strips, eave plates, anchor clips, welding washers, sump pans and plates, pour stops, column closures, zee and cell closures, inside and outside closures, cover plates, filler plates, reinforcing channels, flat plates and such other accessories required as indicated in the Contract Documents and as required to provide a complete installation, of types, sizes and configurations as recommended by deck manufacturer. Galvanize accessories to match deck.
2. Provide flashing and closure shapes as recommended by deck manufacturer, and of galvanized sheet steel as specified for decking.
3. Galvanize Repair Paint: As recommended by deck manufacturer.

4. Closures: Rubber or closed-cell neoprene closures of same profile as that of metal decking. Provide closures to seal against weather at top of interior partitions where there is no ceiling below deck, where deck is cantilevered over exterior beams or walls or where indicated elsewhere on Drawings.

C. Weld electrodes shall be E70XX.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Decking supports, as well as decking, must be clean, free of dirt and debris, ice or other foreign materials that may prevent decking from bearing directly on structural members.

B. Verify support-framing locations to be as indicated, and bracing requirements performed, prior to decking installation.

C. Wire-brush and paint rusted and abraded areas of deck units with one coat of galvanized repair paint.

D. Remove paint and other materials from steel support framing, which would prevent proper welding of the decking to the steel support framing.

E. Prepare composite steel floor deck for concrete placement in accordance with S.D.I. specifications and ANSI/ASCE 9.

3.02 INSTALLATION:

A. Install deck panels and accessories according to applicable specifications and commentary in S.D.I. Publication No. 31, SDI "Manual of Construction with Steel Deck", manufacturer's written instructions, the approved submittal documents, the requirements of this Section, and as indicated on the Drawings.

B. Place deck panels flat and square on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before permanently fastening. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting framework without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings and other work projecting through or adjacent to deck.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

H. Attach steel decking accessories in place by welding in accordance with decking manufacturer's directions.

I. Place deck panels on structural supports and adjust to final position with ends lapped or butted over structural supports with a minimum end bearing of 1.5 inches. Increase end bearing where shown on the Drawings. End laps of sheets shall be a minimum of 2-inches and shall occur over supports. Attach the deck panels firmly to the supports immediately after placement in order to form a safe working platform.

J. Cutting of openings through the deck less than 16 square feet in area and all skew cutting shall be performed in the field. Trades that subsequently cut unscheduled openings through the roof deck are responsible for reinforcing those openings.

1. Locate openings for deck penetrations where indicated on the Drawings or as specified.
2. Steel Framing: Steel shapes for support framing and edge reinforcement shall comply with Section 05 12 33 - Structural Steel.

K. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

L. Fasten steel deck units to structural supports using arc spot welds or mechanical fasteners according to manufacturer's specifications, approved shop drawings, and as indicated in this Section and on the Drawings. Decks thinner than 0.0280-inches shall be welded using 16 ga. welding washers with a 3/8-inch diameter hole. Side lap connections shall be welded or use mechanical fasteners as indicated on the Drawings and in this Section.

M. Arc spot welds (puddle welds) to supports shall have a diameter of 5/8-inches minimum, or an elongated weld of 3/8-inch minimum width and ¾-inch minimum length. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with AWS D1.3.

N. Fastening of deck to supports and side laps:

1. Deck ends at building perimeter: 12-inches on-center, maximum (36/4 min.)
2. Deck end laps: 12-inches on-center, maximum (36/4 min.)
3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36-inch intervals, whichever is smaller.
4. See Drawings for requirements beyond these minimum requirements.

O. Composite Steel Floor Deck General Requirements:

1. Accessories, Pour Stops and Girder Fillers: Fasten accessories including but not limited to, pour stops and girder fillers to supporting structure according to the manufacturers recommendations.
2. Floor Deck Closures: Fasten column closures, cell closures, and Z closures to deck to provide tight fitting closures at open ends of ribs and sides of decking. Fasten cell closures at changes of direction of floor deck units unless otherwise required.
3. Laps and Butted Ends: Deck ends may be either butted or lapped over supports as recommended by S.D.I.
4. Place concrete in composite steel floor deck in accordance with S.D.I. Specifications, ANSI/ASCE 9 and the requirements of Section 03300.
5. Construction of Composite slab systems shall comply with ANSI/ASCE 9 and the S.D.I. Specifications.
6. Composite steel floor deck units shall serve as a form to support the slab weight and construction loading of 20 psf uniform load.
7. If heavier construction loads are required, allowable unshored spans shall be reduced accordingly by installation of temporary shoring.
8. When required, composite steel floor deck units shall be temporarily shored in accordance with the deck manufacturer's shoring tables. Shoring shall be designed in accordance with applicable local and state building code regulations. Shoring shall remain in place until the concrete flooring attains a minimum of 75% of the concrete design compressive strength and removal is subject to the approval of the Engineer.
9. Concentrated loads and impact loads during erection and construction shall be avoided. Before the slab is poured, form deck shall be planked in all traffic areas to prevent damage to the units.
10. Before concrete placement, the deck shall be inspected for tears, dents, or other damage that may prevent the deck from acting as a tight substantial form. Repair the deck as required by the Engineer.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: The Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.

B. Field welds shall be visually inspected.

C. Mechanical fasteners shall be visually inspected.

D. Welder certification shall be verified.

E. Testing agency will report inspection results promptly and in writing to the Contractor and the Engineer.

F. Remove and replace work that does not comply with the specified requirements.

G. Additional inspecting will be performed at the Contractor's expense to determine compliance of corrected work with specified requirements.

3.04 REPAIRS:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Painting Repairs: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

END OF SECTION

SECTION 05 50 00

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of the specification covers all miscellaneous metal items required for the work, except as specified elsewhere.

B. All miscellaneous metalwork shall be fabricated as detailed or approved and shall be installed complete with all necessary anchors, anchor bolts, eye bolts, guides, bolts and other accessories.

C. In general, site and shop fabricated items are included under this section, and factory fabricated items excluded. This section includes but is not limited to: handrails, guardrails, fasteners, plates and all other site or shop fabricated metal items.

A.02 RELATED WORK:

A. SECTION 03 05 00, FIELD CONCRETE

B. SECTION 03 30 00, CAST-IN-PLACE CONCRETE

1.03 QUALITY ASSURANCE:

A. The drawings show the character and extent of the work required, but do not attempt to show all methods, materials, and details of construction, fastening, etc. Supplementary parts customarily necessary to complete an item, though such parts are not definitely shown or specified, shall be included as part of the item.

B. Details of construction of the various items shall be submitted on the shop drawings. High quality construction with a neat, finished, and workmanlike appearance will be required.

C. The size and spacing of screws, connectors, anchors, and similar items, and the size and dimensions of metal items stated herein shall apply in general; specific sizes and spacing of fasteners and dimensions of metal items listed on the drawings shall take precedence.

D. Items supplied hereunder which are required to be built into the concrete, masonry, etc., shall be delivered to the site at locations as required by the Owner's Representative, and as required by the overall construction schedule.

E. Manufacturers of other products comparable in quality and type to those specified will be acceptable if satisfactory data on past performance and other required information is furnished by the Contractor, and if approved by the Owner's Representative.

G. Contractor shall submit an affidavit to Owner's Representative that materials used are protected from or will not be subject to galvanic action.

1.04 REFERENCES:

A. The following standards from a part of these specifications, and indicate the minimum standards required:

American Institute of Steel Construction (AISC)

AISC		Specification for Structural Steel Buildings

American Society for Testing and Materials (ASTM)

ASTM	A36	Structural Steel
ASTM	A53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
ASTM	A123	Zinc (Hot-Dip-Galvanized) Coatings on Iron and Steel Products
ASTM	A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM	A239	Test for Uniformity of Coating by the Preece Test (Copper Sulfate Dip) on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM	A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
ASTM	A366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
ASTM	A525	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements
ASTM	A569	Steel Carbon (0.15 Maximum Percent) Hot-Rolled Sheet and Strip, Commercial Quality
ASTM	B221	Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes
ASTM	B308	Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded
ASTM	C478	Precast Reinforced Concrete Manhole Sections

American Welding Society (AWS)

AWS D1.1 Structural Welding Code Steel

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Before fabricating or assembling any aluminum or stainless steel items, samples indicating full range of finish, color, and texture to be supplied shall be submitted to the Owner's Representative for review.

B. Shop drawings for all metalwork included in this section shall be submitted to the Owner's Representative for review.

C. The shop drawings shall be complete and checked, showing sizes, layout, method of assembly, fastenings, anchorage or connection with other work, finish, and coatings, etc. Shop drawings for aluminum work shall indicate alloys, temper and finish to be used.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. STEEL:

1. Materials, fabrication, and erection of miscellaneous steel sections shall conform to the applicable requirements of the AISC Specification.

2. Steel shapes, plates and bars shall conform to ASTM A36.

3. Steel pipe shall conform to ASTM A53.

4. Stainless steel shall be Type 304 unless otherwise indicated or specified.

B. FASTENERS:

1. Metalwork shall be complete, with all bolts, anchors, plates, washers, clamps, screws, studs and other such devices for proper securing and anchoring. Where positions of anchorages can be predetermined, they shall be shop-installed on the item; otherwise the material or equipment to be fastened shall be expansion bolted, toggle bolted, screwed, or otherwise fastened as shown on the drawings or called for herein.

2. Bolts and nuts for general anchorage and for miscellaneous ferrous metal assemblies and fasteners shall be galvanized, unfinished bolts conforming to ASTM A307 unless otherwise noted on the drawings.

3. Expansion bolts for use in concrete and masonry shall be of one manufacturer and shall be approved. Bolts shall be Kwik Bolt concrete anchors manufactured by Hilti Corp.; Trubolt+ manufactured by Red Head Concrete Anchoring Specialists; Wej-it manufactured by Wej-it Fastening Systems; or an approved equal product.

4. The centerline of expansion shields shall not be closer than 3-inches to the edge of any concrete in which they are placed.

5. Material for fasteners shall match or be galvanically compatible with the materials fastened. Washers, nuts and other accessories shall match the bolts.

6. Where the specific type, material, size and spacing of fasteners has not been called for on the drawings or in specifications, the fasteners proposed by the Contractor shall be reviewed by the Owner's Representative. If, in the opinion of the Owner's Representative, they are not in accordance with good safety practices, the contractor shall revise and resubmit appropriate fasteners.

C. STAINLESS STEEL RAILINGS:

1. Railings shall be in accordance with OSHA and the Commonwealth of Massachusetts Architectural Access Board (MAAB) standards and be capable of withstanding a load of 200 pounds applied at any point, in any direction on the top rail. Unless otherwise indicated on the drawings, pipe rail posts shall be 1-1/2-inch OD type 304 welded steel pipe. Interior reinforcement shall be provided in posts and/or rails as required to resist the 200-pound load.

2. Bends in pipe shall be made with manufactured elbows. Rail ends which are not continuous with posts or bolted to the wall shall have self-return to the post and ground surface. Mid-rail posts shall be approximately 6 feet on centers, or as noted on the drawings.

3. Connections shall be welded, with welds ground smooth. Railings shall be fabricated in panels, which are as long as can be conveniently handled, to eliminate as much field welding as possible.

4. Submit certification by a Professional Engineer licensed in the state where the project is located, stating load capacity.

D. GUARDRAIL WITH STAINLESS STEEL INFILL PANELS

1. Steel Members:

Posts shall be carbon steel structural tubing conforming to ASTM Designation A500.

a. Line posts shall be 1.5" x 1.5" x 1/4" thick steel tubing.
b. End posts and corner posts shall be 2" x 2", 17 ga. steel tubing.
c. Horizontal rails shall be 1.5" x ½" thick steel with eased edges.

d. Sleeves for removable guardrail posts shall be 2" x 2" x 1/2" thickness steel square tube. Sleeves shall be sized to provide stable footing for guardrail posts free from rocking and movement, while allowing for easy removal by maintenance staff.
e. All steel members shall be black, color galvanized.

2. Stainless Steel Infill Panels

a. Mesh Panels shall be ¾" square mesh, Intercrimp weave construction with 0.12" wire. Panel edges shall be encased in ¾" hemmed edging.
b. Mesh panels and edging shall be cut to fit and fabricated per the drawings.
c. All mesh panel components, including mesh, edging, clip attachments and hardware shall be constructed of Stainless Steel Type 304.
d. All infill panels shall be black, color galvanized.

PART 3 - EXECUTION

3.01 GALVANIZING:

A. Hot-Dip Galvanizing:

1. Provide a coating for iron and steel fabrication applied by the hot-dip process. The galvanizing bath shall contain .05-.09% nickel. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A-123 for fabricated products and ASTM A-153 for hardware. Provide thickness of galvanizing specified in referenced standards. Provide coating by Duncan galvanizing or approved equal.

B. Factory-Applied Primer Over Hot-Dip Galvanizing:

1. Provide a factory-applied polyamide epoxy coating primer, 2.0 mils dry film thickness minimum. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations or mechanically abrade to create a uniform surface profile of 1.0 – 2.0 mils, and as recommended by coating manufacturer. Provide primer coating by Duncan Galvanizing, Tnemec Co. or approved equal.

C. Factory – Or Field-Applied Architectural Finish Over Primer And Hot-Dip Galvanizing:

1. Provide a factory- or field-applied polyurethane color coating, 2.5 mils dry film thickness minimum. Apply coating at the galvanizer's plant or coating shop, immediately after application of the prime coat, in a controlled environment meeting applicable regulations, and as recommended by the coating manufacturer. Provide finish coating by Duncan Galvanizing, Tnemec Co. or approved equal.

D. The Contractor shall be responsible for determining if any fabricated items are not suitable to be hot-dip galvanized and shall notify the Owner's Representative in writing.

E. Surfaces of metal to be galvanized shall be free from all dirt, grease, rust and moisture. Burrs and sharp projections shall be removed from edges, holes, etc., before galvanizing. Fabricated items shall be galvanized after fabrication.

3.02 WELDING OF STEEL:

Welding of steel shall be done in accordance with the AWS Code. Welds shall be continuous along entire line of contact, except where plug or tack welding is noted. Exposed welds shall be ground smooth.

3.04 FABRICATION AND ERECTION:

A. Metalwork shall be complete, with all necessary bolts, nuts, washers, anchors, plates, fastenings, and other fittings. To the extent possible, holes for attachment of blocking, clip angles, etc. shall be shop punched. Where shop punching is impracticable, holes shall be field drilled. Burned holes will not be permitted.

B. Material shall be straight, accurately fabricated with joints neatly framed, square, and welded.

C. Metalwork to receive hardware shall have all cutouts and attachments accurately made using the hardware itself or templates where necessary.

D. Metalwork shall be accurately set and secured in position, with lines plumb and level and surfaces flush and square, or as otherwise required to conform to the structure as shown on the drawings.

E. Wherever possible, all metalwork shall be built into the cast in place concrete work and shall have sufficient anchors, well- fastened.

3.05 WORK PROTECTION:

A. Aluminum surfaces, which after erection are to be in contact with wood or treated wood, shall be given a heavy brush coat of aluminum-pigmented bituminous paint or two (2) coats of aluminum metal paint.

B. Aluminum surfaces, which after erection are to be in contact with concrete, shall be given a heavy brush coat of alkali-resistant bituminous paint.

C. Aluminum surfaces which after erection are to be in contact with dissimilar metals, other than zinc or stainless steel, shall receive a heavy brush coat of zinc chromate primer, followed by two (2) coats of aluminum metal and masonry paint, or shall receive a heavy brush coat of alkali-resistant bituminous paint.

D. Aluminum surfaces which are to be exposed to the weather, including anodized surfaces, shall receive two sprayed-on shop coats of water-white methacrylate lacquer, capable of withstanding the action of lime mortar for at least one week in an atmosphere of 100 percent humidity at room temperature. Surfaces shall be perfectly clean and dry before lacquering.

E. Prior to the application of any of the above coatings, any and all areas where the paint has been damaged by abrasion or other cause shall be cleaned and repainted as required so that the aluminum will have a complete protective paint film when brought into contact with the material against which it is being protected.

F. Before application of any coating, the surface shall be cleaned of all dirt, heavy deposits of grease or oil, and other foreign substances such as paint, lacquer, tape, moisture, or other material, which might interfere with the adhesion of the coating to be applied. All metals shall be left in a clean condition. Cleaning methods shall employ steam, mild soaps, mild detergents, or solvents such as kerosene, or naphtha. Lacquered surfaces may be cleaned with a mineral solvent or turpentine. Thorough rinsing with clean water and drying with clean, soft cloths shall follow any of the above cleaning methods. No other cleaning method may be used without the specific permission of the Owner's Representative.

G. After suitable cleaning, all metalwork shall be given an approved shop coating of methacrylate lacquer to protect the surface from stain. The protective coating of lacquer on all metalwork worn off due to handling or erection shall be replaced by a new coating of lacquer of the same type.

H. During construction, precautions shall be taken to prevent damage to the metal work from splashing or the accumulation of paint, concrete, mortar, or other similar materials, or from staining adjacent surfaces during cleaning operations. Any staining or damage that does occur shall be immediately and completely removed.

I. Each piece of metal in transit and in storage shall be individually wrapped with a non-scratching material, with the joints securely sealed. Wrapping shall completely cover and protect each item. Storage shall be out of the weather, protected from moisture, and with adequate ventilation.

3.06 PAINTING:

A. Ferrous metals of this section, except for galvanized or stainless steel shall be shop primed in accordance with the following:

1. Submerged service components shall be sandblasted clean in accordance with SSPC-SP-10, Near White, immediately prior to priming.

2. Non-submerged service components shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming.

3. Shop primer, except as otherwise noted, shall be one spray applied coat with dry film thickness of 3.5 to 4.5 mils of Tnemec 66 Boston Gray Primer by Tnemec Co.; or Aquapun by PPG, Inc; or approved equal.

4. Portions of ferrous metals to be embedded in concrete or masonry shall be given a heavy brush coat of alkali resistant bituminous paint.

5. Scratches or abrasions in the shop coat and areas at field welds, bolts, nuts and other unpainted areas shall be touched up after erection with the paint specified for the shop coat. Cold galvanized paint shall be used for touch up of galvanized surfaces. Paint shall be one of the following; Sealube Co., ZRC; Galvicon Corp., Galvicon; Stanley Chemical Div., Zinc Shield; Duncan Galvanizing Corp., ZIRP; or an approved equal.

6. Shop and field prime paint systems shall be compatible with finish coat.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers tools, equipment, labor, and materials necessary to perform rough carpentry work complete and miscellaneous carpentry items not specified elsewhere including fasteners and supports.

B. Nails, screws, bolts, anchors, brackets, and other hardware for fastening and securing items provided under this section of the specification shall be furnished under this section.

1.02 RELATED WORK:

A. Section 03 05 00, FIELD CONCRETE

B. Section 03 30 00, CAST-IN-PLACE CONCRETE

C. Section 06 20 00, FINISH CARPENTRY

D. Section 09 90 00, PAINTING

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 00, SUBMITTALS, SUBMIT THE FOLLOWING:

Certificates of wood treatment upon delivery of treated wood product. Treated wood product shall bear appropriate American Wood Preservers Bureau (AWPB) quality mark.

1.04 DELIVERY:

Lumber, plywood, and other wood material shall be delivered to the job dry, and shall be protected from injury, dirt, dampness, and extreme changes of temperature and humidity at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LUMBER:

1. The grades of all materials under this section shall be defined by the rules of the recognized associations of lumber manufacturers producing the material specified,

but the maximum defects and blemishes permissible in any specified grades shall not exceed the limitations of the American Lumber Standards.

2. Lumber shall bear the grade and trademark of the association under whose rules it is produced, and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln dried to a moisture content not exceeding 15 percent.

3. Exposed surfaces of wood which are to be painted shall be free from defects or blemishes that will show after the second coat of paint is applied.

4. All lumber for nailers, furring, and blocking shall be seasoned No. 1 Dimension of Common pine, fir, or spruce, S4S.

5. Framing Lumber for joists, rafters, plates, headers, stair stringers and carriages, and sleepers shall be Hem-Fir #1 with the following minimum properties:

   $E = 1.5 \times 10^6$ PSI
   Density = 0.01736 $lb/in.^3$
   Fb = 1400 PSI
   Fv = 75 PSI
   Fc = 1050 PSI
   Ft = 800 PSI

6. Studding shall be 2- inch x 4- inch Western or Eastern Species, Construction Grade, or KD Stud Grade Southern Yellow Pine or studgrade Spruce-pine-fir. Where two or more studs are nailed together, such assemblies may be No. 2 or Better Grade Southern Yellow Pine and stud grade Southern Yellow Pine.

7. Materials not specifically listed shall be of an accepted grade dictated by good practice.

B. WOOD PRESERVATION TREATMENT:

1. The nailers, blocking, sills, and similar items encased in or in contact with concrete, masonry, or the ground shall be pressure treated with a pentachlorophenol preservative solution. The pentachlorophenol shall meet the requirements of the American Wood-Preserver's Association, AWPA Standard P-8, "Standards for Oil-Borne Preservatives." The solvent carrier shall meet the requirements of AWPA Standard P-9 "Standard for Hydrocarbon Solvents for Oil-Borne Preservatives." The preservative solution shall be equivalent to five percent of pure pentachlorophenol.

2. The treatment shall be applied in accordance with AWPA Standard use category 4C (lumber, timber, etc.), Penetration of pentachlorophenol shall be determined using the penta check method, Section 5, AWPA Standard A-3. Retention of pentachlorophenol shall be a minimum of 0.40 pounds per cubic foot of wood for

inground exposures. The treating company shall furnish a notarized certificate of treatment that indicates all pertinent details of the treatment.

3. Before the preservative treatment is applied, the lumber to be treated shall be sawed to exact lengths required, and bored ready for use in the work so far as practicable, in order to reduce to a minimum cutting or boring of lumber after treatment. Only lumber of the same kind and approximately the same size and seasoning shall be treated in any one charge. All surfaces of treated lumber cut after treatment shall receive two heavy brush coats of pentachlorophenol solution before the lumber is placed in the work.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

A. Work shall be erected plumb, true and square.

B. Coordinate delivery and erection of prefabricated components. Field applied items shall be installed in accordance with good trade practices. Cutting and carpentry for other trades shall be performed. Cut ends of lumber previously treated with preservative specified shall be brushcoated with the same material.

C. Except as otherwise indicated on the design drawings, fasteners for roof nailers and for other wood members used as nailers or anchorage material shall be the equivalent of 1/2-inch diameter bolts at 2'-6" o.c. for 2-inch material, and 3/8-inch diameter bolts at 2'-0" o.c. for 1-inch material. Wood members in general shall be fastened to masonry with masonry nails, power-driven fasteners, or bolts in expansion shields, except where otherwise indicated.

D. Minimum length of nails shall be twice the thickness of wood being fastened.

E. Furring, blocking, nailers, and similar items shall be provided wherever required for the support, proper erection, fastening, or installation of carpentry or other materials, and as shown on the drawings.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of the specification covers furnishing tools, equipment, labor and materials necessary to perform finish carpentry work (exterior) complete for the installation of the composite wood decking and miscellaneous carpentry items not specified elsewhere including fasteners and supports. Provide all finish carpentry and millwork indicated on the drawings and as specified herin, including but not limited to:

B. Metal fasteners, plates, brackets, and accessories connected directly into woodwork shall be a part of this section of the specification. Nails, screws, bolts, anchors, brackets, and other similar hardware for fastening and securing woodwork and other items provided under this section of the specification shall be furnished under this section.

1.02 RELATED WORK:

A. Section 06 10 00, ROUGH CARPENTRY

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECRION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer's literature of the materials of this section.

B. Color samples:

a. Three (3) sets of samples of composite wood shall be submitted to the Owner’s Representative for selection of colors.

b. Color samples of the non-slip deck tread.

C. Field Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress. Allow for field cutting and fitting where taking field measurements before fabrication is not possible.

D. Mock-Up:

a. Composite Wood Decking: Contractor shall provide at least two (2) fully finished representative samples that is to be installed in the finished condition. Showing full range of cuts, fasteners, and variations expected. Provide sample of 25 square feet minimum.

b. Non-slip Deck Treads: Contractor shall lay out the treads for review and approval by the Owner's Representative prior to installation.

1.04 DELIVERY AND STORAGE:

Finish carpentry material shall be delivered to the job dry, and shall be protected from injury, dirt, dampness and extreme changes of temperature and humidity always. Composite wood and other material shall be completely wrapped as required to prevent injury during shipment and storage. Finish materials shall not be delivered until the installation is ready and all concrete and other "wet" work has been completed and allowed to become thoroughly dry.

PART 2 - PRODUCTS

2.01 COMPOSITE WOOD DECKING:

A. The grades of all materials under this section shall be defined by the rules of the recognized associations of lumber manufacturers producing the material specified, but the maximum defects and blemishes permissible in any specified grades shall not exceed the limitations of the American Lumber Standards. Materials not specifically listed shall be of an accepted grade dictated by good practice.

C. Composite lumber shall be EverGrain, as manufactured by Envision Composite Decking, 53 Eby Chiques Road, P.O. Box 37, Mount Joy, PA 17552, 1-800-253-1401, www.envisionoutdoorliving.com, or approved equal.

D. Boards shall be nominal 2" x 6". Lengths shall be 16'-0" and 20'-0". Contractor shall make use of board lengths as needed to satisfy the dimensions shown on the plans.

E. Board profile shall be 'Square Edge.' Fasteners shall be the 'Color Match Composite Deck Screws' and color matched to the deck board color.

F. Composite color for bidding purposes shall be color: **Weathered Wood**. Final color to be submitted for approval by the Owner's Representative prior to installation. Contractor is responsible to furnish all stock as well as fasteners required for installation.

G. Composite lumber shall bear the grade and trademark association under whose rules it is produced and mark of where it was produced. Finish carpentry and millwork, in general, shall be of sound stock without defect in a color chosen by the Owner's Representative.

Section l00 Lumber

Section 300 Trim

H. Wood shall be solid stock, in commercial long lengths.

2.02 NON-SLIP DECK TREAD

A. Non-slip deck treads shall be affixed to the top of each composite decking board. One tread shall be used per board and centered on each board. **Field mock up and approval by the Owner's Representative is required prior to installation.**

B. Non-slip deck treads shall be manufactured by Handi-Treads, 5600 99th Ave, Unit A4, Kenosha, WI 53144, 877-328-7389, www.handitreads.com. Treads shall be no-rust and manufactured in aluminum. Dimensions shall be 48-inches long by 1.875-inches wide. Final color to be submitted for approval by the Owner's Representative prior to installation. Hardware needed for the tread installation shall match the tread color.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

A. Deck boards shall be installed with the expansion / contraction joints as shown on the plans. For the area with three-eighths (3/8) inch expansion / contraction joints shown, joints shall not exceed one-half (1/2) inch.

B. The Contractor shall make every effort to reduce material waste to the greatest extent possible.

C. Work shall be erected plumb, true and square. Finish work shall be accurately mitered or butted to meet in straight hairline joints, in accordance with the best commercial practice.

D. All exterior trim shall be fully back primed prior to installation. Prime cut edges after installation and prior to application of additional wood members.

E. Finish fasteners shall be used on all exposed trim. Stainless steel, tamer resistant screws shall be used on all exterior finish work.

F. Minimum length of fasteners shall be twice the thickness of wood being fastened. screw heads in finished work shall be sunk neatly resulting hole filled with putty.

G. Exposed surfaces of woodwork shall be machine sanded to an even, smooth surface, free of defects, blemishes, machine or tool marks, abrasions, dirt, smudges, or raised grain. Adequate protection shall be provided as necessary to prevent damage or staining of carpentry items.

H. Woodwork abutting masonry or other finish materials shall be scribed and fitted as tightly to abutting material as is possible without damaging it.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers field painting and coating of surfaces, complete. Shop painting of metal items is specified under the applicable item.

B. A schedule listing the various types of surfaces to be painted and the types of paints to be applied is included herein.

C. Unless otherwise indicated, the following items shall not be painted:

1. Labels on equipment, such as Underwriters' Laboratories and Factory Mutual, equipment identification, performance rating, and name or nomenclature plates.

2. Moving parts of operating units, exposed bolt threads, mechanical and electrical parts.

3. Electrical conduit.

4. Stainless steel.

5. Concrete.

6. Plumbing fixtures.

7. Uninsulated PVC piping (to be banded only)

1.02 RELATED WORK:

A. Section 05 50 00, MISCELLANEOUS METALS

1.03 SYSTEM DESCRIPTION:

A. The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as prime, intermediate, or finish coats.

B. The Contractor shall do a complete painting job throughout the work in accordance with generally approved modern practices for work of high quality. Unless otherwise specified, all materials and surfaces customarily painted shall be given not less than one

shop coat and two field coats or one prime coat and two finish coats, regardless of whether or not the surface to be painted is specifically mentioned.

C. Paints containing lead shall not be used.

D. To ensure a satisfactory painting job it is essential that the paints applied in the shop and in the field be mutually compatible. The Contractor shall determine what shop paints have been used and shall verify that field applied paints are compatible therewith.

E. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.

F. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (N.S.F.) in accordance with Standard 61. Evidence of such approval shall be an approval letter from N.S.F. listing the submitted materials.

G. Paints submitted shall meet all Federal and State E.P.A. regulations pertaining to volatile organic compounds (VOC) compliance.

1.04 REFERENCES:

A. The following standards form a part of these specifications, and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM F1869 Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer’s literature of proposed paints.

B. Painting schedule.

C. **Three (3)** sets of color chips for selection of colors.

1.06 DELIVERY AND STORAGE:

A. Paint shall be delivered to the site in the manufacturer's sealed containers. Each container shall bear the manufacturer's label, listing the brand name, type and color of paint, and instructions for thinning. Thinning shall be done only in accordance with directions of

the manufacturer. Job mixing or job tinting may be done when approved by the Engineer and for preparing sample colors.

B. Painting materials shall be stored and mixed in a single location designated by the Engineer for this purpose. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. It shall carry all necessary water to its mixing room, and shall dispose of all waste outside of the building in a suitable receptacle. The Contractor will be held responsible for any damage done due to failure to observe these precautions.

C. The paint storage area shall be kept clean at all times, and any damage thereto or to its surroundings shall be repaired. Any oily rags, waste, etc., shall be removed from the building every night, and every precaution shall be taken to avoid danger of fire.

D. Heat must be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F. at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PAINT SCHEDULE:

Except as otherwise indicated, all paint used shall be of the type listed in the schedule below, by Tnemec Company, Inc., or equivalent paints by Sherwin-Williams Company, International Paints, or other approved paint fully equal to paint manufactured by the above named companies. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following painting schedule are submitted in writing to the Engineer, along with sufficient data supported by certified tests.

PAINT SCHEDULE

Key		Tnemec	Note 1
AGE	Acryli Gloss Enamel	1029 Enduratone	3.5
APE	Acrylic Polyurethane	73 Endura-Shield Enamel	3.0
ABF	Cementitious Block Filler	130 Envirofill	80-100 s.f./gal
BO	Bleaching Oil	Note 5	
CEE	Catalyzed Epoxy	L69F Epoxoline II	4.0

Key		Tnemec	Note 1
CEM	Catalyzed Epoxy Mastic	27 WB Typoxy	Note 3
CEP	Catalyzed Epoxy Primer	L69F Epoxoline	3.0
EMC	Epoxy Modified Cement	218 Mortar-Clad	Fill/Surface
EP	Epoxy-Polyamide (thinned 30% #4 thinner)	FC 22 Pota-pox	25-30
EPW	Water-based Epoxy Primer	151 Elasto-Grip	1.0-1.5
HGV	High Gloss Varnish		Note 2
HSE	High Solids Epoxy (Minimum 69%)	L69 Epoxy	6.0
MA	Modified Acrylic	115 Uni-bond	3.0
MAE	Modified Acrylic Elastomer	156 Envirocrete	6.0-8.0
MCU	Moisture Cured Urethane	Series 1 - Omnithane	2.5-3.0
MPE	Modified Polyamine Epoxy	Series 435 - Permaglaze	15-20 mils
NE	Novolac Epoxy	282 Tneme-Glaze	7.5
PEF	Polyamine Epoxy Finish	280 Tneme-Glaze	6.0-8.0
PEP	Polyamine Epoxy Primer	201 Epoxoprime	6.0-8.0
PVA	PVA Sealer	151 Elasto Grip	0.75-1.5
PWC	Potable Water Coating	Series FC 22 Pota Pox	25-30
SA	Silicone Aluminum	39-1261 (Note 4)	1.5
VB	Vapor Barrier	262 Elasto Shield	50-100
WP	Wood Primer	151 Elasto-Grip	1.0-1.5
WS	Wood Sealer	Note 2	-
Z	Zinc-Rich Primer	90G-1K97 Tneme-Zinc	2.5

Notes
1: Minimum Dry Film Thickness/Coat (mils)
2: Furnished by reputable manufacturer and acceptable to the Engineer.
3: Shall be used as a tie-coat between incompatible paints @ 3.0-4.0 mils.
4: This paint is suitable for temperatures up to 1200ºF and must be final cured at 400ºF for one hour.
5: Bleaching oil is a translucent gray paint stain with a chemical additive to enhance the natural bleaching tendencies of cedar shingles.

B. PAINTING SCHEDULE:

Paint shall be applied in accordance with the paint key listed on the following schedule and defined in the preceding Paint Schedule:

Item	Field Coats		
	1st	2nd	3rd
Walls:			
Exterior concrete masonry units (if sprayed, backroll first coat)***	MAE	MAE	--
Metals:			
Exterior miscellaneous galvanized and non ferrous metals and piping (SP7 required)	CEE	APE	--
Exposed electrical conduit, conduit fittings, outlet boxes	Same as adjacent wall or ceiling		
Hot ferrous metal surface	SA	SA	--
Wood and Carpentry Items:			
Wood trim (natural finish)	WS	HG V	HGV
Wood trim (unprimed)	WP	AGE	AGE
Piping:			
PVC Piping designated to be painted (SP7 or hand sand)	CEE	CEE	--
Pipe insulation (plastic or metal sheathed paint as scheduled for plastic or metal surface)	PVA	CEE	CEE
Other piping (see metals)			

***For existing, painted masonry walls, use EPW primer, followed by two coats of MAE.

^ If galvanized metal is provided with a light top coat sealer, light brush blast surface preparation is required prior to first field coat

B. SPARE PAINT:

1. Furnish to the Owner one unopened gallon of each type and color of paint used on the work.

2. Furnish both components for each type and color of epoxy paints used on the work.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint, efflorescence, etc. All necessary special preparatory treatment shall then be applied. Where required, imperfections and holes in surfaces to be painted shall be filled in an approved manner.

B. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting, shall be painted with the first field coat as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surface.

D. Wood shall be sanded to a smooth and even surface and then dusted off. Before priming wood that is to be painted, shellac shall be applied to all knots, pitch and sapwood. After priming or stain coat has been applied, nail holes and cracks shall be thoroughly filled with plastic wood or putty. For natural finish work, putty shall be colored to be imperceptible in the finished work.

E. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paint shall be spot primed with aluminum.

F. Surfaces shall be clean and dry before painting. All efflorescence, grease, oil, etc., shall be removed before painting, and all loose, crumbling material shall be removed by vigorous wire brushing over entire surface, followed by removal of all dust.

G. All holes in plaster shall be filled with plaster of paris and all cracks shall be cut out and filled. No sandpaper shall be used on plastered surfaces. Prior to painting, surfaces shall be tested with a moisture detecting device, such as Kaydel Plaster Tester, Type CP-48, as manufactured by Hard Moisture Gauges, Inc. No sealer or paint shall be applied when the moisture content of the plaster exceeds 8 percent, as determined by the test. Testing shall be done in the presence of the Engineer's representative, and in as many locations as directed. Plaster shall be thoroughly dry-brushed before painting or sealing.

H. All nonferrous metal surfaces to be painted shall be cleaned of all dirt, grease, oil and other foreign substances uniformly profiled per SSPC SP 7.

I. All galvanized surfaces to be painted shall be brush blasted to create a uniform surface profile per SSPC SP7.

J. Before application of the first full field coat, abraded areas of all non-galvanized ferrous metal items having shop coats shall be touched up with paint of the type indicated on the Painting Schedule.

K. All items of equipment such as motors, pumps, instrumentation panels, electrical switchgear, and similar items, that have been given shop coats, paint filler, enamel or other treatment customary with the manufacturer, shall have, after installation, all scratches and blemishes touch up prior to application of the first field coat. Factory prefinished items not to be field painted shall be touched up with matching paint to repair any areas damaged during installation.

L. All submerged concrete surfaces that are to receive an epoxy coating shall be brush blasted to remove surface laitance and provide a uniform surface profile, reference SSPC SP #13. Surface preparation may commence one week after the concrete has been pronounced cured. The curing period is defined as that length of time during which the concrete is fully hydrated (28 day cure). Patch holes and voids with specified modified epoxy cement prior to coating.

M. Concrete floors that are to receive epoxy coating shall be brush blasted or shot blasted per SSPC SP #13 and ICRI Surface Profile requirements per the coating manufacturer (Blastrack). Check for excessive moisture migration per ASTM F1869, Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride. Test results not to exceed 3 lbs per 1,000 square feet in one 24-hour period.

N. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be removed during painting operations and repositioned upon completion of each area or shall otherwise be protected.

O. All PVC pipe to be painted shall be brush blasted per SSPC SP7 or shall be sanded to provide a uniform surface profile.

3.02 APPLICATION:

A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified, and with particular attention to the correct preparation and condition of surfaces to be painted.

B. Paint shall be applied only within the temperature range recommended by the manufacturer. Painting of surfaces when they are exposed to the sun shall be avoided.

C. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist, or when the relative humidity exceeds 85 percent.

D. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40ºF within 18 hours after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the

probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.

E. All paint shall be applied under favorable conditions by skilled painters and shall be brushed out carefully to a smooth, even coating without run or sags. Enamel shall be applied evenly and smoothly. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but also throughout the thickness of the paint film before the next coat is applied. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.

F. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paints shall be spot primed with aluminum paints.

G. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.

H. The Contractor shall not only protect its work at all times, but shall also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of the work. Upon completion of the work, it shall clean up all paint, spots, oil, and stains from floors, glass, hardware, and similar finished items.

I. Paint shall be applied so as to obtain coverage per gallon and the dry film thickness recommended by the manufacturer. Dry film thickness readings shall be taken to insure that required thicknesses have been achieved. The Contractor shall record in a manner satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.

J. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.

K. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area that would have been covered with the same quantity of unthinned paint.

L. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.

M. The use of carbon dioxide or carbon monoxide emitting heaters is not permitted during the painting operation. Only indirect hot-air systems shall be permitted.

3.03 PIPING COLOR CODE:

The following Tnemec colors shall be utilized to facilitate identification of piping. Only insulation is to be painted on chemical feed lines.

1. Water Lines

Raw	Olive Green	110GN
Settled or Clarified	Aqua	10GN
Finished or Potable	Dark Blue	11SF

2. Wastewater or Potable Waste Lines

Sewer (sanitary or drain)	Dark Gray	34GR
Backwash Waste	Light Brown	68BR
Sludge	Dark Brown	84BR
Sewage Plant Effluent	Clay	07RD

3. Other

Compressed Air	Dark Green	91GN
Gas or Oil	Red	28RD
Other Lines	Light Gray	32GR

B. In situations where two colors do not have sufficient contrast to easily differentiate between them, a 6-inch band of contrasting color shall be painted on one of the pipes at approximately 30-inch intervals.

C. Piping which is not painted shall be color coded with bands placed at each change in direction and no more than 5 feet apart on straight runs.

3.04 PIPING IDENTIFICATION:

A. After painting, piping shall be identified by stenciling using the same specified paint as used on the pipes. Stenciling shall be of wording and color selected by the Engineer and sized as follows:

Outside Diameter of Pipe or Covering	Size of Legend Letters
3/4-inch to 1-1/4-inch	2-inch
1-1/2-inch to 2-inch	3/4-inch
2-1/2-inch to 6-inch	1-1/4-inch
8-inch to 10-inch	2-1/2-inch
Over 10-inch	3-1/2-inch

B. Arrows shall indicate direction of flows. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6-inches.

C. Where pipe passes through a wall, use pipe markers and directional arrows on each side of the wall.

D. Use pipe markers and directional arrows every 50 feet along continuous pipe lines.

E. Use a pipe marker and directional arrow at each rise and "T" joint.

F. When using directional arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional arrow.

G. The Engineer will assist in determining pipe content and direction of flows.

3.05 PARKING LOT LINE PAINTING:

A. Paint for parking lot lines shall conform to Federal Specification TT-P-115-E Type I. Paint shall be 11-3 PPG Industries, Pittsburgh, PA, Series 6 Tneme-Cryl, Tnemec, St. Louis, MO, or approved equal.

B. Contractor shall prepare the pavement surface according to the recommendations of the paint manufacturer.

C. Applied markings shall have clean-cut edges, true and smooth alignment and uniform film thickness of 15 mils, $\pm$ 1.0.

D. The Contractor shall be responsible for removing, to the satisfaction of the Engineer, tracing marks, and spilled paint applied in an authorized area.

3.06 CLEANUP:

A. The Contractor shall at all times keep the premises free from accumulation of waste material and rubbish caused by its employees or work. At the completion of the painting, it shall remove all tools, scaffolding, surplus materials, and rubbish from and about the buildings and shall leave the work "broom clean" unless more exactly specified.

B. The Contractor shall also, upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, glass, hardware, etc., leaving the work ready for inspection.

END OF SECTION

SECTION 12 40 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED:

A. Provide site improvements in the locations shown or as described herein, complete with anchorages and associated site work. **Specific to the backed benches (freestanding only), trash and recycling receptacles, and dog waste receptacles, the Owner shall furnish the furnishing themselves and the Contractor shall install them per manufacturer requirements.**

1.03 RELATED SECTIONS:

A. Section 03 30 00, CAST-IN-PLACE CONCRETE

B. Section 31 00 00, EARTHWORK

1.04 SUBMITTALS:

A. Contractor shall submit catalog information on site furnishings for review by Owner's Representative.

PART 2 - PRODUCTS

2.01 BACKED BENCHES **(FOR REFERENCE ONLY – PROVIDED BY OWNER)**

Backed benches shall be Model# '160 SERIES-3AR-Q01 for 2" x 10" Plaque', as manufactured by Dumor, Inc. as represented by M.E. O'Brien and Sons, (508) 359-4200 or approved equal. Benches shall be six (6) feet in length and constructed of ¼" x 1 ½" solid steel slats with 1/2" thick steel plate supports, and 1 ½" schedule 40 steel pipe front bar. Bench ends (legs and arm rest) shall be cast iron. All members shall be zinc rich coated with a baked-on polyester powder finish. Color shall be selected by Owner's Representative. Benches shall be surface mounted and include two end arm-rests and one center arm rest. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements. Backed bench color shall be black.

All backed benches will include a zinc plated memorial plaque, sized 2-inches by 10-inches.

2.02 BACKED BENCHES MOUNTED ON SEAT WALLS:

Backed benches mounted on seat walls shall be Model # '6A-699-3AR-Q01 FOR 2" x 10" Plaque', as manufactured by Dumor, Inc. as represented by M.E. O'Brien and Sons, (508) 359-4200 or approved equal. Benches shall be six (6) feet in length and constructed of ¼" x 1 ½" solid steel slats with 1/2" thick steel plate supports, and 1 ½" schedule 40 steel pipe front bar. Arm rests shall be cast iron. All members shall be zinc rich coated with a baked-on polyester powder finish. Color shall be selected by Owner's Representative. Benches shall be surface mounted on the seat walls and include two end arm-rests and one center arm rest. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements. Backed bench color shall be black.

All backed benches mounted on seat walls will include a zinc plated memorial plaque, sized 2-inches by 10-inches. The City will provide language for each memorial sign to be fabricated. A proof of each memorial plaque shall then be produced by DuMor and submitted to the Owner's Representative for review and approval as part of the submittal process.

Contractor shall provide ½" dia. stainless steel anchor bolts for mounting the benches onto seat walls.

2.03 BIKE RACKS:

Bike Racks shall be Model 'Bike Rack 290', as manufactured by Dumor, Inc. as represented by M.E. O'Brien and Sons, (508) 359-4200 or approved equal. Bike Racks shall be all steel members with zinc rich epoxy and finished with a powder coat. Color shall be selected by Owner's Representative. Bike Racks shall be surface mounted. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements. Bike rack color shall be black.

2.04 TRASH AND RECYCLING RECEPTACLES **(FOR REFERENCE ONLY – PROVIDED BY OWNER)**

The trash and recycling receptacles shall be Model# High Capacity Station (HC5) and the Standard Capacity Station (5.5), bolted together to make one station, as manufactured by Bigbelly, 150 A Street – Suite 103, Needham, MA, 02494, 888-820-0300, www.bigbelly.com,, or approved equal. Receptacle shall be surface mounted and installed per manufacturer's recommendations.

2.05 DOG WASTE RECEPTACLE **(FOR REFERENCE ONLY – PROVIDED BY OWNER)**

Dog waste receptacles shall be the Supersaver Dome Lid Receptacle (Model# 08SA2604), as manufactured by TreeTop Products, Batavia, IL (www.treetopproducts.com), or approved equal. Receptacle shall be surface mounted and include a 32-gallon commercial capacity. Receptacle shall be manufactured in a

plastic coated steel, with stainless steel assembly hardware and a dome constructed in heavy-duty plastic. The receptacle shall include a heavy-duty LDPE liner with handles for easy removal. Receptacle shall be secured and installed per manufacturer's recommendations. Receptacle color shall be black.

2.06 ADA DETECTABLE WARNING MAT

ADA detectable warning mat shall be the 'Cast-in-place Replaceable Tactile Warning Surface Panel' by ADA Solutions, Inc., 323 Andover Street, Suite 3, Wilmington, MA 01887, (800) 372-0519, www.adatile.com, or approved equal. Color shall be Seattle Yellow (SY).

2.07 INTERPRETIVE SIGNS

Interpretive signs shall be the "Cantilevered" sign base by Pannier, 345 Oak Road, Gibsonia, PA, 15044, (724) 265 4900, www.panniergraphics.com, or approved equal. Finish shall be powder coat. Color shall be black. Graphics shall be 36" wide by 27" tall and sealed in place by fiberglass embedment. Graphics panel shall be mounted at 24" from the ground at a 45-degree angle toward the viewer. Interpretive signage at the cantilevered deck shall be surface mounted. Interpretive signage at the at-grade deck shall be in-ground mounted. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements.

The Owner shall provide the Contractor with the artwork for each sign.

PART 3 - EXECUTION

3.01 Equipment shall be permanently installed in concrete anchorages unless otherwise indicated by manufacturer specifications. See Section 03 30 00, Cast in Place Concrete.

3.02 Any site improvement materials which are constructed of steel and not galvanized, or factory coated with a finish system shall be painted in the field in accordance with Specification section 09 90 00, PAINTING. Colors by Owner's Representative.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the General and Supplemental Conditions of the Contract and all Sections within Division 1 – General Conditions, which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A. Work Included: Furnish all labor, supervision, equipment, supplies, and materials and perform all operations necessary to complete the work of this Section, including but not limited to the following:

1. Earth and rock excavation of all types.
2. Providing, placing, and compacting fill materials for site improvements.
3. Sheeting, shoring, and dewatering of excavations and trenches.
4. Removal, hauling, stockpiling, re-handling, and placement of materials.
5. Off-site disposal of excess or unsuitable materials.
6. Rough grading.
7. Preserve and protect existing structures and new site improvements during the course of the work.
8. Prepare subgrades for structures, retaining walls, paved areas, and other site features.

B. Site-Specific Issues:

1. Site preparation and earthwork will require demolition, removal, protection, and/or abandonment of existing underground utilities and other below grade features. The depth, extent, alignment, and other attributes of existing features shown on such drawings should be considered approximate. Actual conditions may vary and are unknown.
2. Existing fill, boulders, and probable bedrock were encountered is subsurface explorations completed at the site and should be expected within required excavation depths for site grading, foundations, pile caps, and other site improvements. Existing fill should be removed below site improvements as required by this section.

Obstructions, such as large boulders, and difficult excavations should be anticipated during earthwork construction, particularly along the existing retaining wall. The Contractor should be aware of the potential for obstructions and the need for removal and replacement. The Contractor may conduct additional explorations to further evaluate the potential for obstructions at no cost to the Owner.

3. Silty soils are highly susceptible to softening and disturbance by construction activity during wet or freezing weather. Subgrade protection is the responsibility of the Contractor and special precautions and protective measures appropriate for the weather conditions during construction shall be used during earthwork and foundation construction to preserve the integrity of subgrades. Disturbed subgrades shall be repaired at the sole expense of the Contractor.

C. Geotechnical Field and Laboratory Testing:

1. The Contractor will retain the services of a geotechnical testing laboratory to conduct the laboratory analyses and field testing of soil materials required by this specification. Coordinate locations and types of field tests to be performed with the Owner's Representative and cooperate in every way with the Owner's Representative and testing laboratory during field testing and with collection of soil samples for laboratory testing.

D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 00 31 32, SUBSURFACE DATA
2. Section 31 11 00, CLEARING AND GRUBBING
3. Section 31 25 00, EROSION AND SEDIMENT CONTROL
4. Section 31 50 00, SUPPORT OF EXCAVATION
5. Section 31 23 19, DEWATERING

1.03 SUBMITTALS AND TESTING:

A. General

1. The Contractor shall forward submittals to the Owner's Representative a minimum of 2 weeks prior to any planned work related to the Contractor's submittals. The time period(s) for submittals are the minimum required by the Owner's Representative to review, comment, and respond to the Contractor. The Owner's Representative may require resubmission(s) after completing review.
2. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
3. The Contractor's submittals shall be reviewed and accepted by the Owner's Representative prior to conducting any work. Work completed prior to receiving acceptance from the Owner's Representative shall be at the Contractor's own risk.

4. The Contractor’s submittals shall be prepared and stamped by a Professional Owner’s Representative registered in the Commonwealth of Massachusetts and retained by the Contractor (unless otherwise approved by the Owner’s Representative).

5. Acceptance of the Contractor's submittals by the Owner’s Representative does not relieve the Contractor of the responsibility for the adequacy, safety, and performance of the Work.

B. Refer to Section 01 33 23, SUBMITTALS, for submittal provisions and procedures.

1. Backfill Materials: For each type of soil to be utilized as fill or backfill, the Contractor shall provide the following documentation:

    a. Representative 50-lb bag/bucket sample of the proposed fill.

    b. Location of borrow source site, including name of the owner or facility name with contact phone number, street address, city, and state.

    c. Present and past usage of the source site and material.

    d. Name of the qualified firm and analytical laboratory that performed the material sampling and testing.

    e. All existing report(s) associated with an assessment of the source site as relates to the presence of petroleum-based or hazardous materials.

    Submit a grain size distribution curve performed in accordance with ASTM D422 and results of a moisture-density relationship determination in accordance with ASTM D1557 for each proposed backfill material for review by the Owner’s Representative. Additional samples and analysis shall be submitted for initial material deliver, and for every additional 500 cubic yards of the same material delivered to the site, more often if a change in material occurs at the borrow source.

2. Excavation and Excavation Support Plan: Submit at least 21 calendar days prior to the start of the work a detailed plan for the sequence of excavation, and methods to be used for excavation support and dewatering/control of surface water in excavations. Submit Engineering design calculations stamped by a Professional Owner’s Representative registered in the Commonwealth of Massachusetts and shop drawings for earth support systems to be used. Design of dewatering and groundwater control systems shall be coordinated with excavation support systems to keep excavations free of water and to prevent disturbance of the subgrade.

3. Geotextile Fabric: Submit the manufacturer's information and a one square foot representative sample of the fabric.

4. Within one week after making field adjustments, resubmit revised working drawings as necessary to reflect changes required by field conditions.

5. During construction, submit to the Owner's Representative written confirmations of fill lift thickness, in-place soil moisture content, and percentage of compaction. Reports shall also include clear descriptions of fill type and test locations, including elevation. Sketches shall be provided as necessary to document test locations/elevations.

6. Obtain required permits for discharge of dewatering effluent. Submit two copies of all permits obtained at least one week prior to system installation.

1.04 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein.

American Society for Testing and Materials (ASTM):

ASTM	C131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C6913	Method for Particle Size Distribution (Gradation) of Soils using Sieve Analysis
ASTM	D1557	Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m^3)).
ASTM	D6938	Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

Commonwealth of Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation

1.05 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions, as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them during the bidding period and formed their own conclusions as to the full requirements of the work involved.

1.06 DEFINITIONS

A. Backfill and Fill Materials: Soil and rock material used in construction as specified herein.

B. Structures: Buildings, concrete slabs, foundations, pile caps, retaining walls, equipment pads, manholes, below grade vaults and equipment capsules.

C. Unsuitable Material: Include topsoil, existing undocumented fill, material containing organic silt, organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inches in diameter, porous biodegradable matter, disturbed soils, debris, contaminated media, snow, ice or refuse. Unsuitable material also includes any materials not suitable for reuse as backfill as defined by the requirements of this Specification.

D. Subgrade: The bottom surface of a trench or excavation extending to the underside of site improvements, including bedding materials for foundations and slabs, structures, pavement subbase, or other surfacing material.

E. Pass: A single complete coverage with compaction equipment over the entire surface of an exposed lift or subgrade being compacted.

F. Zone-of-Influence: Defined by a horizontal plane extending away from the outside bottom edge of the footings, pile caps, slabs, structures, and utilities a distance of two feet, then by a plane that slopes down and away from the foundation at a maximum 1H:1V slope to the natural inorganic, stable, soil subgrade.

1.07 EXISTING SITE AND SUBSURFACE CONDITIONS

A. Refer to Section 00 31 32 – SUBSURFACE DATA for information on site and subsurface conditions.

1.08 EXCAVATION CLASSIFICATIONS

A. Earth Excavation or "Excavation" consists of removing materials encountered to the subgrade elevations indicated in the Contract Documents and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.

B. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner’s Representative. Unauthorized excavation, as well as remedial work required by the Owner’s Representative, shall be at the Contractor's expense.

1. Within the zone of influence of footings, foundations, concrete slabs, or other structures, fill unauthorized excavations to the proper elevations with Structural Fill as defined herein. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise required.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, the Contractor shall notify the Owner's Representative who will observe subgrade conditions.

2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and to the lateral extent as required by the Owner's Representative. Unsuitable material includes, but is not limited to, organic, soft or loose, or wet material. Replace excavated materials as required by the Owner's Representative.

3. Removal of unsuitable materials and its replacement as specified shall be paid on the basis of contract unit rates as provided for in the Bid Form. The Contractor shall promptly notify the Owner and the Owner's Representative if unsuitable material quantities, in the Contractor's opinion, differ from estimated quantities. Any corresponding adjustment to the Contract Price and/or Contract Terms shall be made in accordance with the Contract Documents.

D. Rock Excavation:

1. Rock excavation in trenches and footing excavations includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on medium-size track-mounted hydraulic excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches and footing excavations in excess of 10-feet in width are classified as open excavations.

2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty hydraulic excavating equipment without drilling or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170 HP flywheel power and developing 40,000-lb. breakout force (measured in accordance with SAE J732C).

3. Determination of rock excavation classification will be made by the Owner's Representative. Typical materials classified as rock include boulders 3.0 cubic yards or greater in volume, solid rock, and rock-hard cementitious aggregate deposits. Intermittent drilling or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. The Contractor shall not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Owner's Representative. Visual observation of the completed excavation may be made by the Owner's Representative to modify the excavation classifications. Rock excavation completed prior to classification by the Owner's Representative shall be considered as earth excavation unless accepted by the Owner's Representative in writing. Such excavation will be paid on the basis of contract unit rates for this classification.

4. Rock payment lines (if applicable) are limited to the following:

a. Two feet outside of concrete work for which forms are required.

b. In footing excavations, one foot below bottom-of-footing elevation.

c. One foot outside of the vertical walls of utility structures.

d. In pipe trenches, depth limits shall be 6 inches below the bottom of the pipe:

Depth From Ground Surface to Invert of Pipe	Pay Width (Pipe ID)	
	0 - 24”	Over 24”
0 to 12’	5’-0”	Pipe I.D. +3’-0”
12’ to 20’	7’-0”	Pipe I.D. +7’-0”
Over 20’	9’-0”	Pipe I.D. +7’-0”

e. Rock sloping across the width of trench shall have the top of rock established at the rock elevation over the centerline of the pipe.

f. For all other site improvements not listed above, including but not limited to landscape plantings, and roadways, the payment line for rock removal shall be the subgrade for installation of the earthen components of the particular site improvement.

1.09 EXCAVATION

A. Perform all excavations, and of whatever materials encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the required work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry, and in an acceptable condition to receive the work. Work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.

B. All excavations made in open cuts will be controlled by the conditions existing at that location. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth bladed bucket or by hand.

1.10 PERMITS, CODES, AND SAFETY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of the municipality, the Commonwealth of Massachusetts, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment and services necessary to make the work comply with these requirements shall be provided by the Contractor without additional cost to the Owner. The Contractor shall be responsible for overall site safety.

B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

C. The Contractor shall obtain and pay for all permits and licenses required to complete the work specified herein and shown on the Contract Drawings.

D. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the Contract Drawings. The Contractor shall conduct his operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the work to be affected by the work.

E. The Contractor shall notify "Dig Safe" at 1-888-DIG-SAFE prior to commencing any excavation work.

F. The Contractor shall provide police details when working in roadways, as required by local jurisdictional authorities. The Contractor shall pay for any and all police details.

1.11 PROTECTION OF EXISTING CONDITIONS

A. All work shall be executed in such a manner as to prevent any damage to existing buildings, retaining walls, streets, curbs, paving, service utility lines, structures, and adjoining property.

B. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain in service during operations. Do not interrupt existing utilities except when authorized in writing by authorities having jurisdiction, unless otherwise indicated on the Contract Drawings.

C. When an active utility line is exposed during construction, its location and elevation shall be recorded on the Record Drawings by the Contractor and both the Owner's Representative and the Utility Owner shall be notified in writing. Active utilities existing on the site shall be carefully protected from damage or relocated as required by the work.

D. Inactive or abandoned utilities encountered during construction operations shall be removed or filled with cement grout or controlled density fill (CDF) in a manner to prevent voids. The Owner's Representative shall be notified prior to in-place abandonment of utilities. The location of such utilities shall be recorded on the Record Drawings.

E. Provide barricades, fences, lights, signs, and all other safety devices required to protect the public against injury.

F. In case of any damage or injury caused in the performance of the work the Contractor shall, at their own expense, correct such damage or injury to the satisfaction of, and without cost to, the Owner. Existing streets, sidewalks and curbs damaged during the project work shall be repaired or replaced to their condition prior to commencement of earthwork operations.

G. Acceptance of any of the Contractor's plans, design calculations and methods of construction by the Designer shall not relieve the Contractor of the responsibility for the adequacy of the excavation lateral support system; preventing damage to existing or new structures, utilities and streets adjacent to excavations; the safety of persons working within excavated areas and the public at large; and excavation dewatering.

1.12 FROST PROTECTION AND SNOW REMOVAL

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. The Contractor shall protect the subgrade beneath new structures and utilities from frost penetration when freezing temperatures are expected.

1.13 DISPOSAL

A. All excess and unsuitable excavated soil shall be removed from the site and legally disposed off-site by the Contractor at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 BACKFILL MATERIALS

A. All materials imported to the site shall not contain concentrations of metals above naturally occurring background levels as defined by the Department of Environmental Protection. All materials to be imported to the site shall not contain detectable amounts of all other petroleum-based and/or hazardous materials as defined by the Massachusetts Contingency Plan (CMR 40.0000).

B. **Common Fill:** Common Fill shall be well-graded, natural inorganic soil containing no stone greater than 6 inches maximum dimension. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. It shall be free of plastic clays, of all materials subject to decay or other materials that will corrode piping or metals. Common Fill shall have a maximum dry density of not less than 110 pounds per cubic foot. It shall be of such a nature and character that it can be compacted to the specified densities. Topsoil shall not be considered Common Fill.

C. **Gravel Borrow:** Gravel Borrow shall satisfy the requirements of MassDOT Specification Section M1.03.0, Type b.

D. **Dense Graded Crushed Stone (aka Aggregate Base):** Dense Graded Crushed Stone shall satisfy the requirements listed in MassDOT Specifications Section M2.01.7 Dense-graded Crushed Stone for Sub-base.

E. **Structural Fill:** Structural Fill shall satisfy the requirements of Gravel Borrow or Dense-graded Crushed Stone for Sub-base.

F. **Crushed Stone:** Crushed Stone shall satisfy the requirements listed in MassDOT Specification Section M2.01.4 (for 3/4 inch crushed stone) or M2.01.2 (for 1½ inch crushed stone). Crushed Stone separated from the surrounding soil with Geotextile Fabric as specified herein may be used as Structural Fill, where approved by the Owner's Representative.

G. **Lightweight Aggregate Fill:** Lightweight aggregate fill shall be processed rotary kiln shale material meeting the requirements of ASTM C-330. No by-product slags, cinders or by-products of coal combustion shall be permitted. Lightweight aggregate shall have a proven record of durability, as determined by ASTM C-88 and ASTM C-131, and be non-corrosive, as determined by CAL DOT 422 with the following physical properties.

1. Delivered Gradation:

Sieve Size		% Passing
1"	(25.0mm)	100
¾"	(19.0mm)	90 - 100
3/8"	(9.5mm)	10 – 50
#4	(4.75mm)	0 - 15

2. The minimum compacted density (moist, surface dry) shall not be less than 65 pcf.

3. The maximum soundless loss when tested with 5 cycles of magnesium sulfate shall be 10% (ASTM C-88).

4. The minimum strength of loosely placed material, as determined from drained triaxial tests, shall equal that of cohesionless soil with an angle of internal friction of 36 degrees. Minimum strength of material compacted to 65% relative density shall equal that of a cohesionless soil with an angle of internal friction of 40 degrees.

H. **Controlled Density Fill (CDF):** Controlled density fill shall consist of a cementitious hard excavatable mixture of aggregate, Portland Cement, air entraining admixtures and water. The material shall be Type 2E – Flowable (Excavatable) as described in MassDOT Specification Section M4.08.0, or as required by the Owner's Representative.

I. **Sand:** Sand shall satisfy the requirements listed in MassDOT Specifications Section M1.04.

J. **Geotextile Fabric:** Geotextile fabric used for drainage and separation shall consist of a non-woven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. The fabric shall conform to the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Weight	oz/sy	ASTM D-5261	8.0
Grab Strength	lbs	ASTM D-4632	205
Grab Elongation	percent	ASTM D-4632	50

Trapezoid Tear Strength	lbs	ASTM D-4533	80
Mullen Burst Strength	psi	ASTM D-3786	350
CBR Puncture Strength	lbs	ASTM D-6241	500
Apparent Opening Size (AOS)	U.S. std. Size Sieve	ASTM D-4751	80

Edges of filter fabric shall overlap a minimum of one foot.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contract Drawings indicate the proposed finish alignments, elevations, and grades of the work. Establish the line and grade in close conformity with the Contract Drawings. The Owner's Representative may make minor adjustments in the field as necessary based on conditions encountered.

B. The Contractor is responsible for establishing construction phasing, means, and methods and interim grading and temporary conditions required to attain the finished product required by the Contract Documents. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles and shall establish and maintain suitable benchmarks and grade control to accurately perform the work.

C. All excavation shall be performed in the dry. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of the subgrade soils.

D. Cobbles and boulders are anticipated within the required depths of excavations, specifically behind the existing retaining wall. The Contractor shall implement appropriate means and methods to complete excavations through these materials that will not damage the existing retaining wall or other existing site features.

E. When excavations have reached the prescribed depths, the condition of subgrades shall be evaluated by the Owner's Representative prior to placement of fill, forms, and rebar. When excavating to subgrade level for pavement and hardscaping areas has been completed, the subgrade surface shall be evaluated by the Owner's Representative. Following evaluation by the Owner's Representative, the Contractor will receive approval to proceed if conditions meet the project requirements.

F. Subgrades and bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work. Work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.

G. No excavated material shall be deposited or stockpiled at any time to endanger portions of new or existing structures, either by direct pressure or indirectly by overloading banks contiguous to the operation. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling.

H. When the plans require excavation in areas in close proximity to existing buildings, roads, structures and utilities, it shall be the responsibility and at the expense of the Contractor to use satisfactory means and methods to protect, maintain the stability, and avoid damage to such roads and structures located immediately adjacent to but outside the limits of excavations. No excavation will be permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any in-place footing or utility at a higher elevation without providing adequate sheeting and bracing to prevent movement of the in-place footing or utility.

I. Temporary ditches shall be made as needed to drain off surface water to avoid damage to areas of cut or fill. Such ditches shall be maintained as required for efficient operations at no additional cost to the Owner.

J. The Contractor shall protect all stockpiled material intended for use on-site, imported or suitable excavated, from precipitation. Stockpiled materials that become too saturated to be placed and compacted as required in this Section shall be disposed off-site and replaced with suitable material at no expense to the Owner.

K. Provide shoring, sheeting, and/or bracing at excavations, as required, to assure complete safety against collapse of earth at the side of excavations. Provide shoring of public utility lines where exposed in the excavations in accordance with rules and regulations of the local authorities at no additional cost to the Owner.

L. The Contractor shall place a minimum of 12-inch layer of crushed stone wrapped in geotextile filter fabric over the excavation subgrades to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 FILLING AND BACKFILLING

A. All subgrades must be observed and accepted by the Owner's Representative prior to placement of backfill, concrete, or any structure over the subgrade.

B. Where noted by the Owner's Representative, backfill all holes or voids encountered outside of minimum excavation limits with materials approved and accepted by the Owner's Representative.

C. Backfilling activities, including placement and compaction, shall not be performed when outside temperatures are at or below freezing.

D. Previously placed backfill shall be excavated and replaced at no additional cost if the backfill does not conform to the Contract Documents.

E. Subgrades shall consist of suitably prepared subgrades prepared as required by this section or engineered (placed per backfill specifications herein) Structural Fill that are free of contamination, stable under proof-compaction, and otherwise suitable as determined by the Owner's Representative.

F. Subgrade Preparation: The exposed subgrades shall be shaped to limits shown on the Contract Drawings and described in Paragraph 3.01 and be thoroughly compacted in accordance with the requirements of Paragraph 3.3. These operations shall include any required reshaping and moisture conditioning to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material. Suitable material shall be mineral soil free from organic materials, loam, wood, snow, ice, frozen soil cinders, asphalts, trash, or otherwise deleterious materials. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted.

1. Before surface or base materials are spread, the subgrade shall be shaped to an accurate and true surface conforming to the line and grades indicated on the Contract Drawings and described above. All surface irregularities shall be filled with suitable material or removed and such areas recompacted until the surface is properly shaped and properly compacted. A tolerance of 3/8-inch in paved areas and 1/2-inch in non-paved areas above or below the finished subgrade elevation will be allowed provided that this dimension above or below grade is not maintained for a distance longer than 50 feet and that the required crown is maintained in the subgrade. Any portion, which is not accessible to a roller, shall be thoroughly compacted by other mechanical or manual methods.

2. The first layer of fill on the subgrade soils shall consist of a minimum of 12-inches of crushed stone completely wrapped in filter fabric. The crushed stone shall be placed in 12-inch maximum loose lifts with each lift compacted until well-keyed.

3. All fills shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein. Each layer of fill shall be benched into the existing slope in order to avoid the formation of a shear plane.

4. Excavation shall be backfilled as quickly as possible, but not until completion of quality control testing and acceptance by the Owner's Representative.

G. Backfill Material: Unless otherwise specified or required, material used for filling and backfilling shall meet the material requirements specified herein, and the following requirements:

1. Common Fill for all unpaved areas around the site.

2. Crushed Stone wrapped in geotextile Drawings.

3. Structural Fill within the zone-of-influence of footings and in all other areas indicated on the Drawings.

4. Lightweight Fill to raise grades along the existing retaining wall and in all other areas indicated on the Drawings.

Place backfill materials in maximum loose lift thicknesses of 10-inches (unless otherwise specified on the Drawings). Maintain backfill material with uniform moisture content, with no visible wet or dry streaking, and at a moisture content that allows compaction to the degree specified herein.

H. Trench Backfill:

1. After the utility pipe installation has been inspected and approved, trenches shall be backfilled as soon as practicable with specified material. All trench backfilling shall be done with special care.

2. Backfill material for pipe bedding shall be deposited in the trench uniformly on both sides of the pipe for the entire width of the trench to the springline of the pipe. The backfill material shall be placed by hand shovels, in layers not more than 6-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support free from voids around the pipe.

3. The balance of backfill shall be spread in layers not exceeding 10-inches in loose depth. Each layer shall be thoroughly compacted by mechanical methods and shall contain no rock, stones or boulders larger than 4 inches in their greatest dimension.

4. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time. If necessary, a timber grillage or other suitable method shall be used to break the fall of the material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.

5. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density at least equal to that of the surrounding undisturbed earth, and in such a manner as to permit the rolling and compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value, so that paving of the excavated and disturbed areas, where required, can proceed immediately after backfilling is completed.

6. Any trenches or excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction then refilled and compacted with the surface restored to the required grade and condition at no additional expense to the Owner.

7. During filling and backfilling operations, pipelines will be checked by the Owner's Representative to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe, or any other defects, the defects shall be remedied in a manner satisfactory to the Owner's Representative and at no additional cost to the Owner.

I. Backfilling Against Structures:

1. Backfilling against masonry or concrete shall not be done until permitted by the Owner's Representative. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed and approved, special leakage tests of the structures shall be made by the Contractor, as required by the Owner's Representative.

2. After satisfactory completion of leakage tests and satisfactory completion of any other required work in connection with the structures, backfilling around the structures shall commence using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2-feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition. In general, use Structural Fill for backfilling against structures where the finished ground surface will be pavement; use Common Fill where the finished ground surface will be lawn or landscaped areas.

3. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or required, backfill shall be placed in layers not more than 9 inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.

4. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be repaired by the Contractor at no additional expense to the Owner.

J. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface level with adjacent surfaces at all times. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.

K. The completed and approved subgrades upon which topsoil is to be placed, or pavements are to be installed, shall not be disturbed by traffic of other operations, and shall be maintained in a satisfactory condition until the base and finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

L. Uniformly shape the surfaces of all areas to be graded, to the lines and grades indicated on the Contract Drawings, and as required, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations. The finished surfaces shall be reasonably smooth, compacted, and free from surface irregularities.

M. The Contractor is responsible to provide the finish grades as shown on the Contract Drawings. The Contractor shall provide temporary erosion control throughout the construction period to maintain all constructed lawns, and to protect all existing drains, catch basins, and swales, from any debris or soil entering from excavations, backfill, or erosion. Contractor shall take whatever precautions are necessary to accomplish this temporary erosion control such as straw bales, silt fence, erosion control fabric, or dewatering, at no additional cost to the Owner.

4.03 COMPACTION

A. Compaction Requirements: The degree of compaction is expressed as a percentage of the maximum dry density of the material at optimum moisture content as determined by ASTM D1557. Backfill shall be compacted to a 95% degree of compaction

B. Moisture Control:

1. Fill that is too wet for proper compaction shall be harrowed or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.

2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

C. Unfavorable Conditions:

1. In no case shall fill be placed over material that is frozen. In no case shall frozen soil or soil material containing frost, snow or ice be placed as backfill. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.

D. Compaction Control:

1. In-place density tests shall be made in accordance with ASTM D6938 as the work progresses to determine the degree of compaction being attained by the Contractor. Any corrective work required because of such tests, such as additional compaction,

or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner. Additional in-place density testing shall be made at the Contractor's expense by the geotechnical testing laboratory. Testing locations shall be selected by the Owner's Representative unless otherwise noted.

2. In-place density tests shall be performed according to the following minimum requirements:

    a. One test per lift for each 100 linear feet of trench.
    b. One test per lift for each 10,000 square feet of pavement and sidewalk subgrade fill area.
    c. One test per lift for each 100 linear feet of embankments.

4.04 DISPOSAL OF SURPLUS MATERIAL

A. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Owner's Representative.

B. Surplus excavated materials, which are acceptable to the Owner's Representative and meeting the requirements herein, shall be used to backfill normal excavations or to replace other materials unacceptable for use as backfill. Upon written approval of the Owner's Representative, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.

C. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

END OF SECTION

SECTION 31 05 19.13

GEOTEXTILE FABRICS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing of all labor, materials, and equipment necessary to install specified geotextile fabrics in locations shown on the drawings and as required by the Owner's Representative.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

Shop drawings or working drawings and material specifications shall be submitted to the Owner's Representative for review for each type of geotextile fabric furnished. General installation practices and installation schedule shall be included.

PART 2 - PRODUCTS

2.01 FILTER/DRAINAGE FABRIC:

A. The filter/drainage fabric shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the characteristics of Tencate Mirafi 140N.

B. The filter/drainage fabric shall be Tencate Mirafi 140N as manufactured by Tencate Geosynthetics, Pendergrass, GA; Foss-65 by Foss Manufacturing Co., Hampton, NH; US 120NW, as manufactured by US Fabrics, Cincinnati, OH, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

Installation of geotextile fabrics shall be strictly in accordance with manufacturer's instructions and specific layout plans and details reviewed by the Owner's Representative.

F. FILTER/DRAINAGE FABRIC:

The filter/drainage fabric shall be installed in the final graded trench bottom prior to placement of the crushed stone bedding and at other locations shown on the drawings or designated by the Owner's Representative. The drainage fabric in place shall cover the entire trench bottom and trench sides as shown on the drawings. Each width of

drainage fabric shall be overlapped in accordance with manufacturer's recommendations, but not less than 2 feet, to prevent intrusion of soil fines into the bedding.

3.02 FINAL INSPECTION AND ACCEPTANCE:

A. The Contractor shall, at his expense, have a manufacturer's representative inspect the work at completion of the installation. Any work found to be unsatisfactory shall be corrected at the Contractor's expense.

B. The Owner's Representative, at the Contractor's expense, reserves the right to have a manufacturer's representative inspect the installation process at any time during construction.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall do all required clearing and grubbing as indicated on the drawings or herein specified in the area required for construction operations on the Owner's land or in the Owner's permanent or temporary easements and shall remove all debris resulting therefrom.

B. Unless otherwise noted, all areas to be cleared shall also be grubbed.

C. The Contractor shall not clear and grub outside of the area required for construction operations.

1.02 RELATED WORK:

Any trees and shrubs specifically designated by the Owner not to be cut, removed, destroyed, or trimmed shall be saved from harm and injury in accordance with Section 01 57 19, ENVIRONMENTAL PROTECTION.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 RIGHT TO WOOD AND LOGS:

The Owner shall have the right to cut and remove logs and other wood of value in advance of the Contractor's operations. All remaining logs and other wood to be removed in the course of clearing shall become the property of the Contractor.

3.02 CLEARING:

A. Unless otherwise indicated, the Contractor shall cut or otherwise remove all trees, saplings, brush and vines, windfalls, logs and trees lying on the ground, dead trees and stubs more than 1-foot high above the ground surface (but not their stumps), trees which have been partially uprooted by natural or other causes (including their stumps), and other vegetable matter such as shags, sawdust, bark, refuse, and similar materials.

B. The Contractor shall not remove mature trees (4-inches or greater DBH) in the Owner's temporary easements.

C. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and stubs to be cleared

shall be cut as close to the ground as practicable but not more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of large trees. Saplings, brush and vines shall be cut close to the ground.

3.03 GRUBBING:

A. Unless otherwise indicated, the Contractor shall completely remove all stumps and roots to a depth of 18-inches, or if the Contractor elects to grind the stumps, they shall be ground to a minimum depth of 6-inches.

B. Any depression remaining from the removal of a stump and not filled in by backfilling shall be filled with gravel borrow and/or loam, whichever is appropriate to the proposed ground surface.

3.04 DISPOSAL:

All material collected in the course of the clearing and grubbing, which is not to remain, shall be disposed of in a satisfactory manner away from the site or as otherwise approved. Such disposal shall be carried on as promptly as possible and shall not be left until the final clean-up period.

END OF SECTION

SECTION 31 12 00.13

SELECTIVE CLEARING, INVASIVE SPECIES

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section includes the following:

1. Removal of selected living trees and removal of all dead, dying or diseased vegetation from within the project limits in accordance with these specifications.

2. Removal of invasive species and undesirable undergrowth in accordance with these specifications.

B. Refer to the Contract Drawings for the general quantity and locations of existing trees that require pruning or removal. Trees shall be pruned in conformance with this specification. Tree removals shall be limited to areas as denoted on the plans and shall include the removal of individual trees that would impede the construction of proposed facilities or those that are dead or dying.

C. Prospective bidders are advised to complete a site visit to review the extent of work required and to confirm existing conditions, access issues, terrain and the general nature of the work of this Section.

D. The Contractor shall coordinate invasive species removal with the Owner and Owner's Representative and shall adhere to the requirements set forth by the City of Newton Regulations, City of Newton Wetland Bylaws, the Order of Conditions, and the Mass. DEP Superseding Order to these specifications.

1.02 QUALIFICATIONS OF CONTRACTOR:

A. This work shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. Eligible contractors/subcontractors must derive a majority of their income from arboricultural work. The Owner may require proof of these qualifications.

B. All work shall be conducted by qualified and trained personnel under the direct supervision of a **Massachusetts Certified Arborist (MCA)** in the Contractor's employ.

1.03 PERSONNEL:

A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall advise the Owner of any changes in personnel assigned to this contract.

B. A crew shall consist of one (1) tree trimmer/climber, and one (1) ground person (one of whom shall be a crew foreman). The crew foreman shall have a minimum of five (5) years climbing/pruning experience. At least one (1) crew person shall be an MCA and shall be certified in CPR.

C. Each trimmer shall be experienced and highly qualified with the necessary tree worker skills to successfully complete the work of this Section, including the ability and training to perform aerial rescue. Said skill shall also include worker safety and ability in compliance with current OSHA and ANSI Z-133.1 Standards.

1.04 SPECIAL REQUIREMENTS:

A. Trees: The trees to be removed shall be those shown on the plans or designated by the Owner's Representative/Arborist.

B. Undergrowth: All plants less than 4-inches in diameter, measured at a height of 4 feet 6-inches above the ground, shall be classified as undergrowth. All undergrowth shall be removed from areas shown on the plans, described in the special provisions, or designated by the Owner's Representative; except for those plants designated by the Owner's Representative to be preserved.

C. General: When specified in the special provisions, stumps shall be treated with an herbicide immediately after cutting to prevent sprouting. The herbicide to be used, and the method and rate of application shall be as specified in the special provisions. The Contractor's licensed herbicide applicator shall follow all applicable instructions, warnings, and safety precautions stated on the manufacturer's label, and shall comply with all laws and regulations governing herbicides that are in effect at the time of use. When work is performed properly in accordance with these specifications, no subsequent recutting of sprouts or seeding growth will be required. All trees and undergrowth cut shall be disposed of in accordance with the applicable requirements of Section 2.03 Removals of these specifications.

D. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

E. No burning shall be permitted on the project site.

F. Prior to commencing work, the Contractor shall submit a plan to the Owner for legal

disposal of removed materials, in conformance with State and Federal regulations.

1.05 STANDARDS AND DEFINITIONS:

A. All pruning work shall conform to the following:

1. The ANSI A300 'Standard Practices for Trees, Shrubs, and Other Wood Plant Materials' of the Secretariat: National Arborist Association, Post Office Box 1094, Amherst, New Hampshire 03031.

2. American National Standards Institute (ANSI) Standard Z-133.1.

3. National Arborist Association Standards for Pruning

B. The term 'Owner' shall mean the Owner's designated representative charged with carrying out the requirements of this Project –'Owner's Representative', 'Arborist', 'Engineer', 'Planner', or 'Tree Warden' as referenced herein, rendering approvals for the Owner.

C. The Owner's Representative will monitor job progress throughout the project and approve all payments. A site walk will be conducted before work begins between the Contractor and the Owner's Representative. Specific trees, undergrowth and invasive species may be identified at this time for removal/eradication.

1.06 EXAMINATION OF SITE AND DOCUMENTS:

A. The Contractor shall be responsible for having a clear understanding of the existing site conditions and shall be responsible for fully carrying out the work of this Section, regardless of actual site conditions encountered.

1.07 SCHEDULE OF WORK:

A. The Contractor shall submit a schedule of work for the Owner's review and approval prior to beginning work. Unless otherwise authorized by the Owner, failure of the Contractor to comply with the approved schedule shall be sufficient cause to give notice that the Contractor is in default of the contract.

1.08 PROTECTION OF THE VEGETATION TO BE PRESERVED:

A. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain. The placement of protection devices, such as snow fence enclosures, shall, however, be at the Contractor's discretion. Contractor shall consult with a certified arborist to determine adequate tree protection methods, including but not limited to, fencing, root cutting, and mulch or plywood sheeting to protect root systems from compaction.

B. Damage no plant to remain by burning, pumping water, cutting of live roots or branches, or any other means. Neither vehicles nor equipment shall be parked within the dripline of trees to remain, or wherever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.

C. The Contractor shall be liable for any damage to any trees, shrub, lawn or other features to remain and shall immediately report to the Owner. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner.

D. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the Owner and of sufficient quantity such that the sum of the caliper inches for replacement trees equals the total caliper inches of the damaged tree(s). Damaged shrubs shall be replaced with shrubs(s) of the same size, species, and quantity, unless determined otherwise by the Owner.

E. Any plants that are damaged to such an extent as to destroy their value for landscape purposes shall be cut and disposed of, and grass that is damaged shall be reseeded and remulched as necessary by the Contractor at no cost to the Department when so required by the Owner's Representative.

F. The Contractor shall conduct his operations in such a manner to prevent injury to trees, shrubs, grass, or other types of vegetation that are to remain growing, and also to prevent damage to adjacent property.

G. When any such injuries to trees or shrubs occur, broken branches shall be removed and rough edges of scarred areas shaped and made smooth in accordance with generally accepted arboricultural and horticultural practices.

1.09 USE AND CARE OF THE SITE:

A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.

B. Pavements shall be swept and lawns or other surfaces raked and/or otherwise cleaned of all materials related to the work operation. Degree of clean-up required will be described by the Owner at the outset of the Contractor's work and will be based upon the character of the work area.

C. All trimmings or any other form of debris (except diseased materials or trimmings from Elms) shall be collected and chipped. The Contractor shall remove all materials and shall dispose of such materials off site in a legal manner.

D. The Contractor shall be fully and solely responsible for any damage to equipment or vehicles left at the site of the work. All necessary permits shall be obtained by the Contractor.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the Owner's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory condition or otherwise unsuitable.

B. A disc chipper shall be used which will process material up to twelve (12) inches in diameter.

2.02 HERBICIDE

A. Herbicide to be applied to the root of removed invasive species shall be Rodeo, as manufactured by Dow Agrisciences LLC, 9930 Zionsville Road, Indianapolis, IN 46268 (www.corteva.us; 1-800-992-5994), or approved equal.

PART 3 - EXECUTION

3.01 TREE PRUNING:

A. Tree pruning shall be done in conformance with Specification Section 31 13 13, Tree Pruning and Tree and Stump Removals.

3.02 REMOVALS:

A. Removals shall be done in conformance with Specification Section 31 13 13, Tree Pruning and Tree and Stump Removals.

B. For the purposes of this contract, removals shall also include all species that are dead, dying, or diseased, are undesirable or are considered to be invasive, as recognized by applicable entities of the Commonwealth of Massachusetts and Massachusetts Association of Arborists.

3.03 SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the selective clearing and invasive species work in accordance with all local, state, and federal regulations in force at the time of this contract and in accordance with selective clearing and invasive species removal as specified herein. The invasive species present at Levingston Cove have been documented in the memorandum entitled, "Invasive Species Survey – Levingston Cove, Newton" dated July 12, 2021, which is included as an appendix following this specification section.

3.04 DESCRIPTION OF WORK-SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

A. The Contractor's attention is called to the requirements for work under this item. The desired appearance to be attained in certain areas of heavy growth may require three or more operations. First, the obvious dead, dying and diseased trees and undergrowth shall be cut and cleared out of the area. This work includes removal of any previously fallen trees, branches, uprooted stumps and other debris as directed. Next, the area is to be thinned out, as required by the Owner or Owner's Representative, by removing the less desirable trees and brush which interfere with the growth of the better plant material.

B. Tree up-branching and shaping under this item will be restricted to trees which have limbs and branches restricting sight distance, extending over roadways, shoulders, turn outs, etc. Up-branching or trimming will be required to produce a 6-foot minimum vertical clearance over all locations described hereinbefore, and the removal of limbs and branches involved in this operation shall be accomplished as outlined hereafter.

3.05 INVASIVE SPECIES REMOVAL:

A. For large invasive herbaceous and woody plant species, the Contractor shall hand pull the plant in order to remove as much of its root ball as possible. The remaining roots shall be dabbed with a nonionic surfactant such as Rodeo, or approved equal.

B. For the remaining invasive plant material, the Contractor shall apply the cut-and-dab method for invasive species removal. The plant shall be cut as close to the ground as possible. Herbicide shall be applied to the remaining cut surface of the plant as soon as possible after the plant is cut to increase effectiveness. The application of herbicide shall not take place when no rain is forecast for several days afterward to reduce the risk of treatment washing away. The Contractor shall ensure that seeds do not spread to any non-impacted areas and can achieve this by placing cut vegetation into bags.

C. The extent of the invasive species plant material to be removed is delineated on the drawings.

D. All equipment and clothing used during removal shall be cleaned to remove seed material before leaving the site and entering areas that do not contain invasive species.

E. Cut and excavated materials shall be disposed of at a legal facility that accepts materials containing invasive species.

END OF SECTION

SECTION 31 13 13

TREE PRUNING AND TREE AND STUMP REMOVALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section includes the following:

1. Pruning - Class II, including the removal of all limbs necessary to execute the field, playground and fence work required under this contract.

2. Removal of trees and stumps.

B. Refer to the Contract Drawings for general location of trees along the site perimeter. In general, all trees are to remain and be pruned in conformance with this Specification. Tree removals shall be limited to the area denoted on the plans and shall include the removal of individual trees that would impede the construction of proposed facilities.

1.02 QUALIFICATIONS OF CONTRACTOR:

A. This work shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. The Owner may require proof of these qualifications.

B. All work shall be conducted by qualified and trained personnel under the direct supervision of a Massachusetts Certified Arborist (MCA) in the Contractor's employ.

1.03 PERSONNEL:

A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall advise the Owner of any changes in personnel assigned to this Contract.

B. The crew foreman shall have a minimum of five (5) years climbing/pruning experience. At least one (1) crew person shall be an MCA and shall be certified in CPR.

C. Each trimmer shall be experienced and highly qualified with the necessary tree worker skills to successfully complete the work of this Section, including the ability and training to perform aerial rescue. Said skill shall also include worker safety and ability in compliance with current OSHA and ANSI Z-133.1 Standards.

1.04 SPECIAL REQUIREMENTS:

A. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

B. No burning shall be permitted on the project site.

C. Prior to commencing work, the Contractor shall submit a plan to the Owner for legal disposal of removed materials, in conformance with State and Federal regulations.

1.05 STANDARDS AND DEFINITIONS:

A. All pruning work shall be performed in accordance with the following:

1. The ANSI A300 'Standard Practices for Trees, Shrubs, and Other Wood Plant Materials' of the Secretariat: National Arborist Association, Post Office Box 1094, Amherst, New Hampshire 03031.

2. American National Standards Institute (ANSI) Standard Z-133.1.

3. The standards and practices of the International Society of Arborists.

4. The standards and practices of the Massachusetts Arborist Association.

5. The standards and practices of the American Association of Nurserymen.

B. The term 'Owner' shall mean the Owner's designated representative charged with carrying out the requirements of this Project, Owner's Representative, Planner, or Tree Warden as referenced herein, rendering approvals for the Owner.

1.06 EXAMINATION OF SITE AND DOCUMENTS:

A. The Contractor shall be responsible for having a clear understanding of the existing site conditions and shall be responsible for fully carrying out the work of this Section, regardless of actual site conditions encountered.

1.07 ORDER OF WORK:

A. Based on the site conference, the Contractor shall submit a schedule of work for the Owner's review and approval prior to beginning work. Unless otherwise authorized by the Owner, failure of the Contractor to comply with the approved removal

schedule shall be sufficient cause to give notice that the Contractor is in default of the contract.

1.08 PROTECTION OF THE VEGETATION TO BE PRESERVED:

A. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain. The placement of protection devices, such as snow fence enclosures, shall, however, be at the Contractor's discretion.

B. Damage no plant to remain by burning, pumping water, cutting of live roots or branches, or any other means. Neither vehicles nor equipment shall be parked within the dripline of trees to remain, or where ever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.

C. The Contractor shall be liable for any damage to any trees, shrub, lawn or other site features to remain, and shall immediately report to the Owner. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner.

D. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the Owner and of sufficient quantity such that the sum of the Diameter at Breast Height (DBH) inches for replacement trees equals the total DBH inches of the damaged tree(s). Damaged shrubs shall be replaced with shrubs(s) of the same size, species, and quantity, unless determined otherwise by the Owner.

1.09 USE AND CARE OF THE SITE:

A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.

B. Pavements shall be swept and lawns or other surfaces raked and/or otherwise cleaned of all material related to the work operation. Degree of clean-up required will be described by the Owner and will be based upon the character of the work area.

C. All trimmings or any other form of debris (except diseased materials or trimmings from Elms) shall be collected and chipped. The Contractor shall remove all materials and shall dispose of such materials off site in a legal manner.

D. No vehicles are to be stored on site. The Contractor shall be fully and solely responsible for any damage to equipment or vehicles left at the site of the work. All necessary permits shall be obtained by the Contractor.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the City's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory condition or otherwise unsuitable.

B. Cutting tools shall be kept well sharpened to provide clean smooth cuts. Any tools utilized on any tree suspected to have cankers or other fungal, bacterial or viral diseases shall be sterilized or not used on any other specimen.

C. A disc chipper shall be used which will process material up to twelve (12) inches in diameter.

PART 3 - EXECUTION

3.01 PRUNING:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the work in accordance with all local, state and federal regulations in force at the same time of this Contract and in accordance with tree pruning as specified herein.

B. The work of this Section consists of all pruning work and related items as specified herein and includes, but is not limited to:

1. Pruning - Class II throughout the designated areas and limb removal required to allow for the proper installation of all fields, play equipment and new fencing.

   Class II pruning is defined as medium pruning and shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch one (1) inch or less in diameter may remain within the main leaf area where it is not practical to remove it.

3.02 DESCRIPTION OF PRUNING WORK:

A. Pruning and trimming are generally described as the removal and disposal of limbs, branches and stubs which are either dead, potentially detrimental to the health of the tree or dangerous to pedestrians, visually deficient, interfering or otherwise objectionable as determined by the Owner.

B. The limits of all trees to be pruned have been identified on the plans or referenced elsewhere in this specification section.

C. Vehicle access shall be controlled and approved by the Owner.

D. If the Contractor discovers tree(s) which have not been marked for pruning, but whose condition is such that removal is warranted, whether due to death, disease, decay, or structural weakness, such tree(s) shall not be pruned and the Contractor shall immediately report these findings in writing to the Owner and await the Owner's direction before proceeding with work on the particular tree(s) in question.

E. All pruning shall be performed in a manner that maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch that is a minimum of one third (1/3) the size of the branch being removed, unless otherwise instructed by the Owner.

F. The use of climbing spurs or spiked shoes shall not be permitted and their use will result in the immediate cancellation of the contract.

G. All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. Cuts shall, however, never be made through the branch collar. Slab cuts and rip cuts will result in cancellation of the contract.

H. All limbs over two (2) inches in diameter to be removed shall be precut to prevent splitting. Any branches that by falling would injure existing trees to remain or other objects shall be lowered to the ground by proper ropes.

I. On trees known to be diseased and where there is known to be danger of transmitting the disease on tools, tools shall be disinfected with alcohol or bleach after each cut between trees.

J. Lateral branches as well as occasional branch suckers ("water sprouts") may be retained. Complete removal of secondary laterals and branch suckers resulting in the stripping of major limbs, ("lion tailing") will not be permitted.

K. Tree paint to seal pruning cuts shall not be used.

L. All branches and limbs shall be manually lowered to the ground via rope and pulley. This practice must be consistent with the National Arborist Association Standards for Pruning. All grade-level artifacts and landscaping must be protected from damage.

3.03 REMOVALS:

A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the removals work in accordance with all local, state, and federal regulations in force at the time of this contract and in accordance with tree and stump removals as specified herein.

3.04 DESCRIPTION OF REMOVAL WORK:

A. Removal is generally described as the removal of groups and individual trees and shrubs which interfere with the growth of more desirable types of trees; the clearing away of lesser growth that may obscure outstanding trees; and thinning out to provide space for healthy growth by the elimination of thinner, weaker trees.

B. The Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Owner to immediately reject unsatisfactory work or to notify the Contractor of deviations from the specification shall not relieve the Contractor of responsibility to correct or remedy unsatisfactory work.

C. The Contractor shall only work on trees designated by the Owner. No compensation will be made for work performed on any other tree or trees.

D. Trees designated to be removed shall be taken down and all leaves, branches and trunks of trees properly disposed of by chipping and removal from the premises.

E. Fell trees in a manner that allows all site features and those trees to be saved undamaged.

F. Removal of all the parts of each tree shall be completed on the same day that the tree is cut.

G. Stumps shall be ground to eighteen (18) inches below grade by grinding or other means acceptable to the Owner. The void from the stump removal operations shall be filled with ordinary borrow soil to within six (6) inches of finished grade. The top six (6) inches shall be filled with screened loam, moderately tamped to prevent future settling. In grass areas the disturbed area shall be sown with grass seed of a mix appropriate to the location, as required by the Owner.

H. Excavation or grading within the branch spread of trees to be saved shall be performed as required by the Owner. Removal of pavement such as bituminous concrete in these zones shall be by hand tools and/or air spade to ensure root health for trees to remain.

I. All equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including but not limited to those regulations concerning noise levels, protective devices and operator safety.

J. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury or damage that could be caused by the progress of the work. To this end the Contractor shall provide, erect, and maintain protective devices acceptable to the

Owner, including but not limited to barricades, lights and warning signs.

K. Any practice employed by the Contractor that is obviously hazardous as determined by the Owner shall be immediately discontinued by the Contractor upon receipt of either written or oral notice from the Owner to discontinue such practice.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 57 19, ENVIRONMENTAL PROTECTION

C. Section 31 00 00, EARTHWORK

1.03 SYSTEM DESCRIPTION:

A. Dewatering includes designing, furnishing, installing, maintaining and removing a temporary cofferdam and flow management system. The system should be capable of excluding water from the work area, maintaining the normal water level beyond the cofferdam, and managing storm flows that might occur during construction. The system should also be capable of managing/intercepting groundwater and seepage which would otherwise emerge from the slopes or bottoms of the excavations, increasing the stability of excavated slopes, preventing loss of material from beneath the slopes or bottoms of the excavations, reducing lateral loads on sheeting and bracing, improving the excavation and hauling characteristics of earth materials used during construction, preventing rupture or heaving of the bottoms of any excavations, and disposing of pumped water.

1.04 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the temporary cofferdam, dewatering and flow bypass systems. The Contractor shall retain the services of a Professional Engineer registered in the Commonwealth of Massachusetts, experienced in dewatering systems, to independently evaluate the boring logs and any other information available to determine those areas that will require dewatering and to design the required system(s). The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the dewatering is carried out in accordance with their design.

B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom,

unless otherwise required by the Owner's Representative, so that all excavation bottoms are firm and dry.

C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.

D. The dewatering system shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.

1.05 SUBMITTALS:

A. At least two weeks prior to installing the temporary cofferdam, dewatering, and flow bypass system, Contractor shall submit the attached Certificate of Design completed and signed by Contractor, identifying the engineer responsible for design of the cofferdam and dewatering system. The Contractor shall also submit a schedule showing the timing of installation and operation of the system.

B. The Contractor shall submit the following items to the Engineer bearing the Contractor's Engineer's stamp and signature, and identifying the codes and specifications followed in the design.

1. A Lake Level Management Plan that includes details and descriptions of the cofferdam and dewatering system, including the number, location and depth of pumps, siphons, wells, wellpoints or sumps; designs of filters to prevent pumping of fine soil; method and location for filtering and disposal of pumped water; and flow capacity of proposed system. The Pond Level Management Plan shall also include the Contractor's flood warning and emergency response procedures for accommodating storm flows and flooding during the work.

C. The Contractor shall submit records of pump operation and groundwater elevations as required by the Owner's Representative.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

A. All water pumped or drained from the work shall be disposed of in a manner that will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the provisions of Specification Section 01 57 19, ENVIRONMENTAL PROTECTION, and Specification Section 00 31 43, PERMITS.

B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.

C. Dewatering procedures to be used shall be as described below:

1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.

2. For dewatering operations with relatively minor flows, pump discharges shall be directed into hay bale sedimentation traps lined with filter fabric. Water is to be filtered through the hay bales and filter fabric prior to being allowed to seep out into its natural watercourse.

3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags shall be utilized in catch basins.

D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, tools and equipment, and perform all operations necessary for erosion and sedimentation control work indicated on contract drawings and as specified herein.

1.02 RELATED WORK:

A. Section 01 14 19.16, DUST CONTROL

B. Section 01 57 19, ENVIRONMENTAL PROTECTION

C. Section 31 05 19.13, GEOTEXTILE FABRICS

1.03 PROJECT CONDITIONS:

A. Earthmoving activities in the project area shall be conducted in such a manner as to prevent accelerated erosion and the resulting sedimentation.

B. The Contractor shall implement and maintain erosion and sedimentation control measures as shown on the contract drawings or as required by the Owner or Owner's Representative from the start of construction until provisional acceptance of seeded areas, to effectively prevent accelerated erosion and sedimentation.

1.04 SUBMITTALS IN ACCORDANCE WITH SECTION 01 33 23, SUBMITTALS:

A. The Contractor shall submit to the Owner's Representative certification that the materials used for silt fence and straw wattle construction meet the specifications.

1.05 GENERAL METHODOLOGY:

A. Erosion and sedimentation control methods shall consider all factors which contribute to erosion and sedimentation including, but not limited to, the following:

1. Topographic features of the Project area.

2. Types, depth, slope and areal extent of the soils.

3. Proposed alteration of the area.

4. Amount of run-off from the Project area and the upgradient watershed areas.

5. Staging of earthmoving activities.

6. Temporary control measures and facilities for use during earthmoving.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Slope erosion protection, to protect hydroseed from erosion, shall be fully biodegradable, high performance-flexible growth medium composed of 100% recycled and thermally refined wood fibers, crimped interlocking biodegradable fibers, micro-pore granules, naturally derived cross-linked biopolymers and water absorbants. The high performance-flexible growth medium shall be phytosanitized, free from weed seeks, free from plastic netting, and shall require no curing period. The slope erosion protection shall be Flexterra HP-FGM by Profile Products, 750 Lake Cook Road, Ste. 440, Buffalo Grove, IL 60089, (800) 508-8681, www.profileproducts.com, or approved equal.

B. Compost sock shall conform to the Specification Section 01 57 19, ENVIRONMENTAL PROTECTION.

C. Silt Fence shall conform to the Specification Section 01 57 19, ENVIRONMENTAL PROTECTION.

PART 3 - EXECUTION

3.01 CONSTRUCTION SEQUENCE:

A. Construction of erosion control measures as depicted on drawings will be completed prior to any site work.

B. Sediment barriers shall be used at locations shown on the drawings. Sediment barriers are temporary berms, diversions, or other barriers that are constructed to retain sediment on-site by retarding and filtering stormwater runoff.

C. All temporary erosion control measures will be maintained throughout the course of site construction activities until provisional acceptance of the site vegetation by the Owner's Representative or Owner, at which time the Contractor shall remove all remaining temporary erosion control

structures, and properly dispose of accumulated sediment on-site in areas approved by the Owner.

D. The Owner’s Representative or Owner may order additional erosion and sediment controls be installed. The Contractor shall comply with Owner’s Representative or Owner's request and immediately install the required controls.

E. The Contractor shall inspect all erosion control measures after any storm event to ensure they are in proper working order.

3.02 CONSTRUCTION METHODS:

A. Silt fences and/or straw wattles shall be installed at the site downgradient of work areas as required by Owner or Owner’s Representative in the field. The silt fence shall be installed in accordance with manufacturer’s instructions. Straw wattles shall be placed at locations shown on the contract drawings or approved by the Owner’s Representative. The base of all straw wattles and silt fencing shall be embedded to the depths shown on the contract drawings.

B. On slopes, the Contractor shall provide protection against washouts by an approved method. Any washout, which occurs either in the Contractor's work area or in areas topographically below his work, shall be regraded and reseeded at the Contractor's expense until an accepted vegetative stand is established.

END OF SECTION

SECTION 31 63 33

DRILLED MICROPILES

PART 1-GENERAL

1.01 SUMMARY:

A. Work under this section consists of furnishing all necessary supervision, labor, materials, and equipment required for the design and installation of cement grouted, drilled-in micropiles for support of the proposed cantilevered deck as shown on the Contract Drawings and as specified herein.

B. The micropile specialty Contractor (referred to hereafter as "Contractor") shall visit the site prior to mobilization of equipment to the site to observe and review specific site conditions, access conditions, requirements for equipment, and to evaluate methods and costs to install micropiles.

C. The Contractor is responsible for furnishing all materials, products, accessories, tools, equipment, services, transportation, labor and supervision, and manufacturing techniques required for installation and testing of micropiles and pile top attachments for this project.

D. The Contractor is responsible for designing minimum 6-inch diameter drilled micropiles, installed with permanent casing extending through the non-frictional resistance zone of approximately 8 feet of fill behind the existing retaining wall and to a minimum of 5 feet below the top of the frictional resistance zones comprised of glacial outwash. Within the design bearing strata, the micropiles shall be designed as uncased, frictional micropiles with full length reinforcing steel and grout.

E. The Contractor shall design and install micropiles that will develop the loads capacities indicated on the project plans. The micropile load capacities shall be verified by load testing as required by this Section. The Contractor shall conduct at least one static verification load test and at least two static proof load tests.

F. Protect existing structures in accordance with the requirements of authorities having jurisdiction over the adjacent structures and utilities.

1.02 RELATED WORK:

A. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by the Work of this Section. A list of those Documents and Sections include, but is not limited to, the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.

2. Section 00 31 32 - SUBSURFACE DATA

3. Section 03 30 00 – CAST-IN-PLACE CONCRETE

4. Section 05 12 33 – STRUCTURAL STEEL

5. Section 31 00 00 – EARTHWORK

1.03 REFERENCES:

A. The following standards are applicable to the work of this section to the extent referenced herein:

1. American Association of State Highway Transportation Officials (AASHTO)

AASHTO LRFD Bridge Design Specifications, 7th Edition, 2015

2. American Petroleum Institute (API)

API RP-13B-1 – Recommended Practice for Field Testing Water-Based Drilling Fluids

3. American Society for Testing and Materials (ASTM)

ASTM A36 – Structural Steel

ASTM A252 – Welded and Seamless Pipe Piles

ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement

ASTM A722 Uncoated High-Strength Steel Bar for Prestressing Concrete

ASTM A775 – Epoxy-Coated Reinforcing Steel Bars

ASTM C109 – Test Method for Compressive Strength of Hydraulic Cement Mortars Using 2-inch Cube Specimens

ASTM C150 – Standard Specification for Portland Cement, Type II

ASTM C404 – Aggregates for Masonry Grout

ASTM C494 – Chemical Admixtures for Concrete

ASTM D1143 – Method of Testing Piles Under Static Axial Compressive Load

4. Federal Highway Administration (FHWA)

FHWA NHI-05-039, Micropile Design and Construction Reference Manual, 2005

5. Massachusetts State Building Code, 9th Edition

Chapter 18 – Foundations and Retaining Walls

6. Massachusetts State Building Code, 9th Edition

Chapter 18 – Foundations and Retaining Walls

1.04 PROJECT SITE AND SUBSURFACE CONDITIONS:

A. Micropiles will be installed near the existing gravity retaining wall and Crystal Lake. The Contractor shall be prepared to implement methods to protect the existing structures and lake from damage. Driving of casing and external flushing is prohibited.

B. The following minimum design guidelines shall be used:

1. Micropile and pile top to footing connection shall be designed using the procedures in the FHWA "Micropile Design and Construction, Report No. FHWA NHI-05-039.
2. Micropiles shall be designed as friction piles developing their support entirely in friction in their respective bond zone. End bearing shall be neglected.
3. Micropiles shall be designed using an AASHTO LRFD resistance factor of 0.70, as confirmed by successful completion of static load testing as specified herein.
4. Micropiles shall not be installed using auger cast pile methods.

C. The Contractor shall be aware that remnants of old foundations and other buried structures and naturally deposited cobbles and boulders may exist within the work area and may be encountered. The Contractor is responsible for removal or penetration of obstructions.

1.05 SUBMITTALS – IN ACCORDANCE WITH SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING

A. Submittals shall be delivered to the Engineer a minimum of 21 calendar days prior to micropile installation. Work shall not begin until the appropriate submittals have been received, reviewed, and approved in writing by Engineer. The Contractor shall allow the Engineer up to 2 weeks to review, comment, and return the submittal package after a complete set has been received. Note that any additional time required due to incomplete or unacceptable submittals shall not be cause for delay or impact claims. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

B. Review of the submittals by the Engineer will not relieve the Contractor of the responsibility to provide and safely install micropiles capable of supporting the design loads specified herein.

C. Contractor's Qualifications: The Contractor performing the work in this Specification shall have installed micropiles for a minimum of five (5) years on similar projects. At the time of the bid, the Contractor shall submit a list containing at least five (5) comparable installations on which the Contractor and the Superintendent has installed micropiles. A brief description of key project drilled pile features; time period (dates) when drilled pile work was performed and ultimate client's name; direct client contact name, address, telephone number and email address shall be included for each project. The Contractor may not use consultants or manufacturer's representatives to meet the requirements of this section.

1. Resume of Project Superintendent including pertinent project experience.
2. Prior to the start of work, the Contractor shall submit a list identifying the drill operators and on-site supervisors who will be assigned to the project. Drill operators and on-site supervisors shall have a minimum of one (1) year experience installing micropiles with the Contractor's organization.

D. Shop Drawings:

1. The Contractor's Engineer shall submit for approval, structural and geotechnical design calculations and drawings for the proposed micropile foundation system, sealed by a Registered Professional Engineer currently licensed in the Commonwealth of Massachusetts. Micropiles shall be designed to support the structural loads indicated on the Drawings. As a minimum the micropile design calculations shall include:

    a. Detailed summary of design assumptions
    b. Applicable code and design references
    c. A figure with micropile identification numbers, reference baseline and elevation datum, and proposed subsurface exploration locations
    d. Details of proposed micropile type, diameter, cased and uncased zones, including soil/rock strata and grout to ground bond values for each stratum.
    e. Micropile design axial and lateral capacity calculations, addressing both geotechnical and structural capacities of the micropile elements
    f. Type and size of reinforcing steel
    g. Total micropile length, and minimum embedment lengths in each stratum included for frictional resistance
    h. Combined stress calculation for cased section, cased section at threaded joints, and uncased section
    i. Bearing and tension plate calculations
    j. Top of micropile connection details.

E. Contractor or Contractor's grout supplier shall submit detailed information about the proposed grout mix to the Engineer. The information shall include:

1. Mix proportions and evidence the proposed mix provides adequate strength and uniform consistency of grout.
2. Type, manufacturer, and chemical composition of grout
3. Type, manufacturer or source, and purposes of admixtures
4. Gradation, fineness modulus, and source of fine aggregates
5. Certification of grout mix materials to be in compliance with "Applicable Standards," including cement, aggregate, and all admixtures

F. Certified mill test reports, properly marked, for the reinforcing steel, as the materials are delivered, to the Engineer for record purposes. The ultimate strength, yield strength, elongation, and composition shall be included. For steel pipe used as permanent casing, or core steel, the Contractor shall submit a minimum of two representative coupon tests or mill certifications (if available) on each load delivered to the project.

G. Proposed Work Plan providing step-by-step procedures for micropile installation, including:

1. Details on spoils management in accordance with the requirements set forth in Newton Conservation Commission's Order of Conditions
2. Proposed equipment and techniques for micropile installation, including rig name, model number, proposed drill attachments, and special equipment for proposed installation method.
3. Detailed sequence of excavation and steel casing installation, water or air flushing, reinforcing steel placement, and grout injection. Identify the planned drilling technique(s) in accordance with FHWA NHI-05-039 Micropile Design and Construction Reference Manual.
4. Methods to prevent caving, if necessary
5. Method of advancing the hole through soil, including cobbles and boulders, urban fill, including construction debris or other obstructions, glacial deposits, and bedrock,
6. Procedures for supporting and centering reinforcing steel and steel casing during grout placement,
7. Plan describing how surface water, drill flush and excess grout will be controlled and disposed. Contractor shall not allow discharge of any materials from the installation of micropiles to enter surrounding water bodies.
8. If welding of casing is proposed, submit the proposed welding procedure, certified by a qualified welding specialist. Lap splicing or welding of longitudinal reinforcing bars shall not be permitted.
9. Cement grout or concrete design mix including admixtures to be used in the mix. Identify planned grout cube or concrete cylinder samples as required herein and relate samples to the construction sequence.
10. Method of pressure grouting the annular space between the permanent casing and the drill hole as the temporary casing is withdrawn, if temporary casing is used.
11. Methods to assure quality control.

H. Detailed plans for the proposed micropile load testing method. This shall include all drawings, details, and structural design calculations necessary to clearly describe the proposed test method, reaction load system capacity, and equipment setup, types and accuracy of apparatus to be used for applying and measuring the test loads and pile top movements in accordance with this specification.

1. Calibration reports and data for each test jack, pressure gauge and master pressure gauge and electronic load cell to be used. The calibration tests shall have been performed by an independent testing laboratory, and tests shall have been performed within 90 calendar days of the date submitted. Testing shall not commence until the Engineer has reviewed and approved the jack, pressure gauge, master pressure gauge, and electronic load cell calibration data.
2. Reaction load frame shall be capable of safely supporting 125 percent of the maximum test load. Structural design calculations shall be sealed by a Registered Professional Engineer currently licensed in the Commonwealth of Massachusetts.

I. Within 3 days after completion of the proof load test, a load test report shall be submitted to the Engineer for review. The load test report shall include:

1. Test pile installation log with the information as required in Item 1.05-J.1

2. Information on the load test including, at a minimum, the load testing sequence, rates and durations of load increments, equipment calibrations, graphical and tabular measurements of deflection, and drawings indicating the test pile and reaction pile locations.

3. Comparison of the load test data to the Acceptance Criteria provided in Item 3.07-J.7 and statement regarding the load carrying capacity of the pile relative to the design loads.

4. The submittal shall be prepared by, signed and sealed by a Professional Engineer registered in the Commonwealth of Massachusetts.

5. Production pile installation shall not begin prior to review of the proof load test report by the Engineer.

J. As-Built Records:

1. Contractor shall submit micropile installation logs within 24 hours of installations, which shall include:
   - pile identification number, dimensions (diameter, wall thickness, and length of steel casing; center bar type, size, and length; top and bottom elevations), cutoff and tip elevation, verticality information,
   - any deviation from specified location,
   - description of soil/ water/ obstructions encountered, length and descriptions of bonded zone,
   - grouting records including time and amount of grout used including maximum and average pump pressures, grout samples taken, finished grout head, re-drill and re-grout records.
   - Installation logs shall also include remarks concerning unusual installation behavior or conditions of the micropile.
   - Elevations and distances shall be provided to the nearest 0.1 ft.
2. Contractor shall submit within 30 calendar days after completion of the micropile work a report containing:
   - "As-constructed" drawings showing the location and designation number of the micropiles sealed by a surveyor as specified herein,
   - Steel manufacturer's mill test reports for the steel pile components incorporated in the installation.

1.06 INSTALLATION TOLERANCES:

A. Install the micropiles as close as practicable to the plan location.

B. Micropiles shall be plumb or battered within 2 percent of total-length plan alignment.

C. The center of the micropile head shall not vary from plan location at cutoff by more than 2-inches.

D. Acceptable tolerance of top of micropile from indicated cutoff elevation shall not be more than ½-inch. Contractor may elect to trim micropiles to cutoff elevation after the pile cap is excavated.

E. Centerline of core reinforcement shall not be more than ¾-inch from centerline of piling.

1.07 QUALITY CONTROL:

A. The Contractor shall employ a Registered Professional Engineer in the Commonwealth of Massachusetts to design the drilled micropiles, load test set-up and instrumentation for pile load tests; monitor, record and evaluate test results; and prepare reports on pile load tests. The Engineer shall have at least five (5) years of experience in drilled micropile design, installation and pile load tests setup, monitoring and analysis.

B. Work shall always be directly supervised by an approved, experienced Project Superintendent with at least three (3) years of recent supervision experience on similar projects, constructed with similar methods and in similar ground conditions.

C. Employ a Surveyor licensed in the Commonwealth of Massachusetts to survey as installed micropile locations. Contractor shall be responsible for establishing the correct plan location of each pile in the field and shall determine and certify the actual location of each pile as installed, including a determination of the deviation(s) of the center of each pile from the plan location. Establish and be responsible for the protection and maintenance of project benchmarks.

D. The Engineer will observe the Contractor's micropile installation. The Contractor shall cooperate with the Engineer in all respects to facilitate any testing or observations.

1. The presence of the Engineer shall not relieve the Contractor of its responsibility to perform the Work in accordance with the approved submittals and contract documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site.

E. The Contractor shall adhere to the applicable requirements of the Standard Specifications, OSHA Standards and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

F. Work not in conformance with the specified requirements shall be improved, or removed and replaced, at no additional cost to the Owner. All costs related to testing of nonconforming Work or materials shall be paid for by the Contractor, at no additional cost to the Owner.

G. The Contractor shall employ an experienced, independent testing agency to obtain grout

cube samples and perform grout testing.

1. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Engineer for final acceptance.
2. If, as a result of these tests, it is determined that the specified grout properties are not being obtained, the Engineer may require such changes in proportions or materials, or both, as may be necessary to secure the specified properties, at no additional expense to the Owner.
3. Provide at no additional expense all materials, labor, and services for sampling and testing required by the Engineer, including but not limited to:
    a. Preparation, handling, storage and transportation of concrete test specimens as required by the Engineer.
    b. Suitable containers for the storage, curing and transportation of concrete test specimens in accordance with ASTM C 31.
    c. Suitable storage for a supply of grout cube molds, test equipment and other items required for sampling and testing.

H. All welding shall be performed by operators who have been previously qualified by tests as prescribed in the AWS. Evidence that welders meet qualification requirements shall be submitted to the Engineer before welding begins.

PART 2 – PRODUCTS

2.01 DRILLING EQUIPMENT:

A. Drilling equipment shall be a type and capacity suitable for installing piles as indicated.

B. Equivalent backup drill rig and equipment shall be available and on site within 7 calendar days if micropile rig or its equipment is not operational.

2.02 MATERIALS:

A. Cement Grout

1. Strength – Cement-based grout shall consist of a mixture so proportioned to produce a hardened mortar with a minimum compressive strength in 28 days of 4,000 psi or greater as determined by the Contractor's mix design, and as referenced to ASTM C125.
2. Cement shall meet the requirements provided in Section 03 30 00, Cast-in-Place Concrete.
3. Water shall meet the requirements provided in Section 03 30 00, Cast-in-Place Concrete.
4. Admixtures shall meet the requirements provided in Section 03 30 00, Cast-in-Place Concrete. Admixtures which control bleed, improve flowability, reduce water content, and retard set may be used in the grout subject to the review and acceptance by the Engineer. Admixtures shall only be added to the grout used for filling sealed encapsulations. Admixtures shall be compatible with the grout and mixed in

accordance with the manufacturer's recommendations. The use of admixtures will only be permitted after appropriate field tests on fluid and set grout properties. Admixtures with chlorides shall not be permitted.

5. Fillers – Inert fillers such as sand may be used in the grout in special situations (e.g., presence of large voids in the ground, when grout take and travel are to be limited) as approved by the Engineer.
6. Mixing
   a. Mix the cement grout with approved equipment and accurately measure all materials by volume or weight per the Contractors' mix design. The grouting equipment shall produce a colloidally mixed grout free of lumps and undispersed cement. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The mixer shall be capable of continuous agitation of the grout.
   b. Mixing time shall not be less than one minute producing a homogeneous grout. Contractor shall perform mud balance tests on at least 25% of grout batches, or as otherwise required by the Engineer.
   c. The grout shall have a maximum temperature of 95ºF.
   d. Place grout within 45 minutes after mixing. This period may be extended to 60 minutes or longer as approved by the Engineer.

B. Steel Casing:

1. Steel casing shall meet the requirements of N-80 – API Specification with a minimum yield strength of 80,000 lb./in2.
2. Steel casing may be new "structural grade" (a.k.a. "mill secondary") steel pipe meeting above but without mill certification, free from defects (dents, cracks, tears) and with two coupon tests per truckload.
3. Minimum outside diameter of steel casings shall be as indicated.
4. Minimum wall thickness of steel casing shall be as indicated.
5. The steel casing tip shall be open-ended.
6. Store steel casing on platforms, skids, or other supports at the site and support to prevent excessive deflection.

C. Reinforcing Steel:

1. Reinforcement shall be high strength; ASTM A615, Grade 75 Thread bar, continuous without splices or welds, new straight, and undamaged.
2. Threading may be continuous spiral deformed ribbing provided by the bar deformations (continuous thread bars) or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, provide the next-larger bar number designation from the shown plans, at no additional cost.

D. Reinforcing Steel Splice Couplings: Couplings shall develop at least 125 percent of the specified yield strength of the rebar in compression and tension. No lap splices shall be used.

E. Plates and Shapes: Refer to requirements in Section 05 12 33, Structural Steel.

F. Centralizers: Centralizers shall be fabricated from plastic, steel, or material that is non-detrimental to the reinforcing steel. Wood shall not be used.

G. Corrosion Protection

1. Sacrificial steel – Unless otherwise noted, the structural analysis of permanent steel casing used as reinforcing steel shall consider a reduction in the outer casing wall thickness to account for sacrificial steel as corrosion protection.
2. Epoxy Coating – If used as an alternative corrosion protection method to sacrificial steel, the thickness of coating applied electrostatically to the reinforcing steel shall be 7-12 mils. Epoxy coating shall be in accordance with ASTM A775 or ASTM A936. Bend test requirements shall be waived. Epoxy coating is not required on bearing plates and nuts encapsulated in the pile concrete cap unless the cap reinforcement is epoxy coated.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS:

A. Install the micropiles only in the presence of the Engineer. Provide a minimum of 48 hours' notice to the Engineer that their presence is required.

B. Contractor is responsible for determining the viable drilling technique(s) for the project conditions, including considerations of access, support of equipment, and space constraints. Changes made to the drilling techniques during the project shall not be cause for delay or impact claims.

C. Spoils from micropile installation shall be managed in accordance with all applicable project specific, state, and federal requirements.

D. Install in general accordance with FHWA NHI-05-039 Micropile Design and Construction Reference Manual.

E. Sequence of permanent casing installation, drilling of bond zone, central reinforcing steel placement, grout injection, and removal of temporary casing procedures used for production piles shall be consistent with the sequence used for test pile installation operations.

F. All installation techniques shall be determined and scheduled such that there will be no damage to micropiles in which grout has not achieved final set.

G. The Contractor shall control and properly dispose of drill fluid and construction related waste, including excess grout, in accordance with any related specifications within the contract documents and all applicable codes and regulations.

H. During construction, the Contractor shall observe the ground conditions in the vicinity of the micropile construction site daily for signs of ground heave or subsidence. Immediately notify the Engineer if signs of movement are observed. The micropile Contractor shall immediately suspend or modify drilling or grouting operations if ground

heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged from the drilling or grouting. If the Engineer evaluates that the movements require corrective action, the micropile Contractor shall take corrective actions necessary to stop the movement or perform repairs.

I. Notify the Engineer immediately of any damage or deviation that may affect the acceptability of the micropile so that corrective measures, if required, may be carried out with a minimum of delay.

J. The following will be sufficient cause for the rejection of micropiles by the Engineer:

1. Deviation from location or vertical alignment requirements specified herein.
2. The micropile bonding zone is not within the correct strata and/or has insufficient bond length.
3. Installation methods not approved by Engineer.
4. Inadequate grout strength.

K. Correct, abandon, and/or replace rejected micropiles to the satisfaction of the Engineer. Replace at no cost to the Owner.

L. Provide the Engineer free and safe access to the work areas at all times.

3.02 INSTALLATION:

A. The drilling equipment and methods shall be suitable for drilling through the conditions to be encountered, without causing damage to the overburden, any overlying or adjacent structures, buried structures or utilities, or services. Casings that fail, fracture, or otherwise distort during drilling or after drilling shall, unless otherwise required by the Engineer, be withdrawn or replaced at the micropile Contractor’s expense. The drill hole must be open along the full length to at least the design minimum drill hole diameter prior to placing grout and reinforcement.

B. Provide permanent steel casing during drilling. Driving of casing and/or the use of vibratory hammers will not be allowed. Drilling shall be performed such that the cuttings and wash fluid return through the inside of the casing. External flush will not be allowed. The method of drilling used shall prevent the loss of ground due to erosion, jetting, or blow-in at the bottom of the casing. No open-hole drilling will be allowed except where advancing micropiles into glacial deposits, weathered rock or bedrock, or as accepted by the Engineer. Use of drilling fluid containing bentonite is not allowed.

1. Flush hole with water or slurry prior to installing reinforcing steel or cement grout until all contaminated water and cuttings are removed and a clean return is observed. Use an internal circulation method which will not alter soil stability or aggravate existing environmental conditions.
2. Contractor shall verify the minimum design nominal hole diameter as determined by outside diameter of casing, unless the Contractor can verify that a larger diameter is developed by installation techniques.

C. Place cement grout by tremie method in accordance with PTI "Recommended Practice

for Grouting of Post-Tensioned and Prestressed Concrete" as applicable. Place tremie pipe to bottom of micropile. Maintain tremie pipe at least five feet below grout surface until casing is filled with grout to cut-off elevation.

D. The central reinforcement steel with centralizers shall be lowered into the stabilized drill holes to the desired depth without difficulty. Partially inserted reinforcing bars shall not be driven or forced into the hole. The Contractor shall re-drill and re-insert reinforcing steel when necessary to facilitate insertion.

E. Install reinforcing steel with centralizers to the full depth of micropile at time of grouting. Provide reinforcing steel couplings, if required. Centralizers shall be placed along the entire length of micropile no greater than 10 feet apart and no less than 4 per micropile. The uppermost and lowermost centralizers shall be located at a maximum of 3 feet from the ends of the reinforcement bar. Centralizers shall permit the free flow of grout without misalignment of the reinforcement.

F. Grouting of a micropile shall be completed on the same day that the micropile is drilled. Obtain grout samples from the end of the tremie grout line for each micropile. Grout specimens will be prepared and tested by the Contractor or their representative, in accordance with ASTM C109.

G. Place at least 100 percent of the theoretical volume of grout based on the inside diameter of the casing through permanently cased lengths and outside nominal diameter of the drill hole through the bond zone. Notify the Engineer immediately if the actual grout take is less than the theoretical volume of grout.

H. Contractor shall monitor and record the amount and rate of water and/or compressed air used during the pressure injection drilling.

3.03 GROUTING:

A. The Contractor shall provide the necessary systems, equipment, and manpower to measure the grout quality, quantity, and pumping pressure during the grouting operations.

B. After drilling, the hole shall be flushed with water and/or air to remove drill cuttings and/or other loose debris. Contractor shall provide a stable, homogeneous neat cement grout or a sand cement grout with the minimum 28-day compressive strength as specified herein. The grout shall not contain lumps or any other evidence of poor or incomplete mixing. Admixtures, if used, shall be mixed in accordance with manufacturer’s recommendations. The pump shall be equipped with a pressure gauge to monitor pressures. The pressure gauge shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The grout shall be kept in constant agitation prior to pumping.

C. Cement Grout Compression Tests:

1. Contractor shall cast two sets of six test cubes (1-inch x 2 inches x 2 inches) per rig per day, and generally representing one set of morning and one set of afternoon installation activities for each drill rig. Cubes shall be cast and tested in accordance

with the provisions of ASTM C109.

2. Two cubes shall be tested in compression at each of the ages of 7 days, 28 days, and two retained for testing at 56 days, if the need is so determined.
3. Grout consistency as measured by grout density shall be determined per API RP-13B-1 at a frequency of at least one test per micropile, conducted just prior to start of pile grouting. The Baroid Mud Balance used in accordance with API RP-13B-1 is an approved device for determining the grout density of neat cement grout.
4. Provide grout cube/cylinder compressive strength and grout density test results to the Engineer within 24 hours of testing.

D. The grout shall be injected from the lowest point of the drill hole until clean, pure grout flows from the top of the micropile. The grout may be pumped through grout tubes or drill rods. After tremie grouting, all grouting operations including extraction of temporary drill casing and pressure grouting must ensure complete continuity of grout column. The use of compressed air to directly pressurize the fluid grout is not permissible. The grout pressures and grout takes shall be controlled to prevent excessive heave in cohesive soils or fracturing of soil or rock formations. The entire micropile shall be grouted above the design cut-off level to provide for shrinkage.

E. Upon completion of grouting for Type A and B piles (as defined by FHWA NHI-05-039), the grout tube may remain in the hole, but it shall be filled with grout. For Type C and D piles, grout tubes shall be installed prior to the tremie grouting. If the Contractor uses a post-grouting system, all relevant details including grouting pressure, volume, location and mix design, shall be included in the pre-construction submittals.

F. Place grout without excessive duration or delay in one continuous operation to the required cutoff elevation, to preclude the possibility of grout setting up prior to the completion of micropile placement or cold joints forming in the micropile.

G. Pile grouting and bond zone drilling operations for each individual micropile shall be completed during the same working day to prevent bond zone deterioration or inflow of deleterious materials into the bond zone of the micropile.

H. If grout loss or a drop in the grout level is observed after grouting and prior to the placement of core reinforcement, the grout will be allowed to cure for one day. The hole will then be re-drilled and re-grouted. This process will be repeated until no grout loss or drop in the grout level is observed after grouting and prior to the placement of core reinforcement.

I. Provide hot weather protection to grout mix, installation equipment during placement, and fresh grout during curing in conformance to ACI 305, or as required by the Engineer.

J. Provide cold weather protection to grout mix and installation equipment during placement to prevent installation of frozen grout.

K. Provide cold weather protection to all exposed surfaces of fresh grout during curing in conformance to ACI 306, or as required by the Engineer.

L. Contractor shall be responsible for cleaning up and disposing of all construction related

debris and spoils and disposing of them in a near site disposal area.

M. Contractor shall leave site at a uniformly sloping grade that precludes excessive ponding of water at the site.

3.04 OBSTRUCTIONS:

A. Obstructions are defined as any object encountered below ground surface during drilled micropile installation that prevents advancement of the pile element to the design depth.

B. The Contractor shall reference the boring logs, laboratory data, and available plans showing site conditions as provided in Section 00 31 32.

C. If an obstruction is encountered, the Contractor shall document the following items, and submit them to the Engineer at the end of each work week.

1. Date and time that the obstruction was encountered.
2. Duration that the obstruction prevented Work progress.
3. Depth or depth range of the obstruction.
4. Date and time that the obstruction was passed, and production Work resumed.
5. Nature of the obstruction, and how the obstruction prevented the Work progress.
6. Measures implemented to overcome the obstruction.
7. Cost impact of the obstruction on the Work (labor, equipment, materials).

D. The Engineer will also document the above information when notified by the Contractor that obstructions are encountered.

E. Where obstructions interfere with installing an element at the location shown on the plans and to the required depth, the Contractor shall propose methods and submit details to the Engineer for removal of or advancement through obstructions if encountered during the installation of the micropiles. No excavation for obstruction removal shall be conducted except in the presence of the Engineer. Pre-excavations shall be backfilled in accordance with Section 31 00 00 – Earthwork.

F. If an obstruction is encountered that the installation rig cannot overcome, the Contractor shall move to another production location and continue the Work, while the obstruction is removed or the Engineer selects an alternate element location to replace the obstructed location.

G. Fill with grout any micropile abandoned because of obstructions encountered before reaching the anticipated depth at no additional cost to the Owner.

3.05 MICROPILE PENETRATION:

A. Micropiles shall have a bond zone which starts below the top of the bonding stratum (excluding the casing plunge depth) and extends to at least the required minimum length to develop frictional capacity as determined by the design calculations and confirmed by static load testing.

3.06 REJECTED PILES:

A. The Engineer will determine the acceptability of all micropiles placed and may reject those piles which do not conform to the Contract Documents.

B. As required by the Engineer, for those micropiles which have been rejected, micropiles shall either be left in place or cut off and then install one or more new micropiles at locations designated by the Engineer to replace the rejected pile and maintain symmetry of the pile group or cluster at no additional cost to the Owner.

3.07 MICROPILE LOAD TEST PROGRAM:

A. Perform verification and proof testing of micropiles per the Contractor's approved pile load testing plan at the locations selected by the Engineer. The Engineer shall be on-site to observe and document the load test.

B. Perform tension load testing in accordance with ASTM D3689 and MSBC subsection 1810.3.3.1.11, except as modified herein.

C. Test micropiles shall be installed in accordance with procedures required for production piles.

D. The maximum verification and proof test loads applied to the micropile shall not exceed 80 percent of the structural capacity of the micropile structural elements; including steel yield in tension, steel yield or buckling in compression, or grout crushing in compression. Any required increase in strength of the verification and proof test pile elements above the strength required for production piles shall be provided for in the Contractor's bid price.

E. Testing equipment shall include dial gauges, dial gauge independent reference frame, jack and pressure gauge, electronic load cell (with readout device), strain gauges, and a reaction frame. The Contractor shall provide a description of test setup and jack, pressure gauge and load cell calibration curves in accordance with the submittals section.

F. The testing reaction frame shall be sufficiently rigid and of adequate dimensions such that excessive deformation of the testing equipment does not occur. Align the jack, bearing plates, and stressing anchorage such that unloading and repositioning of the equipment will not be required during the test. The reaction frame shall be monitored for movement during the load test by optical survey.

G. Apply and measure the test load with a hydraulic jack and pressure gauge and load cell. The pressure gauge shall be graduated in 100 psi increments or less. The jack and pressure gauge shall have a pressure range not exceeding twice the anticipated maximum test pressure. Jack ram travel shall be sufficient to allow the test to be done without resetting the equipment. Use the load cell to accurately maintain a constant load hold during the creep test load hold increment of the verification test. The alignment load (AL) shall not be more than 5% of the maximum test load.

H. Measure the pile top movement with at least three (3) dial gauges set 60 degrees apart

capable of measuring to 0.001-inch. The dial gauge shall have a travel sufficient to allow the test to be done without having to reset the gauge. Visually align the gauges to be parallel with the axis of the micropile and support the gauges independently from the jack, micropile, or reaction frame.

I. Provide approved strain gauges in each verification and proof load test pile. A minimum of three strain gauges shall be attached to the steel core in each test pile: 1 foot from the bottom of the micropile, at the mid-point between the bottom of the micropile and the bottom of the surface casing, and at the bottom of the surface casing. There must also be at least one strain gauge per bearing stratum and at least one stain gauge per each 10 feet of total bond length. Provide a strain gauge switching unit and a readout unit for reading the gauges during the load test.

J. Verification Load Testing

1. Contractor shall conduct a static verification pile load test up to 200% of the design bearing load on a sacrificial pile in advance of installing production micropiles. The verification test micropile shall be at a location approved by the Engineer.
2. Contractor shall perform a minimum of three exploratory micropile drill probes at non-production pile locations distributed across the project site. The Engineer will identify specific locations for the exploratory drill probes based on previous borings performed at the site and the foundation plan.
3. Based upon the results of the exploratory micropile probes, the Engineer will select the exploratory micropile probe to be completed as the verification test pile. The remaining exploratory micropile probe locations shall be backfilled with bentonite chips and/or cement grout.
4. The Contractor shall assess the micropile performance and capacity and notify the Engineer of modifications to the pile, if any. These modifications may include modifying the installation methods, increasing the bond length, or changing the micropile type.
5. At the completion of verification testing, test micropile shall be removed down to an elevation specified by the Engineer.
6. The verification testing shall be loaded as indicated in the table below:

Verification Load Test Table

Step	Loading	Applied Load	Hold Time (min.)
1	Apply AL	0.05 DL	2.5
2	Cycle 1	0.15 DL	2.5
		0.30 DL	2.5
		0.45 DL	2.5
		AL	1.0
3	Cycle 2	0.15 DL	1.0
		0.45 DL	1.0
		0.60 DL	2.5
		0.75 DL	2.5
		0.90 DL	2.5

		1.00 DL AL	2.5 1.0
4	Cycle 3	0.15 DL 1.00 DL 1.15 DL 1.30 DL	1.0 1.0 2.5 Creep Test - See Below
Hold the load for the Creep Test at least 10 minutes while recording movement at 1, 2, 3, 4, 5, 6, and 10-minute intervals. If the total movement measuring during the load hold exceeds the specified maximum value, the load should be extended for an additional 50 minutes (i.e., 1 hr. total hold time).			
5	Cycle 3 cont'd.	1.45 DL AL	2.5 1.0
6	Cycle 4	0.15 DL 1.45 DL 1.60 DL 1.75 DL 1.90 DL 2.00 DL 1.50 DL 1.00 DL 0.50 DL AL	1.0 1.0 1.0 2.5 2.5 10.0 5.0 5.0 5.0 5.0
7	Remove the load and compare results to acceptable criteria.		

Notes: Measurement of micropile movement shall be obtained at each increment. The load hold period shall start as soon as the test load is applied. The alignment load (AL) shall not exceed 5 percent of the DL load. Dial gages shall be reset to zero after the initial AL is applied.

7. Acceptance Criteria

    1. The total vertical movement at the micropile head for the 1.0 DL load increment should not exceed 0.5-inch.
    2. The total vertical movement at the end of the 1.3 DL load increment should not exceed 0.04-inch for the hold time between 1 and 10 minutes and should not exceed 0.08-inch between 6 and 60 minutes if held longer.
    3. The failure load is defined as the load where the slope of the load versus micropile head deflection first exceeds 0.025-in./kip.

3.08 WASTE MANAGEMENT:

A. Separate and dispose of waste in accordance with the Project's Waste Management Plan, if applicable. Site cleanup shall be performed to the satisfaction of the General Contractor.

END OF SECTION

SECTION 32 11 00

SIDEWALK CONSTRUCTION AND REPLACEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall furnish all labor, materials, equipment and incidentals required to restore gravel sidewalks and/or construct new or replacement hot mix asphalt or cement concrete sidewalks where directed or where existing sidewalks are disturbed by the Contractor, as shown on the drawings and described herein. The Contractor shall also furnish all materials and install pedestrian curb ramps where shown on the drawings or as required by the Engineer.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 32 16 00, GRANITE CURBING

C. Section 32 16 13.26, PRECAST CONCRETE CURB

1.03 REFERENCES:

The following standards form a part of these specifications, as referenced:

Massachusetts Department of Transportation (MassDOT)
Standard Specifications for Highways and Bridges

Section 701	Cement Concrete Sidewalks, Pedestrian Curb Ramps and Driveways
Section 702	Hot Mix Asphalt Sidewalks and Driveways

Code of Massachusetts Regulations (CMR)

521 CMR 24	Ramps

1.04 SUBMITTALS:

A. In accordance with Section 01 33 23 SUBMITTALS the Contractor shall submit shop drawings and/or materials specifications for each component of the work to be performed under this section of the Specifications.

1.05 SYSTEM DESCRIPTION:

A. GRAVEL SIDEWALKS:

Gravel sidewalks shall be restored to a condition at least equal to that existing immediately before the work was started.

B. HOT MIX ASPHALT AND CEMENT CONCRETE SIDEWALKS AND PEDESTRIAN CURB RAMPS:

1. Except as otherwise indicated, hot mix asphalt and cement concrete sidewalks and pedestrian curb ramps shall be constructed in accordance with the requirements of Sections 701 and 702 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges, and all amendments thereto.

2. Pedestrian curb ramps shall be installed in new sidewalks at intersections in accordance with 521 CMR 24 and Mass DOT Section 701. When curbs or sidewalks are constructed or reconstructed on one side of the street, curb cuts shall also be installed on the opposite sides of the street, where there is a pedestrian path of travel. Curb cuts shall be located within the crosswalk and/or the pedestrian path of travel.

C. Water boxes, manhole frames, and all other castings shall be carefully set to the proposed finished grade.

D. Sidewalks shall not be less than 48-inches in width, excluding curbing. An unobstructed path of travel shall be provided which is at least 36-inches clear, excluding curbing.

PART 2 - PRODUCTS

2.01 HOT MIX ASPHALT SIDEWALKS:

A. Sidewalks shall consist of hot mix asphalt.

B. Hot mix asphalt shall conform to the requirements of MassDOT M3.11.6.

2.02 CEMENT CONCRETE SIDEWALKS AND PEDESTRIAN CURB RAMPS:

A. Cement concrete sidewalks shall be constructed with air entrained Cement Concrete with a minimum compressive strength of 4000 psi at 28 days.

B. Cement concrete shall conform to the requirements of MassDOT M4.02.

PART 3 - EXECUTION:

3.01 HOT MIX ASPHALT SIDEWALKS:

A. The subgrade for the sidewalks shall be shaped parallel to the proposed surface of the sidewalks and shall be thoroughly rolled and tamped. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard in order for a gravel foundation to be placed upon it.

B. The hot mix asphalt sidewalk shall be a minimum of 2½ compacted inches thick, laid in two equal courses. The sidewalk pitch shall be 3/16-inch per foot of width or shall match the existing sidewalk.

3.02. CEMENT CONCRETE SIDEWALKS AND PEDESTRIAN CURB RAMPS:

A. Concrete for sidewalks and pedestrian curb ramps shall be a minimum of 4-inches thick. At driveways, the sidewalks shall be 6-inches thick.

B. The subgrade for the walk or driveway shall be shaped to a true surface conforming to the proposed slope of the walk, thoroughly rolled at optimum moisture content and tamped with a power roller weighing not less than one ton and not more than 5 tons. All depressions occurring shall be filled with suitable material and again rolled or tamped until the surface is smooth and hard.

C. After the subgrade has been prepared as hereinbefore specified, a subbase of gravel borrow at optimum moisture content shall be placed, thoroughly rolled by a power roller, and tamped. The gravel borrow shall be a minimum of 8-inches in thickness.

D. The forms for sidewalks shall be smooth, free from warp, strong enough to resist springing out of shape, and deep enough to conform to the thickness of the proposed walk. All mortar or dirt shall be completely removed from forms that have been previously used. The forms shall be well staked, thoroughly braced, and set to the established lines with their upper edge conforming to the grade of the finished walk. The finished walk shall have sufficient pitch from the outside to the edge of the walk to provide for surface drainage. This pitch shall be ¼-inch per foot unless otherwise directed by the Engineer. Before the concrete is placed, the subbase for sidewalks shall be thoroughly dampened until it is moist throughout but without puddles of water.

E. Concrete shall be conveyed from the place of mixing to the place of deposit in such a manner that no mortar will be lost, and the composition of the mix shall be uniform, showing neither excess nor lack of mortar in any one place. The consistency shall be such that water will float to the surface under heavy tamping. The concrete shall be placed as close to its final position as practicable and thoroughly consolidated, with precautions taken not to overwork it while it is still plastic. The concrete shall be thoroughly spaded along the forms or screeds to eliminate voids and honeycombs at the edges. Retempering of concrete will not be permitted.

F. Concrete shall be placed in alternate slabs not exceeding 30 feet in length. Slabs shall be separated by transverse preformed expansion joint filler ½-inch thick. The surface of all concrete sidewalks shall be uniformly scored into block units of not more than 40 square feet. The depth of the scoring shall be at least one quarter of the thickness of the sidewalk.

G. When concrete sidewalks are constructed adjacent to curbing, building foundations, retaining walls, light pole bases or fixed structures, ½-inch thick premolded joint filler shall be used between the newly constructed sidewalk and the structure.

H. Finishing of the concrete surface shall be done by experienced and competent cement finishers as soon as is practicable. Finishing shall be delayed until all bled water and water sheen has left the surface and the concrete has begun to stiffen. The concrete surface shall be finished as directed with a steel trowel or wood float to give a smooth, uniform and attractive surface finish and uniformly scored into block units or areas of not more than 36 square feet. Following this, the Contractor shall draw a nylon push broom lightly over the surface to produce a non-slip surface. Application of neat cement to the surface to hasten hardening is prohibited.

I. The Contractor shall protect the newly placed concrete surface against vandalism and marking or defacing and must stand ready to replace any blocks which, in the opinion of the Engineer, are excessively marked or defaced, at no additional cost to the Owner. When completed the walks shall be kept moist and protected from traffic and weather for at least 3 days.

J. Adequate protection shall be provided where temperatures of 40ºF or lower occur during placing of concrete and during the early curing period. The minimum temperature of fresh concrete after placing and for the first 3 days shall be maintained above 55ºF. In addition to the above requirements, an additional 3 days of protection from freezing shall be maintained.

END OF SECTION

SECTION 32 15 40.13

STABILIZED STONE DUST PAVEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work to be done under this Section shall be the furnishing, placement and compaction of stabilized stone dust surfacing as shown on the drawings and as specified herein. The Contractor shall be responsible for supplying the material, labor, equipment and transportation necessary to do the work.

1.02 RELATED WORK:

A. Section 01 33 23, SUBMITTALS

B. Section 31 00 00, EARTHWORK

1.03 SAMPLES:

A. Prior to ordering and delivering materials to the site, (1) representative samples of stone dust shall be sent to the Owner's Representative for approval. The material shall be analyzed by a certified testing laboratory and certified by the supplier as a byproduct of a stone quarry operation.

B. The color shall be medium to dark gray when wet and consistent throughout. Samples must match that product which is to be installed.

PART 2 - PRODUCTS

2.01 STONE DUST:

A. Stone dust shall be the product of a stone crusher and shall consist of inert materials that are hard, durable stone, free from surface coatings and deleterious materials.

B. Gradation requirements shall be as follows:

Sieve	**Sieve Size (mm)**	**Percent Passing**
4	4.75	80-100%
6	2.36	65-90%
16	1.18	40-65%
30	0.6	25-55%
50	0.3	15-35%

100	0.15	10-20%
200	0.075	5-15%

2.02 STABILIZER:

A. Non-toxic, non-staining water-activated soil stabilizer.

B. "Organic-Lock" by Envirobond Products Corporation, 6191-2100 Bloor Street West, Toronto, Ontario, Canada M6S 5A5, (866)-636-8476, or approved equal.

PART 3 - EXECUTION

3.01 PLACING AND COMPACTING:

A. The stone dust shall be placed over a previously approved and installed compacted base of gravel as detailed and as specified under Section 31 00 00 of these Specifications.

B. The stone dust shall be placed to the line and grades shown on the plans and shall consist of a minimum of the detailed thickness after watering and compacting to ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T99 compaction test Method C at optimum moisture content as determined by the Owner's Representative.

C. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of three-eighths (3/8) inch above or below the required cross sectional elevations and to a maximum irregularity not exceeding three-eighths (3/8) inch under a ten (10) foot line longitudinally. Any specific area of material sub-base which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed, replaced and recompacted by the Contractor without extra compensation.

3.02 SOIL STABILIZER BLENDING:

A. The soil stabilizer shall be carefully measured and shall be subsequently blended with the stonedust at the manufacturers recommended rate for three (3) inch compacted stabilized stonedust pathways.

3.03 COMPLETING INSTALLATION

A. Apply a light spray to the surface of the material to give a clean appearance. Apply water until the water begins to run-off. Do not allow any traffic on the newly installed pathway until fully cured, a minimum of 24 to 72 hours.

3.04 REPAIRS AND PROTECTION

A. Excavate the damaged area and scarify exposed stone dust pathway.

B. Pre-blend the replacement crushed stone aggregate material with stabilizer at 28-34 lbs / imperial ton. Apply the material to the excavated area and compact. Thoroughly water the material to achieve an 8-10% moisture content.

C. Allow the newly installed stabilized stone dust to cure, but not completely dry out.

D. Re-compact the material, ensuring that the final grade and crown are maintained.

END OF SECTION

SECTION 32 16 00 **[BID ALTERNATE #1]**

GRANITE CURBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers furnishing and installation of granite curb and precast parking curb, where required, as shown on the Drawings and herein specified.

B. This section also covers replacement of curbing removed during construction.

1.02 RELATED WORK:

A. Required earthwork is specified under Section 31 00 00 EARTHWORK.

B. Section 03 30 00, CAST-IN-PLACE CONCRETE

C. Section 32 15 40.13, STABILIZED STONE DUST PAVEMENT

1.03 REFERENCES:

The following standards form a part of these specifications, as referenced:

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

Shop drawings, showing dimensions of typical curb sections.

PART 2 - PRODUCTS

2.01 GRANITE CURBING:

A. Granite curbing shall be Type VAI conforming to Subsection M9.04.1 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges.

B. Special shapes and corners shall be supplied as required.

PART 3 - EXECUTION

3.01 GRANITE CURBING:

A. Removal and resetting and/or removal and replacing of granite curbing shall be in accordance with Section 580 of the latest edition of the MassDOT Standard Specifications for Highways and Bridges. The curbing shall have a 4-inch reveal unless otherwise required by the Owner's Representative.

B. Except as modified herein or on the drawings, installation of curbing shall conform to Section 500 of the MassDOT Standard Specifications for Highways and Bridges.

C. Excavation shall be made to the bottom of the 6-inch gravel base below the curbing, the trench being sufficiently wide to permit thorough tamping. The base shall be compacted to a firm, even surface and shall be approved by the Owner's Representative.

D. The curbing shall be set on edge and settled into place with a heavy wooden hand-rammer, to the line and grade required, straight and true for the full depth. The joints of the stone curbing shall be pointed with mortar for the full depth of the curbing. At approximately 50-foot intervals, a 1/2-inch joint shall not be filled with mortar but left free for expansion. The ends of the stone curbing at driveways and intersections shall be cut at a bevel or rounded as required by the Owner's Representative.

E. The trench for the stone curbing shall be backfilled with approved material; the first layer to be 4 inches in depth, thoroughly rammed; the other layers to be more than 6 inches in depth and thoroughly rammed until the trench is filled.

F. Where indicated on the plans, or as required, drainage openings shall be made through the curbing at the elevations and of the size required.

END OF SECTION

SECTION 32 16 13.26

PRECAST CONCRETE CURB

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to construct the precast concrete curb, as indicated on the Drawings and as specified.

1.02 RELATED WORK:

A. Required earthwork is specified under Section 31 00 00 EARTHWORK.

B. Section 03 30 00, CAST-IN-PLACE CONCRETE

C. Section 32 15 40.13, STABILIZED STONE DUST PAVEMENT

1.03 REFERENCES:

The following standards form a part of these specifications, as referenced:

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges

1.04 QUALITY ASSURANCE

A. Unless otherwise indicated, precast concrete curb materials and construction shall conform to the applicable portions of the following:

MHD Specification Section 500, "Curb and Edging".

1.05 SUBMITTALS

A. Product Data: For each product indicated.

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast concrete curb units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.

D. Welding certificates.

E. Material certificates.

1.06 SAMPLE SECTION

A. A sample curb section, full dimension, 6 ft. long minimum, shall be constructed for curb prior to start of precast concrete curbing. The work will be inspected by the Architect. If the original sample is not acceptable, the Contractor shall have additional sample sections fabricated until an accepted sample is obtained. The accepted sections shall become the standard for the entire job, and shall remain undisturbed until completion of all precast concrete curbing.

1.07 FIELD LAYOUT

A. The Contractor shall field stake the curb layout for Architect's approval prior to start of excavation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Precast curb units shall be delivered to the job adequately protected from damage during transit.

B. Curb units shall be stored off the ground with wood cribbing between each unit. Curb shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Precast curb units shall be the product of one of the following precast concrete suppliers, or an approved equal:

1. Nelson Precast, Inc.
   Braintree, MA 02184
2. Field Concrete Pipe
   Wauregan, CT
3. Durastone Company

Lincoln, RI
4. Chase Precast Corp.
   North Brookfield, MA 01535
5. American Concrete Products Company, Inc.
   Framingham, MA 01701

2.02 CONCRETE MIXES

A. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.45.

B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

2.03 FORMS

A. Forms shall be wood or steel and shall have a "smooth form" surface.

2.04 SIZE AND DIMENSIONS

A. Straight curb units shall be 6 x 18 in., 6 ft. lengths.

B. Curved curbing shall be employed on radii up to 150 ft.

C. Arris exposed to traffic shall be rounded to a 3/4 in. radius. Back arris line shall be straight.

D. Curb units shall be true to line, plane, and dimensions.

2.05 FINISH

A. Finish exposed-face surfaces of precast concrete curb units to match approved design reference sample and as follows:

1. Smooth-Surface Finish: Free of pockets, sand streaks, and honeycombs, with uniform color and texture. Curb units shall have a uniform, smooth texture finish, free from cracks and other defects. Color of units shall be uniform.

B. Curb shall have no paint, mortar, or other coating.

2.06 CURING

A. Precast units shall be moist cured by steam or water for a sufficient length of time for the concrete to obtain the required compressive strength. Curing compounds will not be permitted.

B. Curing by steam shall begin within 2 to 4 hours after concrete has been placed and has attained its initial set.

1. Steam shall be at 100% relative humidity to provide moisture for proper cement hydration. Steam shall be directly applied onto the concrete.
2. During steam application, ambient air temperature shall increase at a rate not to exceed 40^{o}F per hour until a maximum temperature of 130^{o}F is reached.
3. When discontinuing steam application, ambient temperature shall be decreased at a rate of 40^{o}F per hour until a temperature of 20^{o}F above atmospheric temperature has been attained.
4. Forms shall be removed after curb units have been steam cured for 24 hours minimum.
5. Concrete shall not be exposed to temperatures below freezing for a minimum of 6 days after steam curing.

C. Water Curing: Units shall be water cured by covering with water saturated material, or other acceptable or approved methods. Curing period shall be 5 days, minimum.

2.07 PENETRATING SEALER

A. Penetrating sealer shall be Consolideck SX, manufactured by Prosoco Industries, Kansas City, MO 66177; Sil - Act, manufactured by Advanced Chemical Technologies; or equal selected from the "Qualified Product List" as maintained by the MHD Research and Materials Section.

B. Sealer shall be applied to all surfaces in strict accordance with manufacturer's published application and safe use instructions before being shipped from the casting yard.

1. After precast concrete curb has cured, and is at least 14 days old, and before delivery of curb units to the Project site, apply coating of penetrating sealer to curb surfaces.

2. Surfaces shall be thoroughly dry and shall be cleaned to remove all oil, grease, dirt, and loose particles which would prevent the coating from oenetrating the concrete. Immediately before coating application, an air blast shall be directed over the surface to be coated to remove dust.

3. Application rate for protective coating shall not exceed 1 gallon per 200 sq. ft. of curb surface.

4. Protective coating shall be applied to curb surfaces by either low pressure spray or hand methods. Spray nozzles shall be within 18 in. of concrete, or as directed. Unless otherwise directed, temperature of the concrete and air shall be 50^{o}F. or higher at the time of coating application.

5. Following the coating application, concrete shall be protected in accordance with coating manufacturer's printed instructions.

PART 3 - EXECUTION

3.01 SETTING CURB

A. Curb shall be set in a minimum 18 in. wide trench, with trench bottom at 6 in. below bottom of curb. Excavation shall be filled to required level with base course material conforming to the requirements of Section 31 00 00, EARTHWORK.

B. Vertical face of vertical curb shall be plumb, with curb top parallel to adjacent surface.

C. Curb units shall be placed accurately to line. Final points (locations where lines of curb intersect) shall be joined by closure pieces made to order and not greater than 30 in. in length. Curb shall not be field cut except with the prior permission of the Architect.

D. Curb units shall be butted together with joints between curb units (both front and back) no greater than 1/8 in. Joint space shall not be filled with mortar.

E. Set curb to required line and grade. Where indicated, provide transition sections to create smooth transition between standard curb and flush curb at entrances, ramps, etc.

F. Backfill material on each side of curb shall be as specified for adjacent surface and shall be thoroughly compacted by means of power tampers. Extreme care shall be taken not to destroy alignment. Curb sections disturbed during backfilling or otherwise shall be reset to line and grade, and properly backfilled.

3.02 PROTECTION AND REPAIR OF CURBING

A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect.

B. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

END OF SECTION

SECTION 32 17 23

PARK REGULATION SIGNS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including the General and Supplementary Conditions and Division 0 – Bidding Documents, Contract Forms, and Conditions of the Contract and Division 1 – General Requirements, apply to the work of this Section.

B. Carefully examine all the Contract Documents for requirements which affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.1 REFERENCES

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 WORK INCLUDED

A. This work shall consist of the careful removal of signs, attached hardware and supports and installing City galvanized post anchors at locations shown on the plans and as directed by the Owner's Representative.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 03 05 00, Field Concrete

2. Section 03 30 00, Cast-in-Place Concrete

1.4 STANDARDS

A. The following standards including all current amendments form a part of these Specifications:

1. American Society for Testing and Materials (ASTM):

A36	Structural Steel
A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
A120	Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
A325	High Strength Bolts for Structural Steel Joints
A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing Rounds and Shapes

2. American Welding Society (AWS):
   D1.1 Structural Welding Code

3. Steel Structures Painting Council (SSPC):
   SSPC Surface Preparation Specifications

1.5 SAMPLES AND SUBMITTALS

A. At least thirty days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with requirements this specification. Do not order materials until Owner's Representative's approval of samples, certifications or test results have been attained. Delivered materials shall closely match the approved samples.

1. Shop Drawings: Submit detailed shop drawings for each item required to be fabricated or installed under work of this Section. Include plans, sections, and details as required to show completely materials, layout, jointing, clearances and connections for all items required. Shop drawings for handrails at stairs and at other site conditions requiring accurate dimensional relationships to as-built construction shall be prepared following a review and confirmation of as-built measurements and conditions for areas scheduled to receive miscellaneous metal items. Submit shop drawings for the following:

   a. Park Regulations signage and posts
   b. Temporary Pedestrian Access Route signage

2. Material Samples: Submit samples for each material for the following:

   a. Railing tube material and finishes – submit one (1) sample
   b. Sheet metal material and finishes – submit three (3) samples of finishes for brushed stainless steel per manufacturer's recommendation and Owner's direction.

3. Manufacturer's Literature: Submit three (3) copies each of manufacturer's material descriptions and installation instructions for the following:

   a. Non-shrink cement grout,
   b. Sealant.

4. Finishing Schedule: Submit a complete schedule outlining all items to be color finished under work of this Section together with a breakdown of surface preparation techniques and primer and color finish materials to be applied.

PART 2 - PRODUCTS

2.01 PARK REGULATION SIGNS

A. Park regulation sign shall be 12-inches wide by 24-inches high, affixed to a steel pipe post per the details included in the Contract Drawings.

B. The location and quantity of park regulation signs are included on the Contract Drawings.

C. A pdf of the park regulation sign design is included in Appendix D. The original files for the design shall be provided by the Owner upon the Contractor's request.

2.02 STEEL PIPE SIGN POSTS

A. Steel pipe for straight sections and for pipe sleeves shall be schedule 40 square seamless steel pipe in accordance with ASTM A120.

B. Square or rectangular steel tubing as required, shall conform to requirements for ASTM A500, Grade B, structural steel tubing. Wall thickness shall be one-eighth inch (1/8") or as detailed.

C. Steel hardware for designated structural purposes shall conform to ASTM A325 requirements for galvanized hardware.

D. Fabrication: Steel posts shall be fabricated in accordance with details, specifications and approved shop drawings. Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw-cut, formed with "fish-mouth" joints, and shall be full seam welded, ground smooth and sanded to produce a high standard of surface smoothness. No grinding marks shall be visible in the finished work.

E. Welding shall be in conformance to AWS code.

2.03 MISCELLANEOUS HARDWARE

A. Miscellaneous stainless steel hardware as required for the project shall be 18-8 stainless steel (AISI Type 304).

.

B. Bolts: 3/8" Dia. SS Kwik Bolt II Expansion Anchor – Countersunk Version by HILTI Inc., PO Box 21148, Tulsa, OK, 74121

2.04 PIPE AND ACCESSORIES

a. Only weld and seamless galvanized steel pipe shall be utilized.

b. All steel for handrails shall conform to ASTM-A53-67A and all galvanizing shall conform to ASTM-A-123.

PART 3 - EXECUTION

3.01 STEEL PIPE SIGN POSTS

A. Fabricate and install steel sign posts in conformance to details, and approved shop drawings. Measure on-site conditions to receive posts prior to preparing shop drawings.

3.02 MISCELLANEOUS HARDWARE

A. Furnish dowels and other miscellaneous hardware items for work of other Sections as specified and/or as required on the Drawings.

B. All anchoring systems employed shall be vandal-proof.

3.03 TOUCH-UP OF SURFACES

A. After erection, all scratches or abrasions in the color galvanized surface shall be repaired or replaced to the satisfaction of the Owner's Representative.

END OF SECTION

SECTION 32 31 00

BLACK VINYL CHAIN LINK FENCING

PART 1- GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing Black Vinyl Chain Link (BVCL) fence and gates with posts, sleeves and appurtenances, as shown on the drawings and as specified herein including all labor, materials and equipment necessary to finish the work complete in place, but is not limited to the following:

1. 4’ Ht. Steel BVCL Fence and Gates

B. Fences must meet all safety code requirements for BVCL spacing, etc.

C. Provide product and all materials necessary for installation.

1.02 STORAGE AND HANDLING

A. Store items in original undamaged packages until ready for installation. Items must be protected from weather, careless handling and vandalism. Handle items with sufficient care to prevent any scratches or damage to the finish.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Coordinate all of the work with the Owner’s Representative.

B. Quality Standards:

i. Commonly listed standards

1. ASTM – American Society for Testing and Materials.
2. AAMA – American Architectural Manufacturers Association.
3. AISI – American Iron and Steel Institute.
4. ADA – Americans with Disabilities Act (ADA) and MAAB.
5. AASHTO – American Association of State Highway and Transportation Officials.
6. NLGA – National Lumber Grades Authority.

ii. Fabrication

1. All wood components should be premium grade lumber.

2. All hardware and fasteners shall be painted galvanized and / or stainless steel unless otherwise noted.

3. All steel components should be finished with a powder coated system that will ensure long lasting protection again acids, salts, and corrosive moisture.

iii. Installation

1. Installer shall be responsible for coordinating underground utilities and structures with Dig Safe and as-builts for all proposed construction.

2. All items specified in this section shall be installed plumb and set to the existing or proposed grade.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer's literature of the materials specified herein.

B. Shop drawings of the fence and the proposed color.

1.05 WARRANTY:

A. Prior to installation, the fence contractor shall provide the fence manufacturer's notarized certification that all vinyl components are fully warranted by the manufacturer for 15 years against rust and corrosion.

PART 2 - PRODUCTS AND EXECUTION

2.01 STEEL FRAMEWORK (GENERAL)

A. GALVANIZING:

a) Hot-dip galvanize all items under this section in compliance with ASTM A 653/ASTM A635M. Provide minimum .90 oz./ft.^{2} zinc coating. Galvanize after fabrication.

b) Following galvanizing, each item shall receive surface grinding to remove lumps, sags or spikes resulting from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.

B. Top and bottom rails and midrails and hinge assemblies, called for on the drawings, shall conform to ASTM Designation A36.

C. Bolts, nuts, washers and any other fasteners shall conform to ASTM Designation A307.

D. Post caps shall be cast iron or steel in the sizes required, finished in conformance with all other fence elements. Caps shall be as manufactured by Julius Blum & Co., Inc., Carlstadt, New Jersey; Boundary Fence and Railing Systems, Inc. Richmond Hill New York; Monumental Iron Works, Inc., Baltimore, Maryland; or approved equal. All caps are to be coated with a minimum 3.0 mil thickness of liquid galvanizing compound by dipping.

E. All gates shall be equipped with a positive type latching device capable of retaining the gate in a closed position and have provision for padlock. Latches shall permit operation from either side of gate and must be approved by the Owner's Representative prior to the installation

F. Double gates: Provide locking cane-bolt style drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.

2.02 FINISH

A. Cold galvanizing compound shall be a single component zinc rich compound yielding a dry film of at least 85% pure zinc. Galvanizing compound shall meet or exceed the requirements of Federal Specification MIL-P-21035, TT-P-641d primer for zinc rich compounds.

B. Finish color coating shall be Color Galvanized Black as provided by Duncan Galvanizing, Inc., or approved equal.

2.03 CEMENT CONCRETE

A. Cement concrete for footings and edgings shall conform with Section 03 30 00, CAST-IN-PLACE CONCRETE of these Specifications.

2.04 BLACK VINYL CHAIN LINK (BVCL) FENCING

A. Color: Black, unless otherwise approved by the owner.

B. Mesh Fabric:

a) PVC or polyolefin elastomer coating, 7 mil (0.18 mm) to 15 mil (0.38mm) thickness, thermally fused over galvanized wire: ASTM F 668, Class 2b,

in black color. ASTM A 641, galvanized steel core wire, tensile strength 75,000 psi (571 MPa).

b) All Heights: Helically wound and woven to height of as indicated on drawings, 2" (50 mm) diamond mesh of 6 gauge core wire with a diameter of 0.148" (3.76 mm) and a breakload of 1290 lbs (5740 N). Color: black, ASTM F 934.

c) Salvage of fabric knuckled at top and bottom.

C. Framing:

a) Steel pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi (170 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area.

b) Bottom rail must be used on all chain link fence installations

c) Post Length:

1) 4 Foot High Fence Post:

a) Minimum 7.5 feet total length (3.5 feet embedded into concrete footing) unless otherwise noted per details.

d) Post and Rail Size:

1) PVC or polyolefin elastomer coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10-15 mils (0.254 - 0.38 mm) thermally fused in black color to match fabric.

e) 4 Foot High Fence Framing Sizes:

Corner and Line (Intermediate) Post	(2 inch) - 2.375" od
Top and Bottom Rail	(1-1/4 inches) - 1.66" od
Gate and End Post:	(2 1/2 inch) – 2.875" od

D. Accessories: (ASTM F 626) Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

a) Post caps: Formed steel, cast malleable iron, or aluminum alloy weather tight closure cap for tubular posts. For each line post provide tops to permit passage of top rail.

b) Top rail and brace ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

c) Top rail sleeves: 7" (178 mm) expansion sleeve with spring, allowing for expansion and contraction of top rail.

d) Fabric Bands for Tying Fabric: Fabric shall be attached using a BAND-IT band and buckle system. Bands shall be 0.020" thickness, 200/300 series stainless steel ½" wide bands, with a minimum breaking strength of 850 lbs., ½" band capacity ear-loct design buckles to be manufactured with 0.050" thick material, 201/301 series stainless steel. Hog ring ties of 12-1/2 gauge [0.0985" (2.502 mm)] for attachment of fabric to tension wire.

e) Brace and tension (stretcher bar) bands: Pressed steel.

f) Tension (stretcher) bars: One piece lengths equal to 2" (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) or equivalent fiberglass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

g) Tension wire: Thermally fused PVC or polyolefin elastomer applied to metallic coated steel wire: Per ASTM F 1664 Class 2 b, 7 gauge, and [0.177" (4.5 mm) diameter core wire with tensile strength of 75,000 psi (517 MPa).

h) Truss rods & tightener: Steel rods with minimum diameter of 5/16" (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.

i) Fasteners are to be galvanized but not vinyl coated.

E. Setting: Refer to the 03 30 00 CAST-IN-PLACE CONCRETE for standard concrete footing requirements.

END OF SECTION

SECTION 32 90 00.13

TURF REINFORCEMENT SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Under this Section, the Contractor shall furnish all labor, materials, equipment (including low ground pressure, LGP, equipment) and transportation required to furnish and place, or prepare a tee mix and turf reinforcement fibers for the fiber-reinforced area shown on the drawings and as specified.

B. The contractor shall have the option, at their discretion, to use on-site screened loam from stockpile and either mix on site or bring in Tee Mix that adheres to this specification. The Contractor shall be responsible for amending topsoil, as required to comply with this specification and SECTION 32 91 00-SCREENED LOAM BORROW AND TOPSOIL.

C. This work shall consist of preparing a tee mixture consisting of screened native on-site loam, sand and superpeat or suppling from an outside source. A sand sample and compost sample shall be submitted to a testing agent for adherence to specifications prior to blending operations.

D. No heavy-duty equipment and vehicular traffic shall be allowed on the prepared areas.

1.02 SAMPLES/TESTS

A. The Contractor shall furnish an outline of their approach to the project no less than ten (5) days prior to the start of construction.

B. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of fiber reinforcement and tee mix components that are proposed to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Owner’s Representative, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.

C. If the materials do not conform to the above requirements, they shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.

D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility, depending on the approach, testing may be

undertaken:

1. Prior to site delivery; at source;

2. At time of delivery; on-site

E. For quality control, immediately following spreading on site, soil may be tested at the Owner's discretion. Soil sampling shall also indicate if specified soil was supplied uniformly to the minimum specified depth.

1.03 RELATED WORK:

A. Section 32 91 00-SCREENED LOAM BORROW AND TOPSOIL

B. Section 32 92 19-SEEDING

1.04 STANDARDS

A. USGA – United States Golf Association

B. ASTM – American Society for Testing and Materials

1.05 NOTIFICATION

A. The Contractor shall notify the Owner in writing at least ten (10) days in advance of the time he intends furnishing Tee Mix or amendments stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Owner's Representative may require for collecting and forwarding samples.

1.06 QUALITY CONTROL

A. Tee mix: A one-gallon sample for every 2,000 cubic yards of tee mix shall be tested by the Owner's Representative's Testing Agent for approval. All costs shall be done by the Contractor.

B. Prior to seeding, contractor shall notify the Owner's Representative or Owner and provide the owner with compaction tests along the center line of the turf reinforcement area as well as along the edges to ensure that the tee mix has not been heavily compacted. Compaction test shall fall within the manufacturer's requirements for compaction and any areas that exceed these standards shall be corrected at the contractor's expense prior to seeding.

C. The Contractor or Sub-contractor must have a minimum of five (5) years of experience installing tee mix based athletic fields of similar size and quality of this project.

PART 2 - MATERIALS

2.01 LOAM BORROW

A. Refer to Section 32 91 00-SCREENED LOAM BORROW & TOPSOIL.

2.02 TEE MIX

A. Tee Mix shall be provided by Read Custom Soils, (www.readcustomsoils.com, (800) 924-5335), or approved equal.

B. The Tee Mix shall meet the requirements outlined in the "Materials Test Report" provided by Turf & Soils Diagnostics, included in Appendix C.

C. Mixing Materials: Mixing of the sand, loam and superpeat mixture for the tee mix must be blended by an experienced blending operator.

D. Physical performance Evaluation of the tee mix will be in accordance with the guidelines set forth in ASTM standard F 1632 and Determination of Size Factors SOP.

2.03 FIBER REINFORCEMENT

A. Fiber reinforcement shall Geogrids 3610GF as manufactured by FiberSoils (P.O. Box 80198, Baton Rouge, LA 76890, (866) 342 – 3771, www.fibersoils.com), or approved equal. The material shall be 100% polypropylene fibers and shall conform to manufacturer's requirements for material properties.

B. Application rate shall be at the supplier's suggested rates.

2.04 ASTM F2396 DRAINAGE LAYER

A. Drainage layer shall be F2396-11 Gravel Filter Drainage Layer, Section 5.4.3.3 Option 3 and Table 1 in Appendix A of the original specifications.

PART 3 - EXECUTION

3.01 TEE MIX RATIOS

A. Upon approval of the amended existing salvaged loam borrow, sand and compost components, the owners testing agents shall blend the components to determine the correct ratio of sand and compost to create the tee mix. This ratio of sand and compost will be based on laboratory testing and performance guidelines established by these specifications.

Based on previous testing and for bidding purposes, the field tee mix ratio will contain **70% sand, 20% Native Screened Loam and 10% superpeat** by volume.

B. The tee mix developed by the Owner's Representative's testing agent will establish the required mix ratio and specifications for approval or rejections of all quality control submittals during construction.

Performance Testing: USGA recommendations for greens construction shall be used for the evaluation of this tee mix.

3.04 BLENDING

A. **Under no circumstances shall the turf reinforcement fibers be blended into the tee mix on site or in the vicinity of Crystal Lake.** At the blending facility, the turf reinforcement material shall be mixed a until uniform bend with the tee mix is obtained. The mix shall be blended at an application Rate of 1 lb. / 10 square feet for a mixing depth of 4 inches.

3.05 PLACING AND COMPACTING

A. The Contractor shall place and spread fiber-reinforced tee mix in the areas and to the depths shown on the contract drawings, which depth shall be the minimum required depth after settlement. Contractor shall place and spread the mix per the manufacturer requirements, using Drop Spreader, Top Dresser, Modified Straw Blower, or Hand Spreading Application. Some hand raking may be required to obtain uniform coverage at specified addition rate.

B. Tee Mix shall be spread in such a manner as to establish a loose, friable seedbed.

C. Fine grading shall be accomplished with a fully automated dual plain LGP laser grader.

D. The Contractor shall compact the fiber-reinforced tee mix blend with 4 Ton to 6 Ton Double Steel Wheel Roller to the manufacturer's requirements.

E. Finish grades shall be verified by the Contractor using laser operation survey instruments with a tolerance of +/- ¼ inch.

3.03 TEE MIX ADDITIVES

A. The Contractor shall apply all necessary fertilizer and lime to the soil in accordance with the manufacturer's and laboratory's recommendations and as required by the seeding specifications referenced elsewhere.

END OF SECTION

SECTION 32 91 00

SCREENED LOAM BORROW AND TOPSOIL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Under this Section, the Contractor shall furnish all labor, materials, equipment (including low ground pressure equipment (LGP)) and transportation required to furnish and place ½" Screened Loam Borrow as shown on the drawings and as specified. Where proposed tree and shrub planting mix and/or sod or seed is noted on the drawings, it shall be composed of Loam Borrow, or Topsoil in compliance with this specification.

B. The Contractor shall be responsible for screening and amending topsoil as required.

C. No heavy duty equipment and vehicular traffic shall be allowed on the prepared areas. While using the blecavator, the contractor shall fine grade soil over the blecavation areas based on the proposed elevations indicated on the site plan.

1.02 SAMPLES/TESTS

A. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of the proposed Loam to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Owner's Representative, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.

B. At least ten (10) days prior to shipment/delivery of materials, the Contractor shall submit to the Owner a one (1) cubic foot representative sample, certifications, certified test results for materials as specified below. The Contractor shall provide a listing of the addresses (locations) identifying the origin of the soil to be delivered. If the origin is from multiple locations, all locations shall be provided at the time of submission of required information specified above. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Owner. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Owner shall reserve the right to reject, on or after delivery, any material that does not meet these Specifications.

C. If the material does not conform to the above requirements it shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.

D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility testing may be undertaken:
   1. Prior to site delivery; at source;

   2. At time of delivery; on-site; and/or

   3. Immediately following spreading on site. Soil sampling shall also indicate if specified soil was supplied uniformly to the minimum specified depth.

1.03 STANDARDS

A. ASTM - American Society for Testing and Materials.

1.04 NOTIFICATION

A. The Contractor shall notify the Owner in writing at least ten (10) days in advance of the time he intends furnishing Screened Loam Borrow stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Owner may require for collecting and forwarding samples.

1.05 QUALITY CONTROL

A. Following installation of irrigation system and prior to installation of sod, contractor shall notify landscape architect or owner and provide the owner with compaction tests along the center line of the field as well as along the side lines to ensure that the root zone mix has not been heavily compacted. Compaction test shall fall within the industry standards for fields and any areas that exceed these standards shall be corrected at the contractor's expense prior to installation of sod.

B. The Contractor or Sub-contractor must have a minimum of five (5) years of experience installing root zone mix based athletic fields of similar size and quality of this project.

C. The Contractor shall avoid excessive compaction of the subgrade prior to installation of the loam. Refer to Specification Section 31 00 00, EARTHWORK.

PART 2 - MATERIALS

2.01 LOAM BORROW

A. In accordance with the specific requirements of this project, existing on-site soil may be re-used as Loam Borrow only if it meets this Specification. Existing topsoil that does not meet this Specification may be re-used only up to the subgrade elevation within the limits of areas to receive new Loam Borrow. The Contractor shall furnish all required Loam Borrow, from off site sources, as

necessary, to complete the project.

B. Screened Loam shall be "fine sandy loam" or "sandy loam" determined by mechanical analysis (ASTM D-422) and based on the "USDA" Classification System". Screened Loam has the following mechanical analysis:

Textural Class	Percentage of Total Weight	Average Percentage
Sand (0.05 – 2.0mm)	50 – 80	70
Silt (0.002 – 0.05mm)	15 – 30	20
Clay (Less than 0.002mm)	5 – 10	10

C. Screened Loam shall be a natural product consisting primarily of natural topsoil, free from subsoil, and obtained from an area that has never been stripped, as noted above, the location of the source of the loam must be submitted to the Owner. Screened Loam shall not contain less than five percent (5%) nor more than seven percent (7%) organic matter as determined by the loss on ignition of oven-dried samples, at 100°C ± 5°C. To adjust organic matter content, the soil may be amended, prior to site delivery, by the addition of composted leaf mold or peat moss. Use of organic amendments is accepted only if random soil sampling indicates a through incorporation of these materials. No mixing or amending of Loam will be permitted on site. The Loam shall not be delivered when in a wet or frozen condition.

D. Screened Loam shall consist of fertile, friable, natural loam capable of sustaining vigorous plant growth. Loam shall be without admixture of subsoil, and refuse, resulting in a homogeneous material free of stones greater than ½" in the longest dimension, be free of lumps, plants, glass, roots, sticks, excessive stone content, debris, and extraneous matter as determined by the Owner. Screened Loam shall be within the pH range of 6.0 to 6.5 except as where noted on plans and details. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The maximum soluble salt index shall be 100. Screened Loam shall not have levels of aluminum great than 200 parts per million.

E. If limestone is required to amend the screened loam to bring it within a pH range of 6.0 to 6.5 no more than 200 pounds of limestone per 1,000 square feet of loam, incorporated into the soil, or 50 pounds of limestone per 1,000 square feet of loam, surface application, within a single season.

F. The Owner will reject any material delivered to the site that does not meet these Specifications after post-delivery testing. If the delivered screened loam does not meet the specifications stated in this document, the delivered screened loam will be removed by the Contractor at the Contractor's expense and at the time of

rejection.

G. The topsoil shall not be handled or moved when in a wet or frozen condition.

H. Topsoil structure shall not be destroyed through excessive and unnecessary handling or compaction. Inappropriate handling leading to the compaction or deterioration of soil structure will result in rejection of topsoil for use.

I. At no time should equipment or material rest on the soil.

J. Loam Borrow shall be free of plants and their roots, debris and other extraneous matter. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to, or less than, 1.0 millimhos/cm. (test material passing #4 sieve).

PART 3 - EXECUTION

3.01 PLACEMENT

A. The Contractor shall furnish and spread Loam Borrow to the depths shown on the contract drawings, which depth shall be the minimum required depth after settlement. No compaction shall be required beyond that extent necessary to place sod or to plant trees and shrubs to ensure against unevenness or settling below accepted growth lines.

B. All backfill to subgrade, shall be compacted to not less than eighty-five percent (85%) and not more than ninety percent (90%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T-180-86, Modified Proctor Test.

C. Low Ground Pressure (LGP) Equipment must be used for final grading of subgrade in order to minimize the compaction on the backfill and subgrade.

3.02 ADDITIVES

A. The Contractor shall apply all necessary fertilizer and lime to the soil in accordance with the manufacturer and laboratory's recommendations and as required by the sodding, seeding and/or planting specifications referenced elsewhere.

END OF SECTION

SECTION 32 91 16

BIORETENTION SOIL MIX

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Under this Section, the Contractor shall furnish all labor, materials equipment and transportation required to furnish and place six (6) inches of bioretention soil mix as shown on the drawings and as specified.

B. The Contractor shall be responsible for screening and amending topsoil as required.

C. No heavy duty equipment and vehicular traffic shall be allowed on the prepared areas. While using the blecavator, the contractor shall fine grade soil over the blecavation areas based on the proposed elevations indicated on the site plan.

1.02 RELATED WORK:

A. Section 31 05 19, GEOTEXTILE FABRICS

B. Section 31 00 00, EARTHWORK

C. Section 31 11 00, CLEARING AND GRUBBING

D. Section 31 25 00, EROSION AND SEDIMENTATION CONTROL

E. Section 33 41 13.22, CORRUGATED POLYETHYLENE [HDPE] DRAINAGE PIPE

1.03 QUALITY ASSURANCE

A. Reference Standards: Vermont Stormwater Management Manual, Revised 2017.

1.04 SUBMITTALS

A. Certificates: Manufacturers' or suppliers' certification that content of materials meets specification requirements.

1. Lawn Fertilizer
2. Limestone
3. Compost
4. Bioretention soil mix
5. Erosion control blanket

B. Test Reports: Soil phosphorous test using the Morgan Method or approved equivalent.

1.05 DELIVERY, STORAGE AND HANDLING

A. Fertilizer and lime: Deliver to site in unopened, undamaged containers.

B. Store fertilizer and lime materials so they are protected from all forms of moisture such as rain, snow, surface drainage, ground water, condensation, etc.

C. Do not use wet, mildewed or caked material.

1.06 PROJECT CONDITIONS

A. Environmental requirements: Do not prepare or place frozen soils or soils in a muddy condition. Do not spread topsoil on frozen or muddy subsoil.

B. Protection: Protect other parts of this Contract from damage.

PART 2 - MATERIALS

2.01 MIXES

A. Lawn Fertilizer: Available nutrients, percent by total weight.

1. 9% nitrogen-at least 50% from organic source.
2. 23% phosphorus.
3. 14% potassium.
4. Must contain a pre-emergent crabgrass control.

B. Limestone: Ground limestone with a minimum total neutralizing value of 88 % calcium carbonate equivalence, minimum 90 % passing the 20 mesh sieve and minimum 60 % passing the 100 mesh sieve.

C. Compost: Compost shall contain organic matter or material of a generally humus nature capable of sustaining the growth of vegetation, with no "foreign" matter (i.e. glass, plastic, etc.) or material toxic to plant growth. It shall be free from stones, lumps or similar objects larger than two inches in greatest diameter, roots, and brush. Composts that have been derived from organic wastes such as food and agriculture residues, animal manures and sewage sludge that meet the above requirements and are approved by the Vermont Department of Environmental Conservation are acceptable compost sources.

Compost for use in the bioretention area shall have the following properties:

Parameters	Range
pH	5.5 - 8.5
Moisture content	35% - 55%
Particle Size	<1/2"

C:N ratio	15 - 30:1

D. Bioretention Mix:

1. The soil shall be a uniform mix, free of stones, stumps, roots or other similar objects larger than two inches. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations. The planting soil shall be free of all grasses or other noxious weeds.

2. The planting soil shall be tested and shall meet the following criteria:

Parameters	Range
Sand	85% - 88%
Silt	8% - 12%
Clay	0 – 2%
Organic Matter (Compost)	3% - 5%

3. All bioretention areas shall have a minimum of one test. Each test shall consist of both the standard soil test for pH, phosphorus, and potassium and additional tests of organic matter, and soluble salts. Should the pH fall out of the acceptable range, it may be modified (higher) with lime or (lower) with iron sulfate plus sulfur.

E. Slope erosion protection shall be installed in conformance with specification section 31 25 00, Erosion and Sedimentation Control.

F. Water:

1. Water used during the installation, “grow-in”, and Maintenance period shall be provided and paid for by the Contractor. The Contractor shall be responsible for appropriate water application. Water utilized shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas to receive soil preparation to assure work of other trades has been completed.

B. Remove jute mesh, staples, hay bales and other erosion control measures in the line of work.

C. Completely disc subsoil that has become compacted and re-grade to required subgrade.

D. Verify that all subsoils are positively drained and free of ponded areas and debris.

E. Perform topsoil analysis for pH with recommendations for adjustment to specified pH limits.

F. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. If the subsoil has become overly compacted after discing, in the opinion of the Owner's Representative, just prior to placing the topsoil, the subsoil material shall be scarified to a minimum depth of 3 inches so as to ensure a proper bond between the subsoil material and the topsoil.

B. Screen topsoil to remove particles larger than 3/4".

3.03 INSTALLATION

A. Fertilization:

1. Apply fertilizer at a rate of 500 pounds per acre, or roughly 11.5 pounds per thousand square feet to all topsoil.
2. Lightly work fertilizer into the topsoil.

B. Liming:

1. Based on laboratory analysis and recommendations. Adjust pH of all areas to be between 5.5 pH and 6.5 pH, as follows:

Existing pH, less than 4.0	170 lbs./1000 SF
4.1 - 4.5	155 lbs./1000 SF
4.6 - 5.0	125 lbs./1000 SF
5.1 - 5.5	95 lbs./1000 SF

C. Compaction:

1. Exercise extreme caution in all topsoil areas that soil is not overly compacted.
2. Soil that has become overly compacted, in the judgment of the Engineer, shall be re-worked to achieve a satisfactory condition at no additional cost.
3. Topsoil on sloped areas may be lightly rolled to prevent erosion if application of seed is delayed.

3.04 CLEAN-UP

A. Immediately clean up spills of soil and conditioners on paved and finished surface areas.

B. Remove debris and excess materials from project site.

3.05 STOCKPILES

A. Hydroseed excess topsoil remaining in stockpiles. Do not remove excess topsoil from Owner's property. Coordinate with Owner on spreading out excess topsoil, prior to hydroseeding.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, seed and incidental materials necessary to accomplish all grass seeding and related work, complete in place, maintained, and accepted, in accordance with the Contact Drawings and Specifications. All grassed areas with the contract limit line shall be overseeded and those areas disturbed by the Contractor's operations shall be repaired as herein specified.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of grass seeded areas, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 32 91 00, SCREENED LOAM BORROW AND TOPSOIL

B. Section 32 93 00, TREES, SHRUBS, GROUNDCOVERS AND LANDSCAPING

1.03 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following to the Owner’s Representative for review and approval:

A. Six copies of information for seed mixes including the following:

1. Name and address of the seed supplier.

2. Source of origin and dates of harvest for each of the various types of seed

3. Certification of seed mix composition and proportion, indicating named seed varieties by percent, percent germination, purity, and percent crop seed, percent inert matter, and percent weed seed content.

4. Estimated number of seeds per pound of each type of seed in the mix

B. Six copies of information detailing proposed limestone, fertilizers, insecticides, herbicides, fungicides, mulch materials, hydroseeding materials (as required), and slope protection material (as required) to be applied to seeded areas.

C. Six copies of watering, fertilizing and maintenance schedule.

D. Six copies of marked up prints indicating the square footage of all proposed seeded areas with quantities of various soil additives and amendments, and quantities of seed for each area prior to beginning work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

1. Loam Borrow shall conform to specification Section 32 91 00, SCREENED LOAM BORROW AND TOPSOIL.

B. LIMESTONE:

1. Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogenous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. The analysis for supplemental maintenance fertilizer shall have a ratio of Nitrogen (N) – Phosphorous (P) – Potassium (K) of approximately 4 – 1 – 2 and shall be applied to deliver 1 pound of Nitrogen per 1000 square feet, or as approved by the Owner's Representative. At least 50 percent of nitrogenous elements shall be Urea-form or derived from organic sources and contain no less than 3 percent water soluble Nitrogen.

D. SEED:

1. Seed shall be of an approved perennial variety mixture, the previous year's crop, clean, and high in germinating value. Weed seed content shall be less than 0.5 percent and include no noxious weeds. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates of compliance relative to mixture purity and germinating value. Seed shall be furnished and delivered in new, clean,

sealed and properly labeled containers. All seed shall comply with applicable State and Federal laws. Seed that has become wet, moldy or otherwise damaged shall not be accepted.

2. Grass seed for lawn areas shall be the Greenwave Water Saver Extreme by Atlantic Golf and Turf, 27 Industrial Blvd., Turners Falls, MA, (413) 863-4444, or approved equal. Seeding rate shall be 6 lbs. / 1,000 square feet.

Botanical and Common Name	**% of Mix**
Firecracker SLS Tall Fescue	40.00%
Titanium 2LS Tall Fescue	40.00%
SPF30 Texas Hybrid Kentucky Bluegrass	10.00%
Hampton Kentucky Bluegrass	10.00%
Seed Mix Total	**100.00%**

4. Seed for slope stabilization areas not normally mowed shall conform to the following mix, below. Seeding rate shall be at the supplier's suggested rates.

SCIENTIFIC NAME	COMMON NAME
Chamaecrista fasciculata	Partridge pea
*Deschampia flexuosa***	WAVY HAIRGRASS**
Elymus virgincus	VIRGINIA WILDRYE
Eupatorium perforatum	BONESET
*Eurybia divaricata***	WHITE WOOD ASTER**
*Festuca subverticillata***	NODDING FESCUE**
*Geranium maculatum***	WILD GERANIUM**
Juncus tenuis	SLENDER RUSH
Onoclea sensibilis	SENSITIVE FERN

F. MULCH:

1. Materials to be used in mulching seeded areas shall be free of weed seed and shall conform to the following requirements:

a. Hay Mulch shall consist of mowed and properly cured grass, clover or other acceptable plants. No salt hay shall be used.

b. Straw Mulch shall consist of stalks or stems of grain after threshing.

G. HYDROSEED MULCH, TACKIFIERS AND WATER RETENTION AGENTS:

1. Wood fiber mulch for Hydroseed application shall be a manufactured product of natural wood cellulose fibers with a non-toxic green marking dye incorporated to ensure uniform distribution. Mulch shall be packed in sealed original containers, clearly labeled with brand name and manufacturer. It shall have delivered moisture content less than 12 percent.

2. Hydroseed tackifier shall be a powdered starch-based product approved by the Owner's Representative. Hydroseed tackifier shall be applied in conjunction with the hydroseed slurry in accordance with the manufacturer's recommendations.

3. Moisture retention agent shall be a powdered starch-based product, approved by the Owner's Representative, and shall be capable of retaining up to 400 times their weight in water. Moisture retaining agents shall be added to the hydroseed slurry in accordance with the manufacturer's recommendations. Moisture retention agent shall be 'Hydro-Gel', as manufactured by Finn Corporation, Fairfield, OH.

H. Slope erosion protection shall conform to Specification Section 31 25 00, EROSION AND SEDIMENTATION CONTROL

I. WATER:

1. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be the furnished by the Contractor, at no additional cost to the Owner.

J. INSECTICIDES:

1. No insecticides shall be used on-site without the Contractor notifying and obtaining prior approval of the Owner's Representative.

2. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Owner's Representative, that may result in the disfigurement, decline, or death of plant materials.

4. Grub control insecticide shall be Proturf Insecticide III, as manufactured by A.M.

Scotts & Sons, Inc.; Dursban Granules, as manufactured by Old Fox Chemical Corp., or ACMC; or approved equal.

K. HERBICIDES:

1. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Owner's Representative.

2. All herbicides shall be EPA registered and approved for use in public open spaces. All herbicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.

4. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.

L. FUNGICIDES:

1. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Owner's Representative.

2. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

3. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Owner's Representative that may result in the disfigurement, decline, or death of plant materials.

PART 3 - EXECUTION

3.01 GENERAL:

A. All work shall be performed by skilled workers with a minimum of 2 years of seeded lawn construction and establishment experience and under the full-time supervision of a qualified foreman.

B. Seeding operations shall not begin less than 4 days after the application of lime and fertilizer and the seedbed areas are reviewed and approved by the Owner's Representative.

C. Seeding shall be done when soil and weather conditions permit in early spring, until June 15, or from September 10 to October l5, unless otherwise approved. If it becomes necessary for seed to be sown after June 15, provisions shall be made for supplementary water and using a mulch cover over lawn areas.

D. If there is a delay in seeding, during which weeds grow, or soil is washed out, the Contractor shall eliminate the weeds by chemical or physical means, or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

E. Seed shall be sown at the approved rate, on a non-windy day by machine, or as approved by the Owner's Representative.

F. The surface shall be kept moist by a fine spray until the seed shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 square feet, the Contractor shall reseed, roll, and water as necessary to obtain proper germination.

G. If there is insufficient time in the planting season to complete soil preparations, fertilizing, and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor, or as required by the Owner's Representative. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized and the permanent seed crop shall be sown as specified.

H. Protection of all newly loamed and graded areas is required and shall be accomplished by whatever means necessary such as mulch applied with a tackifier, or by other means approved by the Owner's Representative. The Contractor shall be responsible for the prevention of siltation in areas beyond the limit of work and for all means of protection throughout the maintenance period at no additional cost to the Owner.

3.03 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

A. Seed shall be divided into 2 equal amounts and uniformly distributed in 2 applications at right angles to each other. Seed shall then be raked lightly into the soil to a depth of l/4 inch.

B. If mulch is not necessary the seed shall be directly firmed into the soil with a roller that will apply pressure between 75 and 100 pounds per linear foot of width.

C. Straw Mulch shall be used based on time of seeding as previously specified over all seeded areas, as designated on the plans, or as otherwise directed. If mulch is to be used, it shall be loosely spread to a uniform depth at a rate of 4-1/2 tons per acre to provide ¼ inch of cover, or as otherwise directed. The seed and mulch shall then be firmed into the soil with a roller that will apply a pressure between 75 and 100 pounds per foot of width.

D. Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Owner's Representative, the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.

E. Slope erosion control shall be placed as indicated on the plans or as directed by the Owner's Representative.

3.04 HYDROSEEDING:

A. The application of lime, fertilizer, grass seed and mulch may be accomplished in a single operation with the use of approved hydroseeding equipment. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The slurry shall be of such consistency that it can be sprayed from a hydroseed gun or through at least 200 feet of 1½- inch diameter hose. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed, and mulch shall be equal to the specified quantities.

B. Prior to the start of hydroseeding, the Contractor shall furnish to the Owner's Representative, in writing, the weights of limestone, fertilizer, grass seed, mulch, tackifier (as required) and moisture retention agent (as required) per 100 gallons of water to be used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of hydroseeding operations are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other means.

C. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage of 200 pounds of the specified seed mix per acre, as recommended by the seed suppliers, or as required by the Owner's Representative.

D. Wood fiber mulch shall be uniformly spread over certain selected seeded areas at the minimum rate of 1,400 pounds per acre unless otherwise directed. Mulch shall be placed by spraying from an approved spraying machine with pressure sufficient to cover the entire area in a single operation.

E. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Owner's Representative.

3.05 MAINTENANCE:

A. The Contractor shall maintain and protect the entire seeded area, as necessary to ensure dense healthy growth, until completion of the guarantee period and final acceptance of the project, or for 60 days, whichever is longer. If lawns are planted in late summer or during the fall, maintenance shall continue through the following spring for at least 30 days.

Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, and regular mowing. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. The first cutting of lawn areas shall be done when the grass is between 2½ - to 3-inches in height. The lawn shall be cut no shorter than 2-inches in height and shall be regularly mowed as necessary to maintain the above-prescribed conditions. All cuttings shall be removed from the lawn during the maintenance period and disposed of off-site.

C. The Contractor shall be responsible to regularly water seeded areas with the equivalent of 1-inch minimum of rainfall per week, or as necessary to develop and sustain dense, green growth.

D. Six weeks after turf has established, and only during the months of April, May, or September, the Contractor shall apply fertilizer as specified above, at one half the rate recommended by the initial soils laboratory tests, or as required by the Owner's Representative.

E. The Contractor shall be responsible for securing all seeded areas from physical damage as necessary, including warning signs, barriers, temporary fencing, or other means of protection, through the guarantee period until final acceptance. All damaged areas shall be repaired to reestablish healthy vigorous growth of turf to the satisfaction of the Owner's Representative, at no additional cost to the Owner. All temporary barriers shall remain the property of the Contractor and shall be removed by the Contractor upon final acceptance by the Owner's Representative.

F. Pavement shall be kept clean and clear of cuttings and debris at all times during the maintenance period to the satisfaction of the Owner's Representative.

3.06 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. At the beginning of the planting season following that in which the permanent grass crop is sown, seeded areas will be inspected. Any section not showing dense, vigorous growth shall be promptly reseeded by the Contractor at no additional cost to the Owner. The seeded areas shall be watered, weeded, cut and otherwise maintained by the Contractor, as many times as necessary, in accordance with these specifications, until they are accepted.

B. The Contractor shall provide written notice to the Owner's Representative not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Owner's Representative shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

C. Inspection and acceptance of seeded areas may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not

waive any other provisions of this Contract.

3.07 GUARANTEE:

A. Seeded areas shall be guaranteed until final acceptance of the project, or, in the case of late summer or fall planting, the guarantee period shall extend through the following spring.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Guarantee shall not apply to the replacement of seeded lawns resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

D. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.08 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Owner's Representative not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Owner's Representative shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

SECTION 32 93 00

TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all trees, shrubs, herbaceous plants, ground covers, and for all appurtenant work, complete in place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of plant materials, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 32 91 00, SCREENED LOAM BORROW AND TOPSOIL

B. Section 32 91 16, BIORETENTION SOIL MIX

C. Section 32 92 19, SEEDING

1.03 SUBMITTALS:

In accordance with requirements of the general specifications, the Contractor shall submit the following:

A. Prior to planting, State nursery inspection certificates for all plant materials shall be submitted to the Owner's Representative for review.

B. A shop drawing of the layout of each temporary herbivore deterrent fencing area, including post locations, shall be submitted to the Owner's Representative for review prior to aquatic plug installation.

C. Samples and six copies of the manufacturer's product data, as applicable, shall be submitted to the Owner's Representative for review and approval for the following materials:

1. Limestone.

2. Fertilizer.

3. Sphagnum Peat Moss.

4. Humus.

5. Organic Compost.

6. Manure.

7. Mulch.

8. Guying and Staking Apparatus.

9. Crepe Wrapping for tree trunks.

10. Anti-transpirant/Anti-desiccant.

11. Insecticides.

12. Herbicides.

13. Fungicides.

14. Temporary watering bags

15. Temporary plant establishment protection fencing

16. Temporary herbivore deterrent fencing

PART 2 - PRODUCTS

2.01 PLANT MATERIALS:

A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Owner's Representative.

B. Plants larger than those specified in the Plant List may be used if approved by the Owner's Representative. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased, as necessary.

C. All plants shall be certified to have passed all required Federal and State inspection laws requiring ensuring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before

planting any plants delivered from outside the state in which they are to be planted.

D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.

E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched, and densely foliated when in leaf; shall be free of disease, insects, eggs, or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.

F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm, and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.

G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.

H. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the Plant List in the Drawings. The branching height for deciduous trees installed adjacent to or within walks shall be 7 feet minimum, having been pruned to this height at least 1 year prior to transplanting. Except when a clump is designated, the trunk of each tree shall be a single trunk growing from a single, unmutilated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. All pruning cuts shall comply with acceptable horticultural practices. No pruning wounds having a

diameter of more than 1½-inches shall be present. Any such wounds must show vigorous bark growth on all edges. Evergreen trees shall be branched to within 1 foot of the ground. No tree that has had its leader cut or die shall be accepted.

I. Caliper measurements for tree trunks shall be taken 6-inches above ground for trees up to and including 4-inch caliper size and at 12-inches above ground for larger sizes.

J. Shrubs shall meet the requirements for spread and/or height stated in the Plant List on the Drawings. The measures for height are to be taken from the crown or root flare to the average height of the top of the shrub mass (not the longest branch). The fullness of each shrub shall correspond to the trade classification "No. 1". Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twigged and the plant as a whole must be well-bushed to the ground. The plants must be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

K. Herbaceous plants and groundcovers shall be of the size, age and/or condition designated in the Plant List on the Drawings.

L. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered, and otherwise maintained prior to, during, and upon delivery to the site.

M. Plants shall be subject to inspection and approval by the Owner’s Representative at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Owner’s Representative. The Contractor, or his representative, shall be present, if requested by the Owner’s Representative, for inspection of plants at the Nursery. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent defects or injuries. Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State, and other authorities to accompany shipments.

2.02 LOAM BORROW:

Loam Borrow shall be as specified in Section 32 91 00, SCREENED LOAM BORROW AND TOPSOIL.

2.03 BIORETENTION SOIL MIX

Bioretention soil mix shall be specified in Section 32 91 16, BIORETENTION SOIL MIX.

2.04 SOIL ADDITIVES AND AMENDMENTS:

A. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

B. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. Fertilizer for tree, shrub and groundcover plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

Nitrogen (N)	Phosphorous (P)	Potassium (K)
10%	10%	10%

3. As approved by the Owner's Representative, a slow-release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.

C. Organic Compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

D. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of

plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.

E. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.

F. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

2.05 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1-part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

2.06 WATER:

A. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability for the duration of **two years** beginning at the time of project completion. The delivery and distribution equipment required for the application of water shall be watering bags as manufactured by located at each tree stake (3 per tree) furnished by the Contractor, at no additional cost to the Owner.

B. Watering bags shall be Treegator original style watering bags as manufactured by Treegator, 15 Mosswood Blvd., Youngsville, NC 27596 (866) 873-3428, www.treegator.com or

C. Approved Equal

2.07 MULCH:

Mulch shall be fibrous pliable shredded soft bark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture

content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and other materials harmful to plant growth and viability. Organic mulch shall be aged no longer than 2 years.

2.08 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

Tree stakes, drive anchors and guy wire assembies, and tree wraps shall not be used.

2.09 TREE PAINT:

Tree paint shall not be used.

2.10 ANTI-TRANSPIRANT/ANTI-DESICCANT:

Anti-transpirant or anti-desiccant shall be 'Wilt-Pruf', as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

2.11 INSECTICIDES:

A. No insecticides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Owner's Representative.

B. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Owner's Representative that may result in the disfigurement, decline, or death of plant materials.

2.12 HERBICIDES:

A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Owner's Representative.

B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.

D. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.

2.13 FUNGICIDES:

A. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Owner's Representative.

B. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

C. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Owner's Representative, that may result in the disfigurement, decline, or death of plant materials.

2.14 TEMPORARY PLANT ESTABLISHMENT PROTECTION FENCING

A. Plant establishment areas designated on the Contract Drawings areas shall be protected by a barrier raised immediately after plant installation and shall be maintained for the two (2) year establishment period. Areas to be protected are indicated on the drawings.

B. Temporary plant establishment protection fencing shall be "Snow Fence Wood" as manufactured by Louis E. Page, Inc., PO Box 639, Sterling, Massachusetts, 01564 (866-328-5018, www.louispage.com), or approved equal.

C. Fence shall be 4 feet tall. Slats shall be made of natural (intreated) No. 1 grade aspen measuring 3/8" thick x 1-1/2-inches wide x 48-inches high, held together with five 2-wire strands of galvanized wire. Thickness shall be a minimum of three-eights (3/8") inches thick but shall not exceed nine-sixteenths (9/16") inches thick. Both ends shall be cut square. The slats shall be spaced 2 ¼ inches apart plus or minus ¼-inch.

D. The base metal of the wire shall be of a good commercial quality of steel. The galvanized wire shall not be less than 13 steel wire gauge. The weight of the coating shall not be less 3/10 (0.3) ounce per square foot of uncoated wire surface, determined in accordance with AASCO Designation T65 (Class I). Weight of Coating on Zinc-Coated (Galvanized) Iron on Steel Articles. The zinc coating shall adhere to the wire, without flaking and without being removable by rubbing with bare fingers, when the wire is bent completely around a pin of the same diameter as that of the wire.

E. There shall be not less than 2 three hundred and sixty (360) degree twists of the wire in the weave between the slats. The fabric must be tightly woven so that the wire is forced into the wood slats sufficiently to hold tightly. The strands of wire shall be spaced 10 inches

apart and 4 inches from the ends of the slat. The fence shall be stretched after weaving and before being placed in rolls.

F. Posts shall be 3-inches in diameter, 8-foot long, and made from No. 1 grade northern spruce, untreated. End posts shall be adequately braced

G. 16 gauge wire shall be used to secure the sand fence to posts. Fencing shall be tensioned to the manufacturer's specification.

H. Signs shall be placed every 40 feet on center that read "PLANT ESTABLISHMENT AREA".

I. Signs shall be aluminum with font size no smaller than 10 inches by 16 inches. Submit sample for approval.

2.15 TEMPORARY HERBIVORE DETERRENT FENCING

A. Aquatic planting areas designated on the Contract Drawings areas shall be protected by a temporary herbivore deterrent fencing raised immediately after plant installation and shall be maintained for the two (2) year establishment period. Areas to be protected are indicated on the drawings.

B. The herbivore deterrent fence shall be a 2'-6" high barrier, constructed as detailed in the Contract Documents, and include the following:

a. 5-foot x 2-inch x 2-inch No. 1 untreated spruce, pine, or fir stakes set on a 50 foot grid and embedded into the lake's substrate a minimum of 2 feet, with one interior stake placed at the center of each 50-foot by 50-foot square.

b. Polypropylene safety fencing shall be 36-inches tall with 2-inch x 2.75-inch mesh openings secured to the stakes with U-Nail and embedded 6 inches into the lake's substrate. Safety fencing color shall be black.

c. 1/8-inch braided natural-fiber jute twine. Tensile strength shall be 84 pounds.

d. Biodegradable roll flagging, by Presco, 1201 E. Pecan Street, Sherman, TX 75090 (800-527-3295, www.presco.com) or approved equal. Color options shall be provided to the Owner for selection.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All plants shall be subject to inspection and approval by the Owner's Representative upon delivery to the site. No materials shall be planted until approval is received.

B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.

C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or other acceptable material. All foliage shall be protected and covered with perforated shade materials.

D. The planting season for evergreen trees and shrubs shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Deciduous trees and shrubs shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Owner's Representative. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.

E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Owner's Representative before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed planting pit or bed, the Owner's Representative may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Owner's Representative's approval, to a depth of not less than 3 feet below grade and not less than 6-inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds.

F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Tree pits shall be at least 2 feet greater in diameter than the root ball of earth or root system. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.

G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.

H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots. All herbaceous plants and groundcovers shall be evenly spaced

to produce a uniform effect and staggered in rows at intervals designated on the contract drawings.

I. Shrubs and trees shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top half of the ball. If a wire basket is present, the upper 2/3 of the basket shall be cut away and removed. Do not remove the entire basket. Roots or bare root plants shall be properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.

J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.

K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting and watered not less than twice per week until final acceptance of the work.

N. Immediately after planting operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the plans. Mulch shall not contact tree bark, cover tree root flares, or shrub crowns. No mulch shall be applied prior to the first watering.

O. The pruning of trees and shrubs shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Owner's Representative. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Owner's Representative. The tree leader shall never be permitted to be cut. Pruning shall be done with clean, sharp tools. All large pruning cuts that are ½-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than ¼-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.

P. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Owner's Representative.

3.02 TEMPORARY FENCING

A. **As the work proceeds and prior to final completion, the Contractor shall install temporary plant establishment protection fencing around all planting areas shown on the plans and herbivore deterrent fence around all aquatic planting areas. Temporary fencing shall stay in place and maintained for the duration of two (2) years and during the water and plant establishment period.**

B. All temporary fencing should be kept plumb and upright throughout the plant establishment period.

C. Maintain fencing in sound condition until project completion. Do not relocate installed fencing without the express approval of the Owner's Representative or Owner.

3.03 MAINTENANCE:

A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the **two (2) year guarantee period** and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated, and otherwise maintained and protected for two years. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.

C. Contractor shall make arrangements to provide sufficient water to maintain all trees, shrubs, and plant materials until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Owner's Representative.

D. Planting areas shall be protected against trespass and damage of any kind onceeach plant is planted and shall continue during the guarantee period. This shall include the furnishing and installation of approved temporary fencing per plans. If any plants become damaged, they shall be treated or replaced as required by the Owner's Representative at no additional cost to the Owner.

3.04 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. Contractor shall provide written notice to the Owner's Representative not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Owner's Representative shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

B. Inspection and acceptance of plantings may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

3.05 GUARANTEE:

A. All plant materials shall be guaranteed for a plant establishment period of **two years** after preliminary acceptance of the project by the Owner.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth, shall bear foliage of normal density, size, and color, and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.

D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Owner's Representative, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.

E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.

F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.

G. Guarantee shall not apply to the replacement of unacceptable plants resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

H. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

I. Work included during the plant establishment period shall include a meeting two (2) times

a year (one in spring and one in fall). In total, four establishment visits are required. These must be coordinated with the Owner and within the seeding periods, established in specifications herein. The Contractor shall meet with the Owner, or appointed representative, to review the condition of all plants within the contract area. The meeting will establish a list of tasks to be performed. These include:

1. Hand weeding within the designated area to remove any plants not included on the planting plan and schedule (weeds). Contractor must demonstrate the ability to differentiate between weeds and intentional plantings.

2. Cutting back grasses and pruning of shrubs as directed in the planting. maintenance manual or as directed by the Owner.

3. Replacement of any dead plants or shrubs, according to specifications.

3.07 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Owner's Representative not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Owner, Planner, Owner's Representative shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

END OF SECTION

SECTION 33 05 26.13

TRACER TAPE

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing, handling and installation of tracer tape, as called for on the drawings.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer's literature on the materials, colors and printing specified herein, shall be submitted to the Engineer for review.

B. Tape samples shall also be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Tracer tape shall be by Reef Industries, Houston, TX; Empire Level, Mukwonago, WI; Pro-Line Safety Products Co., W. Chicago, IL; or approved equal.

2.02 TRACER TAPE:

A. Tracer tape shall be at least 3-inches wide.

B. Tracer tape for non-ferrous pipe or conduit shall be constructed of a metallic core bonded to plastic layers. The metallic tracer tape shall be a minimum 5-mil thick and must be locatable at a depth of 18-inches with ordinary pipe locaters.

C. Tracer tape for ferrous pipe or conduit shall consist of multiple bonded plastic layers. The non-metallic tracer tape shall elongate at least 500% before breaking.

D. The tape shall bear the wording: "BURIED DRAIN LINE BELOW" (with "DRAIN" replaced by "WATER, "SEWER", "ELECTRICAL", "GAS", "TELEPHONE", or "CHEMICAL" as appropriate), continuously repeated every 30-inches to identify the pipe.

E. Tape colors shall be as follows, as recommended by the American Public Works Association (APWA):

Electric	Red
Gas & Oil	Yellow

Communications	Orange
Water	Blue
Sewer & Drain	Green
Chemical	Red (not APWA)

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Tracer tape shall be installed directly above the pipe or conduit it is to identify, approximately 12-inches below the proposed ground surface.

B. The Contractor shall follow the manufacturer's recommendations for installation of the tape, as approved by the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. TRACER TAPE shall not be separately measured for payment, but shall be considered incidental to installation of all utility improvements for the project.

4.02 PAYMENT (NOT APPICABLE)

4.03 PAYMENT ITEMS (NOT APPLICABLE)

END OF SECTION

SECTION 33 41 13.22

CORRUGATED POLYETHYLENE [HDPE] DRAINAGE PIPE

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. This section includes furnishing all materials, labor and equipment and installing corrugated polyethylene [HDPE] drainage pipe and fittings as shown on the drawings and as specified herein.

1.02 RELATED WORK:

A. Section 31 00 00 – EARTHWORK

1.03 REFERENCES:

A. The following standards form a part of this specification, as referenced:

American Society for Testing and Materials (ASTM

ASTM D2321	Standard for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
ASTM F405	Standard Specification for Corrugated Polyethylene Pipe and Fittings
ASTM F667	Standard Specification for Large Diameter Corrugated Polyethylene Pipe and fittings

American Association Of State Highway and Transportation Officials

AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe
AASHTO MP6	Standard Specification for Corrugated Polyethylene Pipe 42” and 48” Diameter

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01 33 23 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Manufacturer’s literature on the materials of this Section.

B. Manufacturer’s certification that the product was manufactured, tested, and supplied in accordance with this specification.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Pipe shall be packaged to withstand shipment without damage and handled carefully on the jobsite. Pipe shall be stored so that it is not exposed to sunlight.

PART 2 – PRODUCTS:

2.01 MATERIALS:

A. This Section applies to corrugated polyethylene pipe with an integrally formed smooth interior.

B. The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe.

C. The pipe and fittings shall be free of foreign inclusions and visible defects. Fittings may be either molded or fabricated. Fittings supplied by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Owner's Representative. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

2.02 MANUFACTURERS:

A. Pipe and fittings shall be manufactured by Ipex, Inc.; Plexco, Division of Chevron Chemical Co.; J-M Pipe Co.; Advanced Drainage Systems, Inc. (ADS) or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Pipe interiors, fitting interiors, and joint surfaces shall be thoroughly cleaned before installation. Pipes and fittings shall be maintained clean.

B. Pipes shall be installed in the locations and to the required lines and grades shown on the drawings and provided in these Specifications, using an approved method of control.

C. Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water, nor shall there by any joints made up in water.

D. If any defective pipe is discovered after being placed, removal and replacement with sound pipe will be required at no additional cost to the Owner.

END OF SECTION

SECTION 33 42 31

STORMWATER AREA DRAINS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work to be done under this section shall include the installation of standard drainage structures as shown on the plans and specified under this item. The Contractor shall provide all material, labor, tools, equipment and transportation to complete these items. A grate shall be provided for each structure.

B. Drainage structures shall be installed in the quantities and locations identified on the Contract Drawings. Contact the Owner's Representative if obstructions or conflicts are encountered.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

A. Reference to the standards, specifications and tests of technical societies, organizations, and governmental bodies is made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways and Bridges, the Massachusetts Highway Department, hereinafter referred to as "the Massachusetts Standard Specifications", Sections 2.01, M2.01 and M4.05 AND Plate #203.1.0 of the 1977 MDPW Construction standards.

4. Municipal Standard Specifications and Procedures, as applicable.

5. MAAB – Massachusetts Architectural Access Board

6. ADA – Americans with Disabilities Act

1.03 CODES, ORDINANCES AND PERMITS

A. All work shall be performed in strict accordance with local and state codes and regulations.

1. Site utility work shall be done in strict accordance with the Commonwealth of Massachusetts State Plumbing Code, dated September

1976, and all revisions thereto.

2. The Contractor shall secure all permits deemed necessary in connection with the installation of this equipment and pay fees required for same. He shall include the cost and back charge of installing any portion of the work where performed by municipal departments or utility companies.

1.04 SUBMITTALS/SHOP DRAWINGS

A. Shop drawings shall be submitted to the Owner's Representative for all equipment. Copies shall be submitted and shall include cuts, scale drawings, installation details, manufacturer's specifications, certified performance characteristics and capacity ratings.

A. No material or equipment may be purchased or installed before the submission and written approval of the shop drawings.

PART 2 - PRODUCTS

2.04 CASTINGS

B. Dome Grates for installation with catch basins in planted stormwater swales shall be 'Dome Light-Duty' as manufactured by Nyloplast, a division of Advanced Drainage Systems, Inc., or approved equal.

2.05 DRAINAGE STRUCTURES AND DRAIN INLETS

A. Drain inlets, manholes and catch basins shall conform to the following specification:

PVC drainage structures shall be of the inline drain type as indicated on the contract drawings and referenced within the contract specification. Ductile iron grates for each of these fittings are to be used. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or approved equal. The drainage manholes and catch basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the furnished 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. The joint tightness shall conform to ASTM D3212 for joints or drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the inline drain body by use of the swage mechanical joint. The pipe stock used to manufacture the inline drain body and pipe bell spigot of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.

The grates furnished for all surface drainage inlets shall be ductile iron. Grates and covers for drains shall be capable of supporting H-25 wheel loading for heavy-duty traffic. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

PART 3 - EXECUTION

3.01 Structures shall be constructed to the line, grades, dimensions and design shown on the plans and as directed and furnished with the necessary frames, grates, covers, aluminum steps, etc., in accordance with these Specifications. Verify inverts of all utilities to remain.

3.02 Connections will be carefully made to all existing and proposed lines to the grades and elevations shown on the contract drawing.

3.03 Suitable materials obtained from the excavation or from borrow shall be placed between the outside of the structure and the limits of the excavation, uniformly distributed in successive layers not exceeding 6 inches in depth and thoroughly compacted by tamping with mechanical rammers or tampers. When required, the backfill material shall be moistened during the compacting. Compaction with iron hand tampers having a tamping face not exceeding twenty-five (25) square inches may be allowed, but only after permission has been given by the Owner's Representative.

3.04 All materials removed in the excavation for area drains, etc. and remaining after the filling about the finished structure has been made shall be used wherever possible within the project or removed and satisfactorily disposed of outside of the project limits without additional compensation.

3.05 Where directed, the castings shall be temporarily set at such grades as to provide drainage during the construction.

END OF SECTION