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CONTRACT DOCUMENTS

June 2019

CITY OF
Providence
Rhode Island

THE BEIRUT NINE MEMORIAL

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SECTION 01000
SUMMARY OF WORK

PART 1.00 - GENERAL

1.01 PROJECT DESCRIPTION

Rhode Island Department of Administration, Division of Capital Asset Management and Maintenance (the Owner), located at One Capitol Hill, Providence, RI, is requesting the demolition, associated site preparation, and construction of The Beirut Nine Memorial located along the Providence River near Dyer Street and Friendship Street.

1.02 SCOPE OF WORK

A. The work covered by this Contract shall include the following activities, conducted in accordance to the contract bid documents and under the supervision of the Owner and the Owner's Representative

1. Demolition of Existing site structures including pavement, walls, walkway, vegetation, trees.
2. Removal, relocation, and Resetting of existing pedestrian light fixtures
3. Site Preparation, grading, planting, and paving of the memorial pathway, including:

    a. Porous unit pavers
    b. Granite Pavers
    c. Granite slab Thresholds
    d. Granite Paver Inlay of the 9th Marine Unit Patch
    e. Stairs and handrails

4. A lit granite and etched glass monument
5. Lit informational panels

B. Refer to the drawings for a detailed layout and scope of each aspect to the project.

C. In addition to the general construction activities described previously, the work encompassed by the subject contract shall include, but is not limited to the following documentation:

1. Coordination with the Owner and the Owners representatives.
2. Implementation of approved Soil Erosion and Sediment Control Plan, in accordance with "The RIPDES General Permit for Storm Water Discharge from Construction Activity". Site inspections must be conducted at least once every seven (7) calendar days and within twenty-four (24) hours of each storm event of 0.25 inch or greater in a 24-hour period during construction to ensure that the erosion controls are intact.
3. Payment and Performance Bonds as described under General Conditions

4. Specific Insurance coverage as described under General Conditions
5. Construction and maintenance of a temporary construction fence
6. Mobilize all equipment to the job site that is needed to complete the work and then decontaminate and demobilize same upon completion.
7. Prepare for work by preparing and submitting for approval Health and Safety, Traffic Control, Storm Water Management / Erosion Control Plan, Shop drawings, as well as all other submittals required to complete the work.
8. Install erosion control systems per the drawings.
9. Provide all equipment and materials needed to control dust within the project limits as directed by the Owner's Representative.
10. Site clearing, grubbing and erosion control, including removal and disposal of all debris
11. Earth excavation, soil handling, hauling, placement, compaction, grading and off-site disposal of excess soils
12. Furnish, install and grade new clean fill barrier material
13. Maintain the site and control erosion during the work until such time that vegetative cover has been established and accepted by the Owner

D. All work items listed above shall be completed in accordance with all Local, State, and Federal regulations and industry standard best practices as pertaining to each work item.

1.03 SPECIAL REQUIREMENTS

A. The Contractor will coordinate the construction schedule with the Owner's Representative to ensure that access to areas is permitted during the planned time.

B. The Contractor shall be responsible for removing and protecting any equipment that may interfere with the construction operations. Immediately upon completion of construction activities in a given area, the contractor shall be responsible for maintaining the site in a finished condition until accepted by the Owner.

C. The Contractor shall be responsible for verifying the existing and forecasted weather conditions to determine when the conditions are acceptable for work conditions and may be performed in full compliance with the construction storm water management plan.

D. The Contractor shall always be prepared to protect any uncompleted work from the rapid changes in the weather. If work continues during sudden rains the Contractor shall be responsible to protect the work area.

1.04 FORM OF SPECIFICATION

A. These specifications are written in imperative and abbreviated form. Imperative language of Specification sections is directed at Contractor, unless specifically noted otherwise. Incomplete sentences in Specifications shall be completed by inserting "shall," "Contractor shall," "shall be," and similar mandatory phrases by inference in same manner as they are applied to notes on Drawings. Words "shall be" shall be supplied by inference where colon (:) used within sentences or phrases. Except as worded to contrary, fulfill (perform) indicated requirements whether stated imperatively or otherwise.

B. Items of work are specified by section. Specifications or requirements of one or more sections may apply or be referenced in other sections.

C. The Contractor shall provide work described and comply with requirements stated in each Specification section and Drawings unless specifically assigned to other Contractors or Owner.

1.05 WORK BY OTHERS

A. The Contractor shall limit activities to the areas designated to not interfere with work by other on-site contractors or tenants.

1.06 MILESTONES

A. The Contractor shall adhere to the schedule items outlined in the specifications. The construction schedule shall be submitted to the Engineer for approval within seven (7) days of execution of the Contract. Limit activities to the areas designated to not interfere with work by other on-site contractors or tenants. It is the intent of this contract to begin project work by and to be substantially complete work by September 20, 2019 and fully complete work by October 20, 2019.

1.07 CONTRACTORS USE OF PREMISE

A. The Contractor shall limit use of premises for work and storage of materials to allow for the following.

1. Work by other contractors.
2. Owner / Tenant occupancy.

B. The Contractor shall conduct operations to ensure least inconvenience to the owner, facility tenants and other contractors.

C. The Contractor shall assume full responsibility for protection and safekeeping of site areas, Contractor's equipment and products, under this Contract.

D. The Contractor shall confine operations to areas within the contract limits indicated and shall not disturb portions of the site beyond areas in which Work is indicated.

E. The Contractor shall keep driveways, roads, and entrances serving premises clear, clean and available to Owner and public always except when approved by Owner's Representative and shall not use these areas for parking or storage of materials.

F. The Contractor shall not use any of the facilities of the tenants or neighbors at any time.

G. The Contractor shall schedule deliveries to minimize space and time requirement for

storage of materials and equipment on Site.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

SECTION 01175
TEMPORARY FACILITIES

PART 1.00 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all temporary facilities enumerated herein or required for the proper completion of the work.

B. Temporary facilities shall include but not limited to:

1. Sanitary Facilities
2. Electrical Power
3. Lockable Trailer/Storage Container
4. Temporary Construction Security Fence

PART 2.00 - FACILITIES

2.01 SANITARY FACILITIES

A. Adequate sanitary conveniences for use of workman on the premises, properly secluded from public observance, shall be provided and maintained by the Contractor, in accordance with local and state health requirements, and in such a manner and at such points as shall be approved by these authorities, and their use shall be strictly enforced. Sanitary waste shall be treated and disposed of in a manner satisfactory to the Owner and the local and state authorities. Under no circumstances shall sanitary wastes be allowed to flow on the surface of the ground.

2.02 ELECTRICAL POWER

A. The Contractor shall provide all temporary electrical power required to operate equipment for the duration of the Contract.

B. The securing of all permits and approvals from the regulating utility companies shall be the responsibility of the Contractor. All unauthorized sources of power, such as from neighboring homes, shall be prohibited.

2.03 LOCKABLE TRAILER/STORAGE CONTAINER

A. The Contractor shall provide a lockable trailer/storage container to safely secure all new

equipment and materials as required.

B. The Owner's Representative/Owner will designate the storage location.

2.04 TEMPORARY CONSTRUCTION FENCING

A. The Contractor shall furnish and install an six foot (6') high galvanized (12 ga. min.) temporary construction security fence at the project site to surround the limits of work for the duration of the project and also one (1) year after project completion or the start of Phase II construction, whoever comes first, but no longer than one (1) year from project completion date..

2.05 REMOVALS

A. The Contractor shall remove and properly dispose of all temporary facilities at the satisfactory completion of the Contract.

B. All sites utilized for temporary facilities shall be restored to a condition satisfactory to the Owner.

END OF SECTION

SECTION 01200
AS-BUILT DRAWINGS

PART 1.00 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section shall include the transmittal to the Owner's Representative of all applicable data relative to as-built conditions as may be required by the Owner's Representative.

PART 2.00 - PRODUCTS

A. As-built information as specified.

PART 3.00 - EXECUTION

3.01 MARKED-UP PRINTS

A. The Engineer shall provide the Contractor with an extra set of prints of the Drawings to be used for indicating the locations, elevations and other as-built conditions.

C. The marked-up prints shall be kept up to date daily and shall always be available for the Owner's inspection . Any inaccuracies or incomplete information shall be correct immediately.

D. They shall be kept in a safe location by the Contractor, or at the Contractor`s option, in the offices of the Owner.

E. All markings on the prints shall be done neatly with a red pencil.

F. After review of As-Builts by the Owner's Representative and an approval is given, the Owner's Representative shall transmit the revised plans to the Owner via AutoCAD.

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1.00 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit Product Data, Samples and Certifications concurrently as required by Contract Documents and as reasonably requested by the Engineer.

B. Prepare and submit to the Engineer no later than ten (10) calendar days after receipt of Notice to Proceed (NTP), a list of submittals required by each Specification Section in the Contract Agreement. Submit in accordance with this Section.

C. Designate in schedule data dates for submission and review of shop drawings, product data and samples, and the date of return.

1.02 PRODUCT DATA

A. Preparation:

1. Annotate each sheet to clearly identify specific product or part installed and specific data applicable to installation.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.
4. Indicate specified finish.
5. Indicate only those sheets, which are pertinent to specific product(s) with product clearly identified.

B. Manufacturer's standard schematic drawings and documents.

1. Modify drawings and diagrams to delete information, which is not applicable to the Work.
2. Supplement standard information to provide information, which is applicable to the Work.

1.03 SAMPLES

A. Provide a minimum of three (3) office samples, or as otherwise indicated in the Technical Specifications, of enough size to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.

2. Full range of color, texture, and pattern.
3. Samples shall be referenced to applicable section of the specifications.
4. Sample of selected color, texture or finish is to be provided on 4”x 4” (or as appropriate) sample chip. Record sample to match actual material installed.

1.04 MANUFACTURER’S CERTIFICATION OF MATERIALS AND EQUIPMENT

A. Certification is required for the following systems:

1.05 SYSTEMS REQUIRING REVIEW

A. Contractor shall review all submittals prior to transmittal to the Engineer.

1. The Contractor shall consecutively number all shop drawings and product data transmittals. Re-submittals would have the same number of the previous submittal followed by the suffix “A, B, C etc.”
2. The transmittal is to contain the project number and the applicable specification section for each product represented on the transmittal.

B. Apply Contractor’s stamp to submittals, initialed or signed by authorized person and dated, certifying review of submittal, verification of products, field measurements and field construction criteria, and coordination of information within submittal with requirements of Work and the Contract Documents.

C. Submittals without Contractor’s stamp or submittals that, in the Engineer’s opinion are incomplete, contain numerous errors, or have not been checked or have only been checked superficially, will be returned without comments. Delays resulting there from shall be solely the Contractor’s responsibility.

D. Clearly note proposed deviations from the Contract Documents on submittals. Submit listing identifying deviations in a format acceptable to the Engineer.

E. Contractor shall be responsible to ensure quantities and dimensions shown on submittals comply with the requirements of the Contract Documents.

1.06 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the Work. Submittals by Contractor shall be made only through the Engineer.

B. Number of submittals required:

1. Shop Drawings: Submit one (1) reproducible transparency (sepia) and three (3) opaque reproductions (prints) in addition to what the Contractor will require back.
2. Product Data: Submit copies Contractor requires, plus three (3) originals that will be retained by the Engineer.
3. Samples: Submit two (2) samples of each material or the number required in each specification section.

C. Submittals shall contain:

1. Date of submission and dates of any previous submissions.
2. Project title and number.
3. Contract identification number.
   a. The names of:
   b. Contractor.
   c. Subcontractor.
   d. Supplier.
   e. Manufacturer.
4. Identification of the product, with the specification section number.
5. Field dimensions clearly identified as such.
6. Relation to adjacent or critical features of the Work or Materials.
7. Applicable standards, such as ASTM or Federal Specification numbers.
8. Identification of deviations from Contract Documents and justification.
9. Identifications of revisions on re-submittals.
10. Additional information as required by Contract Documents.
11. An 8-in.x 3-in. blank space for Contractor and Engineer stamps.

D. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer and/or Engineer's review of submittals

E. Numbering system established by the Contractor shall be agreeable to Engineer.

1.07 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by the Engineer, mark number of submissions and resubmit as required until approved.

B. Product Data:
   1. Revise initial data and resubmit as specified for the initial submittal.
   2. Indicate any changes which have been made other than those requested by the Engineer.
   3. Mark number of submission and resubmit until accepted.

C. Samples: Submit new samples as required for initial submittal. Remove samples, which are “rejected” or designated “resubmit.”

1.08 OWNER’S REPRESENTATIVE’S REVIEW RESPONSIBILITIES

A. The Engineer shall review submittals with responsible promptness in accordance with the requirements of the Project Manual.

B. Affix stamp and initials or signature, and indicate requirements for revisions and re-submittal, if any.

C. Return submittals to Contractor and Owner for distribution, or for resubmission within fourteen (14) days of original receipt.

END OF SECTION

SECTION 01311

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 Engineer 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, Engineer 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 another federal requirement

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 Engineer and Owner.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1.00 – GENERAL

1.01 RELATED DOCUMENTS

A. Documents related to this section include, but are not limited to, General Conditions, Special Conditions, Bidding Documents, Technical Specifications and Drawings

1.02 QUALITY CONTROL

A. The Contractor shall be:

1. Acceptable to the Owner.
2. Acceptable and approved by the material manufacturers / suppliers.

B. Any deficiencies noted during construction inspection must be corrected by the contractor and approved by the owner at no additional expense to the owner

1.03 FIELD QUALITY CONTROL

A. The existing dimensions shown on the plans are approximated and used to describe the scope of work. The contractor shall verify all existing dimensions.

B. Any discrepancies found must be submitted to the Owner's Representative in writing.

1.04 RANDOM SAMPLING

A. During work, the owner / Owner's Representative may at their discretion secure samples of materials being used from containers at the job site and submit them to an independent laboratory for testing and comparison to specified materials.

B. If test results prove that a material is not functionally equal to specified material:

1. The Contractor shall pay for all testing.
2. All materials having failed testing that have been installed will be removed and replaced with specified materials at no additional expense to the owner.
3. All materials having failed testing not installed will be removed from the job site and replaced with specified materials at no additional expense to the

owner.

PART 2.00 – PRODUCTS

2.01 GENERAL

A. Comply with quality control, references, specifications and manufacturer's data. Where a conflict exists, the more stringent requirements govern.

PART 3.00 – EXECUTION

3.01 SUBMITTALS

A. Provide property owner/engineer a letter from the material manufacturer indicating that the applicator is approved to install their products and will provide warranty for this installation.

END OF SECTION

SECTION 01450
SAMPLING & TESTING

PART 1.00 - GENERAL

1.01 SCOPE OF WORK

A. In the event that Owner testing discovers unsatisfactory work, the Contractor shall conduct any additional testing in accordance with this specification. The work under this Section shall consist of performing or ordering the work of collecting samples for testing, having tests performed by a Certified Testing Laboratory satisfactory to the Engineer, having all test results forwarded to the Engineer for approval, and paying all costs associated with the collection and sampling, transportation, shipping, postage, and testing, and the coordination of test results and approvals.

1.02 SUBMITTALS

A. In accordance with Section 01300 of these Specifications, submit the names, addresses and certification of laboratories to be utilized for approval by the Engineer.

PART 2.00 - MATERIALS

2.01 CONTAINERS AND TOOLS

A. Utilize tools recommended by the laboratory to obtain samples, packaging or containers suitable to, or furnished by, the laboratory, and collect all samples in the proper number and quantity to permit tests to be conducted.

2.02 TESTS

A. Refer to Section specifications for test requirements and criteria for results; coordinate with the Owner's Representative.

B. All utilities, park elements, lighting systems, and any other components from the scope of work as requested by the Owner's Representative shall be tested to ensure complete compliance with manufacturer's installation instructions and warrantee requirements.

PART 3.00 - EXECUTION

3.01 METHODOLOGY

A. Unless otherwise directed by the Section specifications, perform sampling and testing will be ordered by the Contractor and approved by the Owner's Representative. Locations, number and quantity of samples shall be submitted for approval as directed in accordance with the Specifications.

B. Sampling and Testing results must be provided to the Owner's Representative and Approved prior to the installation of any work potentially impacted by unacceptable test results.

END OF SECTION

SECTION 01562

DUST CONTROL

1. Description

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

2. 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 Engineer.

3. Water

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

4. Application

A. Calcium chloride shall be applied when ordered by the Engineer and only in areas which will not be adversely affected by the application. See Section 01570, 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 directed by the Engineer. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be determined by the Engineer.

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 01570

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 the PROJECT.

C. All work under this Contract shall be in accordance with the RIDEM Regulations and required permits, Section 00890 – PERMITS.

D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 01300 – SUBMITTALS

B. Division 2

1.03 SUBMITTALS:

A. The Contractor shall submit for approval 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 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.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer 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 Engineer 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. The Contractor shall not disturb areas designated as wetlands. All work shall be performed on the existing paving and/or concrete tank slab.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. 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 Engineer.

3.05 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 Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

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 Engineer 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 Engineer. 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 Engineer. 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.

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 and to an approved location prior to its discharge into a receiving water or drainage system.

B. The pumped water shall be filtered through filter fabric and baled straw, 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.

3.09 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.

3.10 BALED HAY OR 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. Hay bales shall not be placed within a waterway during construction of the pipeline crossing.

3.11 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation fabric shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation fabric 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.

END OF SECTION

SECTION 01600
DELIVERY, STORAGE AND HANDLING

PART 1 – GENERAL

1.00 RELATED DOCUMENTS

A. Documents related to this section include, but are not limited to, General Conditions, Special Conditions, Bidding Documents, Technical Specifications and Drawings

PART 2 - DELIVERY, STORAGE AND HANDLING

2.00 DELIVERY OF MATERIALS

A. Deliver materials to the job-site in new, dry, unopened and well marked containers showing product and manufacturer's name

B. Deliver materials in sufficient quantity to allow continuity of work

2.01 STORAGE OF MATERIALS

A. Remove plastic packing shrouds. Cover all stored materials with canvas tarp top to bottom. Secure tarps

B. Ground Storage: store materials in a secure location as directed by owner/engineer to avoid interference with normal operations of the site

2.02 MATERIAL HANDLING

A. Handle all materials on site to avoid bending, tearing, or other damage during transportation and installation

B. Material handling equipment shall be selected and operated so as not to damage existing construction. Do not operate or situate material handling equipment in locations that will hinder smooth flow of vehicular or pedestrian traffic.

C. Handle all materials in accordance with manufacturer's guidelines

2.03 ENVIRONMENTAL REQUIREMENTS

A. Do not work when environmental conditions exceed the material manufacturer's guidelines

B. Protect all unfinished work from rain, water or other harsh environmental conditions

C. Any damage to materials or existing construction caused by the Contractor's failure to protect such shall be repaired or replaced at no additional expense to the Owner

END OF SECTION

SECTION 01740

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 Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

A. Section 00700 GENERAL CONDITIONS

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

2.01 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 Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

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

2.02 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.

2.03 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.

2.04 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 Engineer.

2.05 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 Engineer shall approve the condition of the site.

END OF SECTION

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SECTION 02071
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 Engineer.

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

Six (6) sets of shop drawings or working drawings and material specifications shall be submitted to the Engineer 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 72 mils thick and possess the characteristics of Mirafi 180N.

B. The filter/drainage fabric shall be Mirafi 180N as manufactured by TenCate Geosynthetics; 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 Engineer.

B. EROSION CONTROL FABRIC:

Erosion control fabric shall be placed over the prepared surface in drainage swales and other locations as required by the Engineer. The fabric shall be unrolled, placed in the direction of water flow, overlapped, pinned down with wood stakes, and seeded. All

installation work shall be in accordance with manufacturer's recommendations or as required by the Engineer.

C. 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 Engineer. 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 Engineer, 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 02220
DEMOLITION

PART 1- GENERAL

1.01 SCOPE OF WORK:

A. Work under this Section shall consist of the careful removal, storage on site, storage for reuse, legal transportation off-site, or demolition, of all structures and site features encountered or noted to be removed or abandoned to four feet below finished grade, and the removal and legal disposal of all materials not called for to be reused or salvaged, in accordance with the contract drawings, these specifications, and the directions of the Engineer. Provide all labor, equipment, materials, transportation and permits necessary to complete the work.

B. Items plan-referenced to be removed and stored shall be carefully removed and stored on site or in a designated location in town in a manner and location designated by the Engineer for reinstallation later or pick up by DPW representatives as shown on the plans or as required by the Engineer.

C. Items plan referenced, or as required by the Engineer 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 Engineer, shall be transported to a municipal storage facility, located within the Town's confines, and unloaded and stacked as required by the Engineer or Project Manager.

E. The scope for the general work/demolition requirements of this section include:

1. Removing cement and bituminous concrete pavements.

2. Clearing and grubbing of existing vegetation.

3. Stripping and stockpiling of existing top soil.

4. Removal of existing wall sections.

5. Removal of conduit and other utilities to be abandoned.

6. Removal and disposal of miscellaneous site features within the project areas, as indicated on the drawings.

7. Installation and maintenance of erosion controls.

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 all, frames, grates, and covers from any demolition work and transport these to the Municipal Storage Yard unless these are called for to be reused, stored on site, or ordered by the Engineer 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. Refer to Section 01570 ENVIRONMENTAL PROTECTION.

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 nearest 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 Engineer at no additional cost to the Owner.

PART 2 - MATERIALS

2.01 BACKFILL:

A. The Contractor shall provide suitable backfill as specified under Section 02300 EARTHWORK 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.

2.02 TEMPORARY FENCE:

A. Refer to Section 02821- TEMPORARY CHAIN LINK FENCE

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 Engineer 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.

3.04 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 Town requirements.

C. Electrical conduits encountered and previously abandoned shall be capped or plugged unless called out to be removed in their entirety.

END OF SECTION

SECTION 02230
CLEARING AND GRUBBING

PART 1.00 - GENERAL

1.01 SCOPE OF WORK

a. The work under this Section shall consist of clearing, grubbing, cutting, removal and disposal of all vegetation and debris from areas within the Limit of Work where noted on the plans or as designated by the Engineer. The work shall also include the preservation from injury or defacement of all vegetation and objects designated or directed to remain.

1.02 SPECIAL INSTRUCTIONS

a. The burning of trees, brush, stumps, etc., shall not be permitted. The Contractor shall provide other satisfactory methods of disposal without additional compensation.

b. When fencing is installed outside normal clearing areas, every reasonable effort shall be made to preserve trees or shrubs whose removal is not essential to the installation of the fencing.

c. Trees and shrubs that are not to be cut, removed, destroyed or trimmed shall be saved from harm and injury. All damage done to trees by the Contractor's operation shall be appropriately pruned in accordance with accepted horticultural practice unless damage is so extensive that the damage claim process shall be adopted.

d. Equipment and supply storage areas shall be kept well away from the root zones of existing trees. This zone is determined to be equal to the outreach of the above ground branch structure of the trees. All effort shall be made to minimize any activity in these areas to help insure the continued good health of the existing trees.

1.03 PERMITS

a. Per Permit Section of these Specifications, the Engineer shall be furnished notarized copies of agreements between the Contractor and owners of legal landfills and disposal or storage areas upon request. The Contractor shall make arrangements and negotiations necessary for the satisfactory legal disposal of trees, shrubs, stumps, roots, dead-wood and other litter off site.

PART 2- MATERIALS

2.01 SUITABLE BACKFILL

a. Refer to Specification Section 023O0 EARTHWORK for suitable backfill

requirements.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

a. Clear and grub all areas as designated on the plans. At the discretion of the Owner, individual plant materials, not plan referenced, may be denoted in the field to remain as determined by the Project Representative.

b. The stumps of all trees, brush and major roots shall be grubbed and removed per Section 02235 of these Specifications.

3.02 DISPOSAL OF TREES, BRUSH AND STUMPS

a. Trees and stumps shall be properly disposed of off-site at a legal dump site as specified.

3.03 DISPOSAL OF DUTCH ELM DISEASED WOOD SHALL BE DONE IN THE MANNER HEREIN SPECIFIED:

a. Dutch Elm diseased wood shall be disposed of in accordance with the provisions of General Law, Chapter 87, Section 5 and Chapter 132, Sections 8 and 11, as amended; and in accordance with any additional local regulations.

b. Where the work includes the removal of elm trees or the limbs of elm trees, such trees or limbs thereof shall be disposed of immediately after cutting or removal and in such a manner as to prevent the spread of Dutch Elm disease. This shall be accomplished by covering them with earth to a depth of at least six (6) inches at the off-site location where the Contractor has arranged for disposal.

c. Where the work includes the removal and disposal of stumps of elm trees, such stumps shall be completely disposed of immediately after cutting in the manner specified above.

3.04 BACKFILLING

a. Fill all voids with suitable backfill in controlled eight (8) inch maximum compacted lifts flush with proposed subgrades in adjacent areas.

END OF SECTION

SECTION 02235
TREE PRUNING AND TREE AND STUMP REMOVALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

a. The work of this Section includes the following:

1. Pruning - Class II, including the removal of all limbs necessary to execute the field, Pathway 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. Eligible contractors 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 Rhode Island Certified Arborist in the Contractor's employ.

1.03 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.

1.04 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 Rhode Island Tree Council.

5. The standards and practices of the American Association of Nurserymen.

b. The term 'Owner' shall mean the City of Boston's designated representative charged with carrying out the requirements of this Project –'Landscape Architect', 'Engineer', 'Planner', or 'Tree Warden' as referenced herein, rendering approvals for the Owner.

1.05 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.

1.06 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.

1.07 PROTECTION OF THE VEGETATION TO BE PRESERVED

a. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain.

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 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 City and of sufficient quantity such that the sum of the 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.

1.08 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. 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 - MATERIALS

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.

2.03 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 roster assigned to this Contract.

b. A crew shall consist of one (1) tree trimmer/climber, and one (1) ground person (one which 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 a 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.

PART 3 - EXECUTION OF PRUNING/REMOVALS

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 will be identified or will be as required to provide for passage compliance on pathways or the passage of equipment. The

owner or the owner's representative shall approve all tree pruning.

c. Vehicle access shall be controlled and approved by the owner's Representative.

d. If the Contractor discovers tree(s) which have not been marked for pruning, but whose condition is such that pruning or 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 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 of trees removed shall also be removed 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 directed by the Owner.

h. Excavation or grading within the branch spread of trees to be saved shall be performed only under the direction of the Owner unless otherwise directed.

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 02240
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 00890, PERMITS

B. Section 01570, ENVIRONMENTAL PROTECTION

C. Section 02252, SUPPORT OF EXCAVATION

D. Section 02300, EARTHWORK

1.03 SYSTEM DESCRIPTION:

A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

1.04 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the dewatering systems.

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 Engineer, 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 and excavation support (see Section 02252, SUPPORT OF EXCAVATION) 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. Contractor shall submit six copies of a plan indicating how they intend to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or stormwater runoff during the life of the project.

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 Section 01570 ENVIRONMENTAL PROTECTION and Section 00890 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 02252
SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of the specification covers wood sheeting and bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to other methods of excavation support and underpinning which the Contractor elects to use to complete the work.

B. The Contractor shall furnish, and place timber sheeting of the kinds and dimensions required, complying with these specifications, where indicated on the drawings or required by the Engineer.

1.02 RELATED WORK:

A. Section 02300, EARTHWORK.

B. Section 02240, DEWATERING.

1.03 QUALITY ASSURANCE:

A. 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 all State of Rhode Island General Assembly Statutes regarding rules and regulations for the Prevention of Accidents in Construction Operations. Contractors shall be familiar with the requirements of these regulations.

B. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Timber sheeting shall be sound spruce, pine, or hemlock, planed on one side and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2 inches thick.

B. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design. Timber or steel used for bracing shall be new

or undamaged used material which does not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Work shall not be started until all materials and equipment necessary for their construction are either on the site of the work or satisfactorily available for immediate use as required.

B. The sheeting shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation, as required in Section 02240, DEWATERING.

C. The sheeting shall be driven by approved means to the design elevation. No sheeting may be left so as to create a possible hazard to safety of the public or a hindrance to traffic of any kind.

D. If boulders or very dense soils are encountered, making it impractical to drive a section to the desired depth, the section shall, as directed, be cut off.

E. The sheeting shall be left in place where indicated on the drawings or ordered by the Engineer in writing. At all other locations, the sheeting may be left in place or salvaged at the option of the Contractor. Steel or wood sheeting permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise directed.

F. All cut-off will become the property of the Contractor and shall be removed by him from the site.

G. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.

H. The Contractor shall be solely responsible for repairing all damage associated with installation, performance, and removal of the excavation support system.

END OF SECTION

SECTION 02290
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 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 02910, SCREENED LOAM BORROW

B. Section 02930, TREES, SHRUBS, GROUNDCOVERS AND LANDSCAPING

1.03 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following to the Engineer 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.

E. 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 be as specified in Section 02910, SCREENED LOAM.

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 Engineer. 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 conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Chewing's Fescue (Festuca rubra commutata)	30%	70%	97%
'Kentucky 31' Tall Fescue (Festuca arundinacea 'Kentucky 31')	30%	90%	98%
Kentucky Bluegrass (Poa pratensis)	20%	80%	85%
Perennial Ryegrass (Lolium perenne)	20%	90%	98%

E. TEMPORARY COVER CROP:

1. Temporary cover crop shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Annual Ryegrass (Lolium multiflorum)	80% min.	85%	%
Creeping Red Fescue (Festuca rubra)	4% min.	85%	95%
Perennial Ryegrass (Lolium perenne)	3% min.	90%	98%
Red Clover (Trifolium pratense)	3% min.	90%	%
Other Crop Grass	0.5% max.		
Noxious Weed Seed	0.5% max.		
Inert Matter	1.0% max.		

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 Engineer. 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 Engineer, 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:

1. Erosion control blanket shall be 100 percent biodegradable mesh with 100 percent biodegradable straw or straw/coconut fill. Fill shall be held together by biodegradable fastening. Weight shall be 0.50 pounds per square yard. Erosion control blankets shall be applied parallel to direction of water flow. The erosion control blankets shall be by North American Green, Evansville, IN or approved equal. For slopes 4:1 or greater, erosion control blanket shall be composed of 70 percent straw 30 percent coconut fiber, Model SC150. For slopes less than 4:1, erosion control blanket shall be a high velocity straw matting, Model S150.

2. Six-inch wire staples shall be placed in accordance with the manufacturer's recommendations to anchor the mesh material. Staples shall be biodegradable.

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 Engineer.

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, which 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 Engineer.

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 Engineer.

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 Engineer.

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 Engineer.

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 on order of the Engineer. 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 Engineer. 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.

3.02 LOAM TESTING REQUIREMENTS

A. Loam (vegetative support layer) samples shall be collected from in-place loam at a minimum of every 1000 cubic yards and analyzed for grain size (ASTM D422), pH (ASTM D6276) and organic content (ignition test).

3.02 SURFACE PREPARATION:

A. If approved by the Engineer, the entire site area to be seeded shall be treated with an approved herbicide, in accordance with the manufacturer's instructions, not less than 7 days before the start of seeding operations.

B. If approved by the Engineer, grub control insecticide shall be spread on the surface of the seedbed, in accordance with the manufacturer's instructions, after the seedbed has been properly graded, not less than 24 hours before the start of seeding operations.

3.03 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

A. The seed mix shall be broadcast at 6 pounds per 1000 square feet, as recommended by the seed supplier, or as directed by the Engineer. 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. Hay or 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. Hay or Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Engineer, 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 blankets shall be placed as indicated on the plans or as directed by the Engineer.

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 1 ½ 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 Engineer, 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 directed by the Engineer.

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 Engineer.

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 2 ½ - 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 directed by the Engineer.

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 Engineer, 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 Engineer.

F. Pavement shall be kept clean and clear of cuttings and debris at all times during the maintenance period to the satisfaction of the Engineer.

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 Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer 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 Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer 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 02300
EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

A. Special Conditions, PERMITS

C. Section 01570, ENVIRONMENTAL PROTECTION

D. Section 02071, GEOTEXTILE FABRICS

E. Section 02230, CLEARING AND GRUBBING

F. Section 02240, DEWATERING

G. Section 02252, SUPPORT OF EXCAVATION

I. Section 02745, PAVING

J. Section 02910, SCREENED LOAM BORROW AND TOPSOIL RE-USED

K. Section 02290, SEEDING

1.03 REFERENCES:

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	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.

ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Rhode Island Department of Transportation Standard Specification for Road and Bridge Construction.

Rhode Island Waste Regulations for Contaminated Media and Contaminated Debris

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

Samples of all materials proposed for the project shall be submitted to the Engineer for review. Size of the samples shall be as approved by the Engineer.

1.05 PROTECTION OF EXISTING PROPERTY:

A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.

C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.07 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 pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in MHD Specification Section M1.03.0, Type b.

B. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in MHD Specification Section M2.01.

C. SAND BORROW:

Sand Borrow shall satisfy the requirements listed in MHD Specification Section M1.04.0.

D. PEASTONE:

Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:

Passing 5/8 inch square sieve opening	-	100%
Passing No. 8 sieve opening	-	0%

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

H. SPECIAL PIPE BEDDING MATERIAL

1. The special pipe bedding material shall consist of a filter cloth installed on the trench bottom before backfilling with crushed stone as specified and as shown on the contract drawings.

2. The filter cloth shall be composed of needle punch, stapled fibers thermally bonded together to form a sheet.

3. The filter cloths shall possess the following minimum properties:

Grab strength:	120 lbs	ASTM D 4632.
Elongation:	50%	ASTM D 4632
Burst Strength:	240 psi	ASTM D 3786
Puncture Strength:	65 lbs.	ASTM D 4833
Trapezoid Tear:	4 0 lbs.	ASTM D 4533
Equivalent opening size:	No. 70 sieve	ASTM D 4751
Permittivity (sec^{-1})	1.8	ASTM D 4491
Flow Rate ($gal/min/ft^2$)	135	ASTM D-4491

4. The filter cloth shall be Mirafi 140N by Mirafi, Inc. Charlotte, NC; Foss-65 by Foss Manufacturing Co., Haverhill, MA; Supac 4NP, Phillips Fibers Corp., Greenville, SC or approved equal.

I. PROCESSED GRAVEL:

1. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

2. The gradation shall meet the following requirements:

Sieve Designation	Percentage Passing
3 in.	100
1 1/2 in.	70-100
1/4 in.	50-85
No. 4	30-60
No. 200	0-10

3. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.

C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil 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 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings. If unauthorized excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Engineer.

3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.

4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.

5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as directed by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise directed by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

2. The Contractor shall satisfy all dewatering requirements specified in Section 02240 DEWATERING, before performing trench excavations.

3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.

4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.

5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.

6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.

7. If, in the opinion of the Engineer, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.

C. BUILDING AND FOUNDATION EXCAVATION:

1. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.

2. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.

3. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support, the Contractor shall excavate and dispose of the unsuitable material to the required width and depth as directed by the Engineer. If, in the opinion of the Engineer, filter fabric is required; the Contractor shall place filter fabric, approved by the Engineer, as per manufacturer's recommendations. Crushed stone shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

D. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.

2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.

2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.

3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

Location	Percent of Maximum Density
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Engineer reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.

6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.

7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

B. TRENCHES:

1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.

2. As soon as practicable after pipes have been laid, backfilling shall be started.

3. Unless otherwise indicated on the Drawings, select backfill shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.

4. Class B backfill shall be placed from the top of the select backfill to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.

5. Water Jetting:

   a. Water jetting may be used when the backfill material contains less than 10 percent passing the number 200 sieve, but shall be used only if approved by the Engineer.

   b. Contractor shall submit a detailed plan describing the procedures he intends to use for water jetting to the Engineer for approval prior to any water jetting taking place.

c. Compaction of backfill placed by water jetting shall conform to the requirements of this specification.

6. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.

7. Should the Engineer order crushed stone for utility supports or for other purposes, the Contractor shall furnish and install the crushed stone, as directed.

8. In shoulders of streets and road, the top 12-inch layer of trench backfill shall consist of processed gravel for sub-base, satisfying the requirements listed in MHD standard specification M1.03.1.

9. Trenches in state highways shall be backfilled with Controlled Density Fill, in accordance with the state highway permit included in Section 00890, PERMITS.

C. BACKFILLING UNDER BUILDINGS AND FOUNDATIONS:

Material to be used as structural fill under structures shall be special bedding material or gravel borrow, as shown on the Drawings or as directed by the Engineer. Where gravel borrow fill is required to support proposed footings, walls, slabs, and other structures, the material shall be placed in a manner accepted by the Engineer. Compaction of each lift shall meet the density requirements of this specification.

D. BACKFILLING ADJACENT TO STRUCTURES:

1. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.

2. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.

3. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.04 DISPOSAL OF SURPLUS MATERIALS:

A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill.

Upon written approval of the Engineer, 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.

B. 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.

C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.

D. The Contractor shall comply with Rhode Island regulations that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

END OF SECTION

SECTION 02329

TOPSOIL LOAM BORROW

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers all labor, materials, and equipment necessary to furnish and place Loam Borrow and all related work as indicated on the drawings and as herein specified.

B. Existing on-site topsoil that has been stockpiled may be re-used provided it meets these specifications. The Contractor shall be solely responsible to determine if adequate quantities of on-site topsoil exist that may potentially be reused.

1.02 RELATED WORK:

A. Section 02300, EARTHWORK

B. Section 02290, SEEDING

C. Section 02930, TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

1.03 QUALITY ASSURANCE:

A. For each particular source of loam, the Contractor shall send representative samples totaling approximately 10 pounds of Loam Borrow to an approved State-certified testing laboratory.

B. Loam shall be subject to tests for Soluble Salts (1:2 soil-water ratio), Nitrogen (including nitrate and ammonium Nitrogen), Phosphorous, Potassium, Sulfate, Calcium, Magnesium, Aluminum, and Ferric Iron concentrations.

C. Loam shall also tested for heavy metals concentration, which shall include Boron, Cadmium, Zinc, Chromium, Copper, Lead, Manganese, and Nickel.

D. Mechanical gradation (textural analysis) as per USDA Soil Classification System and determine Organic matter content and the pH (1:1 soil-water ratio).

E. All tests shall be at the Contractor's expense. Laboratory test results shall state whether the Loam Borrow is acceptable as a planting medium, whether it needs to be amended, or if it fails to meet accepted requirements. Test results shall also include soil amendment and fertilizing recommendations and shall be forwarded to the Engineer at least 1month before any loaming is to be undertaken.

F. Samples and tests shall continue to be made at the Contractor’s expense until Loam Borrow to be provided is found to be acceptable to the Engineer.

1.04 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following:

A. One (1) electronic copy or Six (6) hard copies of information detailing the soil amendments including limestone, fertilizers, organic material amendments, and the name and address of the supplier and origin of Loam Borrow shall be submitted to the Engineer for approval.

B. One (1) electronic copy or Six (6) hard copies of soils test results shall be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW:

1. Loam Borrow shall consist of, fertile, friable natural topsoil, typical of productive soils in the vicinity, obtained from naturally well-drained areas that have never been stripped. Loam Borrow shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1/2-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.

2. Loam Borrow shall be classified as a sandy loam by the USDA textural classification system as determined by sieve and pipette or hydrometer analysis. Loam Borrow shall have the following mechanical analysis:

Textural Class	Percent of Total Weight	Avg. Percentage
Sand (0.05 – 2.0mm range)	50 – 80	70
Silt (0.002 – 0.05mm range)	15 – 25	20
Clay (less than 0.002mm)	5 – 10	10

3. Loam Borrow shall contain not less than 4 percent or more than 7 percent organic matter as determined by the loss of weight by ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degrees F.4. Loam Borrow shall not be excessively acid or alkaline, and shall not contain any phytotoxic materials or unacceptable concentration levels of any substance harmful to plant growth as determined by the soils testing laboratory. Loam Borrow shall have a pH value range between 5.0 and 6.5. Maximum soluble salt index shall be 100. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be less than or equal to 1.0 millimhos/cm. Aluminum concentration levels shall be less than 200ppm.

5. Loam Borrow shall not be worked, excavated, or delivered in a frozen or muddy condition. Soil structure shall not be destroyed through excessive and unnecessary handling or compaction.

6. Existing on-site topsoil may be re-used as Loam Borrow provided it meets these specifications.

7. All amendments to Loam Borrow shall be approved by the Engineer and shall be made in accordance with recommendations from the soils testing laboratory for use of Loam Borrow as a plant-growing medium and these specifications.

B. 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.

C. 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. For Fertilizers containing Nitrogen, at least 50 percent of the nitrogenous elements shall be Urea-form or derived from organic sources and contain no less than 3 percent water-soluble Nitrogen.

3. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, containing not less than 18 percent available phosphoric acid.

D. ORGANIC MATERIAL AMENDMENTS:

1. 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.

2. 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.

3. 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.

4. 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.

PART 3 - EXECUTION

3.01 After approval of rough grading, the sub-base shall be raked to a depth of 3 inches to remove stones, rock or other foreign materials 3-inches or larger in dimension. The Engineer shall inspect the work for approval, prior to placing of Loam Borrow.

3.02 Loam Borrow shall be placed and spread to the required depths over the locations approved by the Engineer.

3.03 Lime shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer, at a maximum rate of 100 pounds per 1000 square feet per application, in necessary quantities to achieve the pH range requirements for Loam Borrow.

3.04 Fertilizer shall be uniformly applied in accordance with the soil testing laboratory recommendations, or as required by the Engineer. At slopes exceeding 25 percent gradient, fertilizer shall be applied manually in a manner approved by the Engineer. Fertilizer shall not be applied between June 15 and August 31.

3.05 Loam Borrow shall be worked by tilling or power raking to a minimum depth of 3-inches, thoroughly incorporating the lime and fertilizer into the soil. The Loam Borrow shall then be raked until the surface is finely pulverized and smooth and compacted with rollers, weighing between 75 and 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines, grades and depths indicated on the plans.

END OF SECTION

SECTION 02775

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 required 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 wheelchair ramps where shown on the drawings or as required by the Engineer.

1.02 RELATED WORK:

A. Section 02300, EARTHWORK

B. Section 02773, CURBING

1.03 REFERENCES:

The following standards form a part of these specifications, as referenced:

State of Rhode Island
Department of Transportation (RI-DOT)
Standard Specification for Road and Bridge Construction

1.04 SUBMITTALS:

A. In accordance with Section 01330 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. CEMENT CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS:

1. Except as otherwise indicated, cement concrete sidewalks and wheelchair ramps shall be constructed in accordance with the requirements of Section 701, Sidewalks, Wheelchair Ramps and Driveways, of the latest edition of the RI-DOT Standard Specifications for Road and Bridge construction, and all amendments thereto.

2. Wheel chair ramps shall be installed in new sidewalks at intersections in accordance with RI-DOT Standards. 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 CEMENT CONCRETE SIDEWALKS AND WHEELCHAIR 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 RI-DOT Standard Specifications at minimum.

PART 3 - EXECUTION:

3.01. CEMENT CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS:

A. Concrete for sidewalks and wheelchair 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 required 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

Document5

SECTION 02783
GRANITE AND UNIT PAVERS

PART 1 – GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete the installation of granite pavers according to the lines, grades and details identified on the plans and in accordance with the specifications herein.

B. In summary, the limited work required under this section shall require the following:

1. Installation of unit pavers, including concrete and granite pavers at site entrance "thresholds" and at the memorial, as identified on the plans. All unit pavers and and granite pavers are to be installed on a stone dust setting bed with a concrete base below, as indicated on the details. Pavers are to be furnished in accordance with the schedule identified on the Contract Drawings.

2. All excavations, removals and backfilling of required materials necessary to install the granite pavers.

1.02 RELATED WORK:

A. Section 01330, SUBMITTALS

1.03 SUBMITTALS:

A. The granite supplier shall submit shop drawings for approval in coordination with Section 01330, Submittals.

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

1.04 SAMPLES:

A. Prior to ordering any materials, the Contractor shall submit representative granite and concrete unit paver samples to the Engineer for selection and approval. Do not order materials until Engineer's approval has been obtained. Delivered materials shall exactly match the approved samples.

1. Granite Pavers

The Contractor shall submit six (6) granite samples to show the texture, finish, and full range of color variation that can be expected in the finished work. Identify both the quarry and fabricator (if different) for all the granite features specified under this section.

2. Granite Paver Sample Panels

Construct two (2) sample panels of pavers on stone dust setting bed at locations as required by the Engineer. The sample panels shall encompass twenty-five (25) square feet and be located by the Engineer. The Engineer must approve the quality of workmanship before permanent granite pavement construction is started. If the samples are not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved samples shall become the standard for granite pavement throughout the entire job. The sample panels should be constructed on a location becoming part of the final pavement and shall remain undisturbed until all paving is completed.

3. Unit Pavers

The Contractor shall submit six (6) paver samples to show the texture, finish, and full range of color variation that can be expected in the finished work.

1.04 SHIPPING AND HANDLING OF MATERIALS:

A. Notwithstanding any prior acceptance of materials given prior to delivery, acceptance and approval for all work will be based upon the conditions at completion of installation.

B. It is the responsibility of the Contractor to exercise all necessary precautions to properly protect materials. Where damage occurs the items will be rejected.

1. Granite pavers shall be packaged and delivered/off-loaded to manufacturer's standards. Pavers damaged in any manner will be rejected and shall be replaced with new material at no additional cost to the Owner.

2. Store all granite pavers on raised platforms in such a manner as to prevent damage or intrusion of foreign matter. Storage piles or stacks shall be located to avoid damage and be protected from heavy and unnecessary traffic. Materials shall be stored under an approved roof or covered with waterproof tarpaulins, at all times, except when men are working and using the materials.

1.05 CLEANUP:

A. After completion of all work, all debris, rubbish, and surplus materials shall be removed from the site. The site shall be left clean, presentable, and to the satisfaction of the Engineer.

1.06 REFERENCE STANDARDS AND SPECIFICATIONS:

A. Reference to the standards, specifications and tests of technical societies, organizations, and governmental bodies is made in the following publications:

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

2. ASTM - American Society for Testing and Materials.

3. MassDOT Standard Specifications – Latest edition of the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.

4. Specifications for Architectural Granite as published by the National Granite Quarries Association, Inc.

1.07 QUALIFICATIONS:

A. In conformance with qualifications requirements described elsewhere in the contract documents, the entity responsible for the installation of all granite pavement shall possess significant experience with projects of a precise nature. Individuals or companies proposing to accomplish the work of this section shall be subject to the approval of the Owner or its representatives.

PART 2 – PRODUCTS

2.01 GRANITE PAVERS:

A. All granite 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. The thickness of all pavers shall be three inches (3”). Other dimensions (length and width) shall be in accordance with the Contract Drawings.

B. For all granite paver locations/applications furnish “Milford Pink” as quarried by Fletcher Granite Company. The color shall be pinkish and light gray with charcoal colored flecks of a medium to course texture indicative of the type and a thermal finish.

C. The required number of the pavers shall be determined by the Contractor based on the square footage identified on the plans for the particular items. The paving pattern details on the drawings are presented to identify the general concepts. Final paving solutions are the responsibility of the Contractor and subject to the approval of the Owner.

D. Fabrication of all granite pavers shall be in accordance with the National Building Granite Quarries Association to the tolerance typical for the dimensions specified.

E. Granite pavers shall be furnished in the following dimensions:

1. Typical Paver – 12-inches x 4' (min.) with a thickness of 3-inches and furnished in straight or radial sections as indicated and otherwise required.

2.02 CONCRETE UNIT PAVERS

A. All unit pavers shall be of standard grade, free of cracks, seams chips or imperfections that would compromise 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. For all unit paver locations/applications furnish "Hollandstone" in Granite Blend as manufactuered by Unilock or approved equal. The color shall be a medium gray mix.

C. The required number of the pavers shall be determined by the Contractor based on the square footage identified on the plans for the particular items. The paving pattern details on the drawings are presented to identify the general concepts. Final paving solutions are the responsibility of the Contractor and subject to the approval of the Owner.

2.03 CEMENT CONCRETE PAD:

A. Cement concrete for use as a base below granite pavers shall be a single pour in accordance with Section 03300 CAST IN PLACE CONCRETE..

PART 3 – EXECUTION

3.01 STONE DUST SETTING BED:

A. After the concrete and gravel bases have been installed to the appropriate grades, place stone dust to achieve the specified compacted depths.

3.02 INSTALL PAVERS:

A. All pavers are to be set with zero clearance and the specified pattern alignment must be maintained. Adjust paver alignment so that no less than 1/3 of a full size paver will be used at any point. All adjustment of pavers to the patterning will be done with a special hydraulic masonry saw, or otherwise stipulated by the manufacturer and agreed to by the Engineer.

B. Adjust any surface variations at this time and reinstall those areas so affected and re-vibrate.

C. Sweep fine stone dust screenings over surface of pavers as many times as necessary to fill any voids. Fog paver areas and repeat stone dust applications until joints are full and compacted.

D. All areas on which water stands or which are found to be excessively uneven shall be promptly brought to the correct grade and line.

E. No pavers shall be laid in inclement weather or when the temperature is 36ºF, and dropping, nor shall any work be done on rising temperatures until the temperature reaches 32ºF, and subgrade is free of frost.

F. The final surface elevation shall be adjusted so that when the granite pavers are placed, the top surface of the pavers will be at the required finished grade. A maximum 1/16-inch deviation when tested with a twelve-foot straight edge shall be allowable.

END OF SECTION

SECTION 02821
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 8-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.

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

A. Six sets of manufacturers literature of the materials specified herein shall be submitted to the Engineer for review.

B. Six sets of shop drawings of the temporary chain link fence and gates shall be submitted to the Engineers for review.

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-GALVANIZED

2.01 TEMPORARY CHAIN LINK FENCING:

A. Unless otherwise indicated, type of 6-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.

C. Scrim Fabric: Contractor shall provide scrim fabric at all temporary chain link fencing, and at all existing chain link fencing to remain abutting private residences.

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.

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 02910
SCREENED LOAM BORROW AND TOPSOIL RE-USED

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 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 Reused in compliance with this specification.

b. Prospective bidders are advised that significant quantities of topsoil are present at the property and presumably available for reuse if compatible with the requirements of this specification. The Contractor shall be responsible for amending topsoil, as required to comply with this specification.

c. Refer to testing results contained at the back of this Section for lime and fertilizer application rates required to amend existing topsoil permitted for reuse as stipulated and as approved by the Owner.

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 Loam that is 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 Engineer, 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.

PART 2 - MATERIALS

2.01 LOAM BORROW

a. In accordance with the specific requirements of this project, existing topsoil 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)	45 – 75	60
Silt (0.002 – 0.05mm)	15 – 35	25
Clay		

(Less than 0.002mm)	5 – 20	15

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 ten percent (10%) 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 Parks and Recreation Department 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).

2.02 REUSE OF EXISTING TOPSOIL

a. The reuse of topsoil shall not be permitted except as a general fill material to subgrade elevations at the limits of proposed fields, lawn and planting areas.

b. Care shall be taken not to overwork the soil, causing it to break down, utilizing only agricultural equipment such as plows, discs, or harrows and portable quarry sieves, screens, or blenders.

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.

3.02 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 sodding, seeding and/or planting specifications referenced elsewhere.

END OF SECTION

SECTION 02930
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 vines, 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 02329, LOAM BORROW

B. Section 02920, 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 Engineer for review.

B. Samples and six copies of the manufacturer's product data, as applicable, shall be submitted to the Engineer 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.

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 Engineer.

B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. 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

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, vines 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 Engineer 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 Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, 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 02329, LOAM BORROW.

2.03 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 Engineer, 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.

2.04 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

2.05 WATER:

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 furnished by the Contractor, at no additional cost to the Owner.

2.06 MULCH:

Mulch shall be fibrous pliable shredded softbark 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.

2.07 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

A. Tree stakes shall be sound, untreated 2 x 3 (nominal) x 8-foot length Douglas Fir reasonably free of knots. No paint or stain shall be used in conjunction with tree stakes. Tying material shall be flexible braided nylon webbing, ¾-inch wide and have a tensile strength of 900 pounds. Webbing shall be 'ArborTie', or approved equal.

B. Drive anchors and guy wire assemblies shall be suitable for protecting trees and shall be sized in accordance with the manufacturer's recommendations. No materials shall be used for guying that will girdle, chafe, or otherwise injure trees.

C. Tree wrap shall be duplex, waterproof kraft paper crinkled to 33-1/3 percent stretch, 4- to 6-inch wide strips. Tying materials shall be jute twine, 2-ply for shrubs and trees less than 3-inch caliper; 3-ply for larger plants.

2.08 TREE PAINT:

Tree paint shall not be used.

2.09 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.

2.10 INSECTICIDES:

A. No insecticides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Engineer.

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.

2.11 HERBICIDES:

A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide 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.

2.12 FUNGICIDES:

A. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.

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.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All plants shall be subject to inspection and approval by the Engineer 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 Engineer. 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 Engineer 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 Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer'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.

L. All thin barked deciduous trees shall be wrapped after they are planted and before they are staked. Prior to wrapping, inspect trees for injury to trunks or improper pruning. Take corrective measures as necessary. Wrap trunks of all trees spirally from bottom to top with tree wrap and secure top and bottom at 2-foot intervals with jute twine. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 2-inches.

M. Stake trees immediately after planting as detailed. All staking apparatus shall be adequate to hold the tree in a vertical position under severe weather conditions. All staking

apparatus and tree trunk wrapping shall be removed and disposed of off-site by the Contractor at the end of one growing season.

N. Immediately after planting and staking 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 Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. 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 Engineer.

3.02 MAINTENANCE:

A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Tree guys and stakes shall be tightened and repaired. 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 Engineer.

D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance

period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

3.03 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer 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.

3.04 GUARANTEE:

A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and 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 Engineer, 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.

3.05 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer 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 03100
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 03200, CONCRETE REINFORCEMENT

B. Section 03150, WATERSTOPS

C. Section 03300, 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 Engineer.

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 no staining 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 Engineer.

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.

REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, 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 03150
WATER-STOPS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers furnishing and installation of PVC Water-stops.

1.02 SYSTEM DESCRIPTION:

Water-stops shall be used at all construction and control joints, scheduled or unscheduled, which are subject to internal or external hydrostatic pressure.

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

A. Six sets of shop drawings of the materials of this section shall be submitted to the Engineer for review.

B. One 1-foot long sample of each type of water stop shall be submitted to the Engineer.

1.04 RELATED SECTIONS:

A. Section 03100 - CONCRETE FORMWORK

B. Section 03200 – CONCRETE REINFORCEMENT

C. Section 03300 – CAST-IN-PLACE CONCRETE

PART 2 - PRODUCTS

2.01 MATERIAL:

A. Water-stops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material. They shall be produced by an extrusion process and be dense, homogeneous, and free from holes and other imperfections. The cross section of the Water-stop shall be uniform along its length and shall be symmetrical transversely so that the thickness at any given distance from either edge of the Water-stop will be uniform.

B. Water-stop materials shall meet or exceed the requirements of the U.S. Army Corps of Engineers Specification CRD-C572-74.

C. Water-stops shall be the ribbed center-bulb type, 9 inches wide unless otherwise indicated on the drawings.

D. Water-stops shall be capable of resisting water pressure of various heads, with maximum of 40 feet.

PART 3 - EXECUTION

3.01 PREPARATION:

Sweep all horizontal joints prior to pour to insure that foreign matter does not interfere with direct contact between the Water-stop and concrete.

3.02 INSTALLATION:

A. All Water-stops shall be protected from oil, dirt, concrete spatter and damage and shall be left clean to receive concrete forms. Particular care shall be taken during installation of Water-stop to eliminate all possibilities that may cause leakage. Be sure reinforcing bars and slip dowels do not interfere with positioning of Water-stops during installation.

B. Water-stops in expansion and construction joints shall be carefully and correctly positioned during installation to avoid the possibility of joint leakage. Water-stops shall be installed to form a continuous watertight diaphragm in each joint.

C. Install Water-stops in the center of the joint so that approximately half of the Water-stop material is embedded in the concrete on each side of the joint.

D. All Water-stops shall be held rigidly in place by extending through slots in keyways; held by split bulkheads; tied to reinforcing bars; or other adequate methods as required to insure proper support and embedment during the concreting process.

E. When installed in an expansion joint, the center bulb shall remain unembedded between the two pours.

F. Joints in Water-stops shall be made by qualified mechanics using the manufacturer's splicing procedures to form a continuous watertight diaphragm. All splices shall be made on a bench at the site or at the manufacturer's plant. A miter guide and portable power saw shall be used to cut the ends to be joined to insure good alignment and contact between joined surfaces. The continuity of the characteristic features of the cross section of the Water-stops (ribs, center bulb and the like) shall be maintained across the splice. Splices shall be made by heat-sealing the adjacent surfaces in accordance with the manufacturer's printed instructions. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material concerned but the applied heat should be sufficient to melt but not char the plastic. Water-stops shall be reformed at splices with a remolding iron with ribs or corrugations to match the pattern of the Water-stop. The spliced area, when cooled and

bent by hand in as sharp an angle as possible, shall show no sign of separation. If the splice separates, the Water-stop shall be replaced.

G. In all cases the concrete shall be systematically and thoroughly vibrated around the Water-stop to avoid honeycombs and voids in the concrete and to insure complete contact between Water-stop and concrete.

END OF SECTION

SECTION 03200
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 03100, CONCRETE FORMWORK

B. Section 03150, WATERSTOPS

C. Section 03300, CAST-IN-PLACE CONCRETE

1.03 SYSTEM DESCRIPTION:

Materials and construction shall conform to ACI 318 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 the Engineer 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 Engineer.

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 SP-66 ACI Detailing Manual

ACI 318 Building Code Requirements for Concrete

ACI 350 Environmental Engineering Concrete Structures

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.

2.02 FIBER REINFORCEMENT

When called for on the drawings, concrete engineered reinforcing fibers shall be polypropylene, collated, fibrillated fibers from Fibermesh Co., 4019 Industry Drive, Chattanooga, TN; Forta Corporation, One Hundred Forta Drive, Grove City, PA; or approved equal. Only fibers designed and manufactured specifically for use in concrete from virgin polypropylene and so certified by the manufacturer shall be acceptable.

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 Engineer.

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 Engineer has been obtained in advance. Such welding shall be performed only under conditions established by the Engineer, 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 Engineer.

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 03300
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 02300, EARTHWORK

B. Section 03100, CONCRETE FORMWORK

C. Section 03200, CONCRETE REINFORCEMENT

D. Section 03150, WATERSTOPS

E. Section 07920, CAULKING

F. 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 Concrete Sanitary Engineering 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 GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of shop drawings of the materials specified herein shall be submitted to the Engineer for review.

B. Six copies of the 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 Engineer 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 Engineer, 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 Engineer. 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 Engineer 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 Engineer 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 Engineer 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 Engineer.

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 Engineer 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 Engineer 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 Engineer shall be obtained for the use of proprietary grouts, and the instructions of the Engineer 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 which 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. The moisture barrier shall be fungi-resistant and shall have a vapor permeance rating not exceeding 0.5 perm. The moisture barrier shall be asphalt-saturated waterproof reinforced Kraft paper, clear polyethylene sheeting 0.006-inch thick, polyethylene coated asphalt-saturated reinforced Kraft paper, two layers of 30-pound asphalt-saturated felt solidly mopped with hot bitumen, or other similar material meeting the requirements for fungi-resistance and vapor permeance. Sheets shall be lapped 6-inches at joints and sealed with 2-inch wide tape.

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 Engineer.

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 which 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 Engineer. 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 Engineer.

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 Engineer. 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 under the direction of, the Engineer.

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 name plate. 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 Engineer. 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 Engineer.

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 Engineer 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 Engineer.

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 which 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 Engineer.

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 Engineer. 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 which 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 will 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 which would delay the prosecution of the work, the openings shall be subject to the approval of the Engineer. 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 Engineer, 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 Engineer.

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 Engineer'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 Engineer.

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 Engineer, 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 Engineer 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 Engineer'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 Engineer 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 which 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 09900, 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.

K. TESTING:

1. The Contractor shall provide all field testing and inspection services, and shall pay for all such services. The Engineer 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 Engineer 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 State Building Code. They shall be licensed by the State Board of Building Regulations and Standards.

2. At least one slump test shall be performed from each truck load of concrete. The sample for slump shall be taken from the middle third of a truck load. Air content

tests shall be made at the discretion of the Engineer. 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 Engineer of his readiness to proceed with concrete placement at least one working day prior to each placement. The Engineer 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 Engineer.

4. A minimum of four standard compression test cylinders shall be made and tested for **each 50 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 Engineer 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; **such tests will be at the Contractor's expense.**

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 Engineer may elect to test the fourth cylinder immediately or test it after 56 days.

M. FAILURE TO MEET REQUIREMENTS:

1. The Engineer 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 Engineer 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 Engineer 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 Engineer, 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 Engineer.

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 Engineer 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 Engineer.

END OF SECTION

SECTION 04410

GRANITE

PART 1 - GENERAL

1.01 SCOPE OF WORK

The work to be performed under this Section consists of the furnishing of all labor, materials, equipment and transportation required to install granite and refurbished granite features as shown on the drawings, detailed and as specified under this item, including granite memorials, seat walls blocks, wall caps, and other items as called out in the plans.

a. Specifically, the work required under this section shall require the following:

1. Quarrying, manufacturing, engraving transporting and installation of granite memorial blocks at the locations designated on the plans, in addition to the general granite work throughout the site.

1.02 DEFECTIVE WORK OR DAMAGED REFURBISHED GRANITE

Any piece of granite showing manufacturing flaws upon receipt at the project site shall be referred to the Engineer for determination as to whether it shall be rejected, patched or redressed for use.

1.03 REFERENCE STANDARDS AND SPECIFICATIONS

A. Reference to the standards, specifications, and test of technical laboratories, societies, organizations, and/or governmental bodies shall be considered to be a part of these specifications and contract.

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

2. ASTM - American Society for Testing and Materials.

3. RiDOT- Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction

4. Specifications for Architectural Granite as published by the National Granite Quarries Association, Inc.

1.04 SUPPLIER CERTIFICATION AND SAMPLES

A. The Contractor shall have the granite supplier provide certification to the Engineer that an adequate supply of the approved material selected for the project is available and that said material complies with these specifications. No substitution of suppliers or material shall be made after certification of supplier and supply is approved.

B. Prior to ordering and delivering materials to the site, three (3) representative samples of the granite finish and color shall be sent to the Engineer for approval. The material shall be certified by the supplier as a by-product of a naturally occurring material from a stone quarry operation.

1.05 SUBMITTALS

A. Provide complete shop drawings from the granite quarry and/or fabricator for the work described in this section which identifies minimum and maximum lengths, thickness of materials, finishes (i.e., thermal, sawn, split, etc.).

B. Submittals shall be reviewed for design intent, and the appropriate application of the materials. Approval shall be based upon the completeness of shop drawings as they depict the granite work to be constructed.

1.06 QUALIFICATIONS

A. Only an interest or concern possessing specific experience in the quarrying, manufacturing, engraving, transporting and installing of major granite features shall provide the work of this section. The Owner retains final approval relative to this matter.

1.07 GRANITE SELECTION

a. Samples (approximately 12” x 12” x 1” thickness) shall be submitted prior to the site visit in order to establish the basic variations that are characteristic of the approved quarry.

1.08 SHIPPING AND HANDLING OF MATERIALS

a. Notwithstanding any prior acceptance of materials given prior to delivery, acceptance and approval for all work will be based upon the conditions at completion of installation.

b. It is the responsibility of the Contractor to exercise all necessary precautions to properly protect the granite pieces. Where damage occurs items will be rejected.

1. The selected manufacturer and supplier(s) of the granite shall provide

a written plan to the Project Representative clearly identifying each phase of the loading, transport, unloading and erection process for approval. Any variations from the approved plan shall be immediately brought to the attention of the Project Representative for review and acceptance.

2. It is intended that granite shall be set in place immediately after delivery to the site in order to minimize the handling (and hence opportunities for damage) of the signature granite.

PART 2 - MATERIALS

2.01 NEW AND REFURBISHED GRANITE

A. All material new granite shall be new, hard and durable granite of a quality approved by the landscape architect, free from seams, depressions or other structural or aesthetic imperfections, and shall be of uniform color throughout. Granite shall be per ASTM C615. Granite side surfaces shall be smooth saw cut, free from drill holes and with no projection of more than ½".

B. NOT USED

C. Granite Wall Caps shall be Woodbury Gray, dimensions to match plans and details.

D. Whenever granite is sawed, all surfaces that are to be exposed shall be thoroughly cleaned, with any iron rust or iron particles removed by sand blasting or other approved methods satisfactory to the owner.

E. Saw-cuts shall be sawn through the full thickness of the granite piece. Scoring and breaking (split face/rock face) will not be permitted at joints/seams, or other finished faces unless specifically called for.

F. Thermal finish all visible sawn faces. Coping edges shall be split face or rock pitch, and provide nosing as detailed. Redress granite using approved colored mortar.

G. Contractor to provide shop drawings and means and methods plan and schedule prior to removal of any existing granite material.

2.02 GRANITE

a. All granite 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 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 Project Representative.

b. For the granite, furnish Classic Dark Gray by Pacific Coast Memorials Jet Mist granite as quarried by Fletcher Granite Company, 535 Groton Road, Westford, MA; Midnight Mist as quarried by Rock of Ages, 558 Graniteville Road, Graniteville, Vermont 05654 or approved equal. The color shall be black with a fine to medium texture and finishes as indicated in the drawings. The basic parameters of the granite pieces shall be as summarized below:

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

2. The granite benches shall be 2' x 1'-8" x 5'-ll" per section, on a radius of 78.5'-ft with a n estimated finished weight of approximately 2,000 lbs. (1 tons).

3. Granite monument sections shall be as detailed, roughly 4' x 2' x 4/5' on a 93.5' radius, with an estimated finished weight of approximately 2,500 lbs, (1.5 tons)

4. As a general description, the granite shall be generally rectangular in shape allowing for normal irregularities associated with the surface finishes described below.

5. Granite is to be set vertically on top of a concrete foundation as specified and detailed elsewhere. The bottom of the granite is to receive a sawn finish.

6. All visible faces shall have a honed finish unless otherwise noted in the drawings.

7. Final engraving text and font shall be provided prior to fabrication.

2.03 CONCRETE

A. Concrete for footings shall be as specified under SECTION 0331- CAST-IN-PLACE CONCRETE and constructed in compliance with the relevant details.

PART 3 - EXECUTION

3.01 FOUNDATIONS

a. Construct all foundations in accordance with relevant specifications and details, including the installation of steel dowels (as applicable) to receive the granite memorials.

b. Ensure proper elevations of all foundations prior to installation of the required footings. Refer to relevant details for the relationship of foundation top/memorial bottom and finished grades and surfaces.

3.02 INSTALLATION OF AND SEATWALL CAPS

a. The installation of granite memorial and seatwall caps shall not commence until each foundation has been reviewed and accepted by the Project Representative.

b. The contractor shall carefully plan out every aspect of the installation as previously described and coordinate with City and Project Representatives as necessary to ensure that all completed work is protected from damage.

c. Unless otherwise authorized it intended that the granite pieces shall be lifted directly from the bed of the transport vehicle to the final position and installation onto the foundation.

d. Granite shall be lifted onto the concrete bases; taking care to align holes with dowels extruding from the foundation tops. Fill holes with epoxy grout prior to lifting to ensure adequate bonding with helical piles.

e. Shimming of the Granite shall not be permitted.

f. Upon satisfactory installation, the granite shall be encapsulated with a protective covering and suitable strapping that eliminates any potential of removal. The protective covering and associated strapping shall be maintained in place until acceptance of the project or as otherwise stipulated.

3.03 NEW AND REFURBISHED GRANITE

A. Packing and Loading – Existing and finished granite shall be carefully packed and loaded for shipment using all reasonable and customary precautions against damage in transit. No material which may cause staining 3.4(h) or discoloration shall be used for blocking or packing. Granite is highly resistant to staining, but should be protected from certain elements, such as wet (green) wood, oils, mud, rust, construction waste, and asphalt compounds. Contact supplier for proper remedies to staining problems that occur.

B. Site Storage - upon receipt at the project site or storage yard, the granite shall be stacked

on timber or platforms at least 3" above the ground, and extreme care shall be taken to prevent staining 3.4(h) during storage. If storage is to be for a prolonged period, polyethylene or other suitable plastic film shall be placed between any wood and finished surfaces and shall be used also as an overall protective covering. All holes shall be plugged during freezing weather to prevent the accumulation of water. Salt shall not be used for melting of ice formed in Lewis holes or on pieces, or for any purpose involving its contact with the granite.

C. Proceed with the installation of the stonework in accordance with Drawings and using skilled mechanics capable of proper handling of the setting of the stone and able to field cut where necessary with sharp and true edges.

D. Set stone with joints uniform in appearance and stone edges and faces aligned to tolerances indicated.

E. Granite shall be cleaned of all loose or foreign materials upon installation. Clean surfaces that are dirty or stained. Scrub with fiber brushes, and then rinse with clear water.

F. Provide expansion, control, and pressure-relieving joints of widths and at locations shown on Drawings.

G. The granite shall be laid true and plumb at the approved locations and as detailed.

H. Cleaning and protection

1. Cleaning - granite shall be shop cleaned at the time of final fabrication. After installation and pointing or caulking are completed, the contractor shall carefully clean the granite, removing all dirt, excess mortar, weld splatter, stains, and/or other site incident defacements Stainless steel wire brushes or wool may be used, but the use of other wire brushes or of acid or other solutions which may cause discoloration is expressly prohibited. Fabricator should be contacted before cleaners other than detergents are used.

2. Protection of Finished Work - After the granite work is installed, the granite shall be properly and adequately protected from damage. Boxing or other suitable protection shall be provided wherever required, but no lumber which may stain or deface the granite shall be used. All nails used shall be non-corrosive. All granite work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.

END OF SECTION

SECTION 04926
REPAIR OF EXISTING STONE WALLS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Furnish all labor, materials, and equipment to complete all required repairs to the masonry walls as indicated on the Drawings and in this Section. Walls to be repaired are the secondary spillway training walls.

B. Repair of the stone walls includes:

1. Supply and placement of all stones missing from the work area. The Contractor has the option of using stones on site after obtaining the written approval of the Owner.

2. Supply, placement, and compaction of mortar mix, as specified in this section, between and behind the stones in the work area.

3. Preparation of the surfaces where mortar is to be applied. Preparation shall consist of drying the surfaces and removal of any deleterious materials utilizing sand blasting technique, or other method approved by the Owner.

4. Rodding the mortar after application to eliminate air pockets.

5. Cleaning all the exposed surfaces.

1.02 RELATED WORK:

A. Section 01110, CONTROL OF WORK AND MATERIALS

B. Section 00890, PERMITS

C. Section 01570, ENVIRONMENTAL PROTECTION

D. Section 02240, DEWATERING

E. Section 03300, CAST-IN-PLACE CONCRETE

F. Section 03302, FIELD CONCRETE

1.03 REFERENCES:

A. American Concrete Institute

B. ASTM C150 Portland Cement

C. ASTM C494 Chemical Admixtures for Concrete.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. CEMENT:

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

B. SIKATOP 124:

SikaTop 124 shall be as manufactured by Sika Corporation of Lyndhurst, New Jersey, or approved equal.

C. WATER:

Water for mortar shall be potable, free of deleterious materials such as oil, acid, alkali and organic matter.

PART 3 - EXECUTION:

3.01 SURFACE PREPARATION:

A. All stone wall surfaces to be repaired shall be cleaned of all dust, dirt, laitance, loose stones, and any other deleterious materials which could affect the application and bonding of mortar to the stone surfaces. All surfaces shall be cleaned and acceptable to the Engineer prior to the application of mortar.

B. The Contractor has the option of using sand blasting techniques, chipping and washing, or other approved method, when preparing stone wall surfaces.

C. The Contractor shall submit, a minimum of two weeks prior to commencing work, a plan detailing the proposed surface preparation method and obtain written approval from the Owner prior to commencing work.

3.02 MORTAR MIXING:

A. The Contractor shall submit to the Owner, a minimum of two weeks prior or commencing work, a mix design suitable for the application. Mortar mixes shall include SikaTop 124, or approved equal with a minimum 28 day compressive strength of 3000 psi.

3.03 APPLICATION:

A. Prior to application of mortar, all cleaned and approved surfaces shall be saturated with water but shall have no standing water on the surface.

B. Fill mortar in the voids between stones deep inside the wall. Compact the applied mortar to insure the complete filling of the voids between and behind the stones. Filling shall proceed with small amounts to insure proper compaction. Application of mortar at one area shall proceed in a continuous manner before the prior application has dried or set.

C. All surfaces shall be cleaned after completion of the work to bring the walls back to their original appearance.

END OF SECTION

SECTION 05500
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: railings and posts, grating, frames and covers, loose metal frames, nosings, edgings, signs and frames, and all other site or shop fabricated items otherwise excluded.

1.02 RELATED WORK:

A. Section 03300, 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 directed, 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 Engineer.

F. Color galvanized system shall be guaranteed by manufacturer for 20 years.

G. Contractor shall submit an affidavit to Engineer 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 Spec Design, Fabrication, and Erection of Structural Steel for 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 Code Standard Code for Arc and Gas Welding in Building Construction

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 Engineer for review.

B. Shop drawings for all metalwork included in this section shall be submitted to the Engineer 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. Sheet steel shall be cold-rolled or hot-rolled carbon sheet steel conforming to ASTM A366 or ASTM A569 as appropriate.

4. Steel pipe shall conform to ASTM A53.

5. Stainless steel shall be Type 304 unless otherwise indicated or specified.

C. 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 McCulloch Industries, Phillips Red Head manufactured by Phillips Drill Company, Wej-it manufactured by Wej-it Expansion products or an approved equal product.

4. The centerline of expansion shields shall not be closer than 3 inches to the edge of any concrete or masonry 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 Engineer. If, in the opinion of the Engineer, they are not in accordance with good safety practices, the contractor shall revise and resubmit appropriate fasteners.

D. STEEL GRATING:

1. Steel grating shall be rectangular pattern grating made in accordance with industry standards. The grating shall be made from structural stainless steel conforming to TYPE 304. The completed grating shall be free from imperfections or irregularities, which would cause warping or camber when the grating is in use.

2. Loading and structural requirements shall be checked by the grating manufacturer to determine its stability. Unless otherwise indicated, the grating shall be designed for a live load of 250 pounds per square foot.

3. The steel grating shall have positive anchorage when in place, such as bolting, or clipping.

O. STEEL EDGE ANGLES, CURBS, PLATES:

Stainless Steel angle nosings, guards, and frames shall have steel strap anchors for embedment in concrete.

PART 3 - EXECUTION

3.01 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.

3.02 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 well-riveted, bolted, or 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 masonry work and shall have sufficient anchors, well- fastened. Anchors shall be welded to steelwork and shall be staggered where attached to structural shapes. Metal- work impracticable to set before masonry is built shall be anchored to it with approved expansion bolts set in solid masonry units or in concrete.

F. Miscellaneous metalwork shall be plainly marked to indicate its location in the structure.

3.03 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.

B. Finish Coat for all visible ferrous metal surface shall be powdercoated steel, color to be determined in the field

END OF SECTION

SECTION 06100

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 02252, SUPPORT OF EXCAVATION

B. Section 03300, CAST-IN-PLACE CONCRETE

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

Three sets of 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. 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 C-2 (lumber, timber, etc.), C-9 (plywood) or C-28 (lumber treated before laminating). 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

07900

JOINT SEALANTS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers the sealing of joints designated on the drawings or specified herein, including but not limited to, concrete to concrete, masonry to concrete, structural steel to concrete, structural steel to masonry, and any other metal surfaces butting to another metal, concrete or masonry.

B. The above-mentioned joints shall be sealed even if not called out on the drawings.

C. Seal beneath threshold and other items required to be set in caulking compound shall be by the trade installing the item.

1.02 RELATED WORK:

A. Section 400, PAVEMENT

1.03 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C920	Specification for Elastomeric Joint Sealant
ASTM C 1193	Standard Guide for Use of Joint Sealants
ASTM D1667	Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed-cell Foam)

United States of America Standards Institute (USA)

USA 116.1	Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade

B. When reference is made to one of the above standards, the revisions in effect at the time of bid opening shall apply.

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

A. Six sets of manufacturer's literature of the materials of this section shall be submitted to the Owner's Representative for review.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Materials shall be delivered to the site in the original, unopened, factory-sealed containers, bearing the manufacturer's label fully identifying the material and the producing company.

B. Handle materials with care. Do not dump from trucks or delivery vehicles nor handle in any manner likely to cause damage.

1.06 QUALITY ASSURANCE

A. Materials shall not be applied in wet weather or to wet or damp surfaces. No work shall be performed when temperature is below 40 degrees Fahrenheit. Surfaces shall not be caulked until thirty days after completion of concrete, masonry work, or patching, whichever is later. At least three good drying days shall immediately precede application. Application shall in each case be in accordance with the instructions of the manufacturer of the material, except as modified herein.

B. Surrounding areas which are not to be coated shall be completely protected from spray, spattering, or dripping, using drop cloths or other protective measures, as required. Spillage or dripping which occurs shall be immediately and completely removed, leaving no stain. Solvents or cleaning methods shall be those recommended by the manufacturer of the material being used.

C. Furnish the service of a competent field representative of the approved manufacturer of the sealant. The field representative shall be present at the work site prior to any mixing of components to instruct on application and inspection of procedures and to inspect the finish or the prepared surfaces prior to application of the sealant. The representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Owner's Representative, advising as to whether the application is being performed in accordance with this specification and the printed instructions of the manufacturers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Sealants and primers for use with sealants shall be as manufactured by J.B. Fred Kuhls, Brooklyn, New York; Minwax Co., Inc., New York, New York; Dewey and Almy Chemical Division of W.R. Grace & Co., Cambridge, Massachusetts; Sonneborn Building Products, New York, New York; or an approved equal product.

2.02 MATERIALS

A. SEALANTS:

1. Sealants shall be non-staining materials conforming to the requirements of United States of America Standards Institute "Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade", USA 116.l. Compound shall be Class A (self-leveling), or Class B (non-sag), as applicable in each case for the joint to be caulked. Contractor shall confirm sealant is suitable for use in chlorinated conditions. Color of sealant shall match as closely as possible the color of the surrounding materials, and when used adjacent to masonry work the compound shall match the color of the mortar in the masonry joints. Precise color shall in all cases be subject to the approval of the Owner's Representative.

2. Sealant at joint of existing mow strip/ wall and proposed paving joint shall be Sikaflex 1C SL Self-Levelling sealant as manufactured by Sika Corporation, Lyndhurst NJ (800) 933-7452 or approved equal. Color to match adjacent concrete mow strip/wall. Refer to detail and plans for location.

B. JOINT CLEANER:

1. Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.

C. PRIMER:

1. Primer shall be non-staining type as recommended by the manufacturer of the sealant.

D. BACK-UP MATERIAL:

1. Back-up material for sealer shall be a non-staining type oakum, treated to prevent rot, or shall be a non-staining, compressible, closed-cell joint filler of polyvinyl chloride, neoprene vinyl, or a similar inert and permanent back-up material approved in advance by the Owner's Representative. Back-up materials containing oil or grease and materials which are not compatible with the primers and caulking compound shall not be used. Tremco Joint Backing and Dow Corning "Ethafoam" are approved back-up materials.

E. BOND BREAKER:

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors, Inc. Silcoseal 77 by Nox-Crete Incorporated or equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION:

A. Where recommended by the manufacturer of the sealant, primer shall be used before sealant is applied. Copper to be in contact with sealant shall be primed with five-pound cut shellac or as recommended by the sealant manufacturer, before sealant material is applied. Aluminum, stainless steel, and other materials shall have any protective film removed using a cloth dampened with Toluol, Xylol, or other suitable solvent.

3.03 APPLICATION:

A. Sealant shall be mixed and applied in accordance with the manufacturer's printed directions. No materials shall be added to the compound.

B. Joints and spaces to be caulked shall be clean, dust-free, and dry. Mortar droppings, construction debris, and other foreign matter shall be removed from the joint before it is caulked. Raking out excess mortar in masonry and similar joints which are to be caulked shall be performed by the trade responsible for installing the mortar.

C. The joint or space to be sealed shall be packed tight with oakum or other approved filler materials, leaving a space approximately square in cross-section, and in no case deeper than half of its width, to receive the caulking compound. Filler materials shall be sufficiently wider than the joint in which they are used to provide adequate resistance when sealant material is being gunned into the joint.

D. Sealant shall be applied with a gun, using a nozzle of proper size to fit the joint width, and shall be forced into the joints with sufficient pressure to expel all air and fill the joint solid. Superficial pointing of joints with a skin bead will not be accepted. Sealant shall be uniformly smooth and free from wrinkles, and shall have a slightly concave joint profile when dry. Intersections of beads shall form neat miters. Sealant at edges of the joint shall be flush with the edges of the adjacent surfaces. Excess sealant material shall be removed. Improperly filled or finished joints shall be raked out and resealed.

E. Sealant depth shall not exceed one-half of joint width.

F. Particular care shall be taken not to soil adjacent surfaces. Spillage or excess material shall be removed immediately, leaving no stain. Masking tape shall be used as required to protect surrounding surfaces and prevent staining. Masking tape shall be removed immediately after tooling of the sealant. Adjacent surfaces soiled by operations under this section shall be cleaned to equal their condition before the start of the caulking work.

G. Spaces left between walls and elements of roof shall be filled with back-up material inserts and then caulked on both sides.

END OF SECTION

SECTION 07920

JOINT PROTECTION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers the sealing of joints designated on the drawings or specified herein, including but not limited to, concrete to concrete, masonry to concrete, structural steel to concrete, structural steel to masonry, and any other metal surfaces butting to another metal, concrete or masonry.

B. The above-mentioned joints shall be sealed even if not called out on the drawings.

C. Seal beneath threshold and other items required to be set in caulking compound shall be by the trade installing the item.

1.02 RELATED WORK:

A. Section 03150, WATERSTOPS

B. Section 03300, CAST-IN-PLACE CONCRETE

C. Section 04200, MASONRY

D. Section 05120, STRUCTURAL STEEL

E. Section 05500, MISCELLANEOUS METALS

1.03 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C920	Specification for Elastomeric Joint Sealant
ASTM C 1193	Standard Guide for Use of Joint Sealants
ASTM D1667	Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed-cell Foam)

United States of America Standards Institute (USA)

USA 116.1 Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade

B. When reference is made to one of the above standards, the revisions in effect at the time of bid opening shall apply.

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

A. Six sets of manufacturer's literature of the materials of this section shall be submitted to the Engineer for review.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Materials shall be delivered to the site in the original, unopened, factory-sealed containers, bearing the manufacturer's label fully identifying the material and the producing company.

B. Handle materials with care. Do not dump from trucks or delivery vehicles nor handle in any manner likely to cause damage.

1.06 QUALITY ASSURANCE:

A. Materials shall not be applied in wet weather or to wet or damp surfaces. No work shall be performed when temperature is below 40 degrees Fahrenheit. Surfaces shall not be caulked until thirty days after completion of concrete, masonry work, or patching, whichever is later. At least three good drying days shall immediately precede application. Application shall in each case be in accordance with the instructions of the manufacturer of the material, except as modified herein.

B. Surrounding areas which are not to be coated shall be completely protected from spray, spattering, or dripping, using drop cloths or other protective measures, as required. Spillage or dripping which occurs shall be immediately and completely removed, leaving no stain. Solvents or cleaning methods shall be those recommended by the manufacturer of the material being used.

C. Furnish the service of a competent field representative of the approved manufacturer of the sealant. The field representative shall be present at the work site prior to any mixing of components to instruct on application and inspection of procedures and to inspect the finish or the prepared surfaces prior to application of the sealant. The representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Engineer, advising as to whether the application is being performed in accordance with this specification and the printed instructions of the manufacturers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Sealants and primers for use with sealants shall be as manufactured by J.B. Fred Kuhls, Brooklyn, New York; Minwax Co., Inc., New York, New York; Dewey and Almy Chemical Division of W.R. Grace & Co., Cambridge, Massachusetts; Sonneborn Building Products, New York, New York; or an approved equal product.

2.02 MATERIALS:

A. Sealants

1. Sealants shall be non-staining materials conforming to the requirements of United States of America Standards Institute "Standard Specification for Polysulfide-Base Sealing Compounds for the Building Trade", USA 116.l. Compound shall be Class A (self-leveling), or Class B (non-sag), as applicable in each case for the joint to be caulked. Color of sealant shall match as closely as possible the color of the surrounding materials, and when used adjacent to masonry work the compound shall match the color of the mortar in the masonry joints. Precise color shall in all cases be subject to the approval of the Engineer.

B. Joint Cleaner

1. Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.

C. Primer

1. Primer shall be non-staining type as recommended by the manufacturer of the sealant.

D. Back-Up Material

1. Back-up material for sealer shall be a non-staining type oakum, treated to prevent rot, or shall be a non-staining, compressible, closed-cell joint filler of polyvinyl chloride, neoprene vinyl, or a similar inert and permanent back-up material approved in advance by the Engineer. Back-up materials containing oil or grease and materials which are not compatible with the primers and caulking compound shall not be used. Tremco Joint Backing and Dow Corning "Ethafoam" are approved back-up materials.

E. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors, Inc. Silcoseal 77 by Nox-Crete Incorporated or equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION:

A. Where recommended by the manufacturer of the sealant, primer shall be used before sealant is applied. Copper to be in contact with sealant shall be primed with five-pound cut shellac or as recommended by the sealant manufacturer, before sealant material is applied. Aluminum, stainless steel, and other materials shall have any protective film removed using a cloth dampened with Toluol, Xylol, or other suitable solvent.

3.03 APPLICATION:

A. Sealant shall be mixed and applied in accordance with the manufacturer's printed directions. No materials shall be added to the compound.

B. Joints and spaces to be caulked shall be clean, dust-free, and dry. Mortar droppings, construction debris, and other foreign matter shall be removed from the joint before it is caulked. Raking out excess mortar in masonry and similar joints which are to be caulked shall be performed by the trade responsible for installing the mortar.

C. The joint or space to be sealed shall be packed tight with oakum or other approved filler materials, leaving a space approximately square in cross-section, and in no case deeper than half of its width, to receive the caulking compound. Filler materials shall be sufficiently wider than the joint in which they are used to provide adequate resistance when sealant material is being gunned into the joint.

D. Sealant shall be applied with a gun, using a nozzle of proper size to fit the joint width, and shall be forced into the joints with sufficient pressure to expel all air and fill the joint solid. Superficial pointing of joints with a skin bead will not be accepted. Sealant shall be uniformly smooth and free from wrinkles, and shall have a slightly concave joint profile when dry. Intersections of beads shall form neat miters. Sealant at edges of the joint shall be flush with the edges of the adjacent surfaces. Excess sealant material shall be removed. Improperly filled or finished joints shall be raked out and resealed.

E. Sealant depth shall not exceed one-half of joint width.

F. Particular care shall be taken not to soil adjacent surfaces. Spillage or excess material shall be removed immediately, leaving no stain. Masking tape shall be used as required to protect surrounding surfaces and prevent staining. Masking tape shall be removed immediately after tooling of the sealant. Adjacent surfaces soiled by operations under this section shall be cleaned to equal their condition before the start of the caulking work.

G. Spaces left between walls and elements of roof shall be filled with back-up material inserts and then caulked on both sides.

END OF SECTION

SECTION 08800

GLASS AND GLAZING

PART 1 – GENERAL

1.01 SUMMARY

A. The work of this Section consists of custom glass and glazing work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.

B. Furnish and install the following:

1. Laminated tempered glass in with custom image etching.
2. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.

1.02 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. AAMA 804.1 - Ductile Back-Bedding Compound.
2. ASTM C 1036 - Flat Glass.
3. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
4. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.
5. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
6. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
7. SGCC: Certified Products Directory, and Certification Guidelines.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. GANA Laminated Glazing Reference Manual (2009 edition).
2. GANA - Glazing Manual (50th Anniversary edition).
3. Consumer Product Safety Commission-Safety Standard for Architectural Glazing Materials.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work of this Section with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Sequencing:

1. Field Measurements
   a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
   b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
2. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Section, have been received and approved by the Architect/Engineer.
3. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.04 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data:
   a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
   b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
   a. Plans and elevations Large scale drawings of glazing assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.
3. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1. Bonds and Warranty Documentation:

a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.05 QUALITY ASSURANCE

A. General: Perform glazing work in accordance with GANA - Glazing Manual, FGMA Glazing Manual, SIGMA and LSGA standards for glazing and installations methods.

1. Notify the Architect/Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Glass Labeling:

1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.

2. Safety glass: Label tempered safety glass with permanent manufacturer's label on each light with the mark visible after installation.

a. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.

C. Qualifications:

1. Fabricator/Installer: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect/Engineer.

2. Deliver materials in labeled, protective packages, when and as required.

B. Storage and Handling Requirements:

1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.

a. Carefully store materials to avoid overloading any building component or structure.

b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Engineer.

2. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.07 SITE CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.

PART 2 - PRODUCTS

2.01 GLASS - GENERAL

A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.

1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

B. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.

1. Heat Soaking of Tempered Glass: Provide "heat checking" of tempered glass prior to delivery to job site. Provide documentation and test results of "heat checking" process.

a. Heat check all monolithic greater than 8 mm (5/16 inch) in thickness.

C. Laminated glass: consisting of an outer face and inner face of specified glass, factory laminated to clear polyvinyl butyl (PVB) innerlayer equal to Monsanto "Saflex" or DuPont "Butacite. Certified by Safety Glazing Certification Council. Glass shall be free from foreign substances and air pockets.

2.02 GLASS – TYPES

A. Glass: Nominal 3/4 inch (20 mm) thick laminated tempered glass units with custom etching:

1. Components

a. Outer face: 3/8 inch (10 mm) thick tempered clear glass.

b. Interlayer: Interlayer: 0.100 inch (2.5 mm) thick clear, Dupont "SentryGlasPlus" (SGP) interlayer (no substitutions).

c. Inner face: 3/8 inch (10 mm) thick tempered clear glass.

2.03 FABRICATION

A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Engineer.

B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.

C. Fabricate glass with the following edge treatments.

1. Exposed edges: Polished-finished radiused (penciled).
2. Concealed edges: Cut edges with minimum edge work.
3. Butt-joint edges: Flat round and finished with edges eased.

D. Shop Fabrication:

1. All glass shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.
2. Sandblast, acid or laser etch or using other approved methods accurately depict required images. Provide sample units showing results of methods employed as approved by Architect/Engineer.

2.04 ACCESSORIES

A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:

1. Protective treatments 3030 or 606.
2. Tremco Preshimmed 440.
3. Woodmont Chem-Tape 40.

B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:

1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
2. Width: equal to glazing rabbet space minus 1/16 inch.
3. Height to suit glazing method and pane weight and area.

C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.

D. Glazing sealant:

1. General glazing sealant: One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 25 for uses NT, G and A, FS TT-S-001543A, Type, Class A. Color as selected by Engineer.

   a. Dow Corning Corporation, Midland MI; product, "Silicone Glazing Sealant".

   b. General Electric Company (GE Silicones) Waterford NY; product, "SilGlaze II SCS2800".

   c. Tremco, Beachwood OH; product, "Proglaze.

E. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.

F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.

B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.

1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.

2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

C. Beginning of installation means acceptance of existing conditions.

3.02 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS

A. Install glass units so that appropriate manufacturer's permanent label for safety glass, and permanent label for fire-rated glass are visible.

3.03 INSTALLATION - WET GLAZING

A. Place setting blocks at quarter points on web of sill receiving member. Set glass unit in place with equal spaces on all sides.

B. Install spacers at a spacing not exceeding 24 inches apart uniformly around perimeter, between interior face of glass unit and bracket.

C. Apply a continuous heel bead of specified sealant between the outer edges.

D. As the glazing stop is being applied, install spacers between the outer face of the glass unit and the stop, locating the spacers directly opposite the previously installed interior spacers. Install the glazing stops, ensuring that all clearances around the perimeter of the glass unit conform to the requirements of the respective standards referenced herein.

E. Apply a continuous bead of sealant around the exterior and interior perimeters, between the glass unit and bracket, and between the glass unit and the applied glazing stop, extending the sealant material slightly above the sight line to permit proper tooling thereof.

F. Tool all exposed sealant at a 45 degree angle away from the glass surface, leaving the sealant surface uniformly dense and smooth.

G. Immediately remove all excess sealant from surfaces of metal and glass.

3.04 PROTECTION

A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.

B. Cover glass to protect it from activities that might abrade the glass surface.

3.05 CLEANING

A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

END OF SECTION

SECTION 16010

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work covered by this section of the specifications consists of furnishing all labor, equipment, appliances, materials and incidentals in connection with the installation of the complete electrical systems as herein specified and as shown on the drawings.

B. It is not the intent that the drawings shall show every junction box, conduit, wire, fitting, device, accessory, etc., but the Contractor shall be required to furnish without additional expense all transportation, labor and materials necessary to complete the electrical systems in accordance with the best practice of the trade.

C. Unless otherwise specified, materials of the same classifications, used for the same purpose shall be the product of the same manufacturer.

D. The work shall include furnishing and installing the following items:

1. Underground Secondary Services
2. Grounding System
3. Raceways
4. Lighting fixtures
5. Cabinets
6. Feeder and Branch Circuit Conductors
7. Hangers and Supports
8. Solderless Lugs and Connectors

E. Electric Service and Metering

The electric service and metering are existing to remain and to be utilized as indicated to serve th needs of the project.

F. Interpretation of Drawings

1. The Drawings are diagrammatic only and are not intended to show exact locations of outlets and conduit runs.

2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.

3. The Contractor shall verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

4. Any work installed contrary to Contract Documents, or without approval by the Engineer, shall be changed or replaced as required by the Engineer and no extra compensation will be allowed the Contractor for making these changes.

5. The locations of equipment, fixtures, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. The Contractor shall obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, shall proceed as required by the Engineer and shall furnish all labor and materials necessary to complete the work in an approved manner.

6. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

7. The number of conductors shown on the Drawings are not necessarily the correct number required. As many conductors as are required in each case shall be installed.

8. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as can be determined in advance of the purchase of equipment. The ratings shown for motor branch circuit protective devices are the maximum ratings permitted. Lower ratings may be used where approved as being proper for the dynamic characteristics of the motor and its connected load.

9. Unless otherwise specified, all conduits, wires, and cables and the support systems for the conduits and cables that are required to make the electrical connections to equipment shall be furnished and installed. All connections to equipment shall be made as shown, specified, and required and in accordance with the approved shop and setting drawings.

10. The Contractor shall verify, in the field, all measurements necessary for his work and shall assume responsibility for their accuracy.

1.02 LOCAL CONDITIONS:

A. The Contractor shall provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. The Contractor shall locate all necessary slots for his work and these shall be formed before concrete is poured.

B. All cutting and patching shall be done in a thoroughly workmanlike manner.

C. Before submitting proposals, the Contractor is expected to inspect the site and survey the conditions to be encountered in the performance of the work. Failure to familiarize himself with the conditions shall not relieve the Contractor's responsibility for full completion of the work in accordance with the provisions of the Contract.

1.03 PERMITS AND INSPECTION:

A. Permits, fees and notices shall be in accordance with the General Conditions.

B. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over electrical construction at this project.

C. All required permit and inspection certificates shall be obtained, paid for, and given to the Owner at the completion of the work.

1.04 CODES AND STANDARDS:

A. Unless indicated or specified otherwise, materials and workmanship shall conform with the latest editions of the following codes, standards and specifications.

1. National and Rhode Island Electrical Codes

2. National Bureau of Standards Handbook H-30 National Electrical Safety Code

3. State and Local Codes, and all other authorities having jurisdiction

4. Underwriter's Laboratories, Inc. (UL)

5. American National Standards Institute, Inc.

6. Institute of Electrical and Electronic Engineers (IEEE)

7. National Electrical Manufacturers Association (NEMA)

8. National Board of Fire Underwriters

9. International Municipal Signal Association (IMSA)

10. Insulated Power Cable Engineers Associated Specifications

11. American Society for Testing Materials Specifications

1.05 REVIEW OF MATERIALS:

A. Material and Equipment Schedules. As soon as practicable and within thirty days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit to the Engineer six (6) complete Brochures for approval of materials, fixtures, and equipment to be incorporated in the work. The list shall include manufacturer's name, catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required. No consideration will be given to a partial submittal from time to time. Approval of materials will be based on manufacturer's published ratings. Any materials, fixtures and equipment listed that are not in accordance with the specification requirements will be rejected.

B. Substitutions: Substitution of material or equipment shall be in accordance with the General Conditions.

C. Shop Drawings. Shop drawings shall be submitted to the Engineer for review in accordance with the Division 1. Shop drawings shall be submitted for, but not limited to the following:

1. Wire and Cable

2. Hangers and Supports

3. Raceways

4. Lighting fixtures and poles

5. Handholes

D. Submit the following information with all equipment shop drawings.

1. Manufacturer's certified scale drawings, cuts, or catalogs, including installation details and manufacturer's name.

2. Manufacturer's specifications, including certified performance characteristics and capacity ratings.

3. Electrical wiring diagrams and controls, where applicable.

4. Certificate of compliance with Code, where applicable.

E. Equipment shop drawings and wiring diagrams must be prepared specifically for this installation. Standard factory wiring diagrams with a revision marked in ink for this installation will be accepted.

F. All control and wiring diagrams shall be complete with the following description:

1. Sequence of operation

2. Sequence of interlocking

3. Operation of alarms

4. Legend

5. Wiring Numbers

G. All equipment shop drawings shall be properly identified and indicate the Article number of the specifications or the Drawing number which applies to the submitted item.

H. Shop drawings for the items listed above shall be submitted for approval in accordance with the preceding paragraphs. The Engineer, however, reserves the right to require submittal of shop drawings on any other material or equipment to be installed under this Section not specifically listed above.

1.06 MINOR DEVIATIONS:

A. The work as shown on the drawings is diagrammatic and is intended to show the work included and the arrangement of the various systems.

B. It is not intended that the accompanying plans and specifications cover every detail of the required installation. Furnish and install equipment, materials and labor as shown or specified, as are usually furnished, or as are needed to make a complete and satisfactory operating installation, whether mentioned or not, omitting only those items which are specifically excluded.

C. Locations and mounting heights of equipment and/or devices as shown are approximately correct. The Engineer reserves the right to relocate any equipment or device prior to actual installation at no extra cost to the Owner.

D. No deviation from layout shall be made without written approval from the Engineer.

1.07 TEMPORARY LIGHT AND POWER:

A. The Contractor shall provide temporary light and power and pay all energy charges as described in Division 1.

1.08 ELECTRICAL REFERENCE SYMBOLS:

A. Symbols shown on the drawings shall approximate location of fixtures, outlet boxes, and conduit runs, and other equipment, unless otherwise detailed. The exact location shall be governed by structural conditions and obstructions. This is not to be construed to permit redesigning systems. All outlets shall be interconnected as shown on the drawings. Locate and install all boxes and equipment where they will be readily accessible.

1.09 PHASE IDENTIFICATION:

A. The entire system of wiring shall be phased by color code as follows:

1. Wires No. 6 AWG and smaller shall have a continuous colored outer covering.

2. Wires larger than No. 6 AWG shall be identified at all points of termination by gummed tape, plastic tape, etc., applied to the wire.

3. Bus bars in motor control centers and panelboards shall be properly identified by color as herein specified.

4. Code colors for 120/208 volt systems shall be:

a. Phase A - Black

b. Phase B - Red

c. Phase C - Blue

5. Code colors for 277/480 volt systems shall be:

a. Phase A - Brown

b. Phase B - Orange

c. Phase C - Yellow

6. Neutral wires shall be white or grey.

7. Equipment ground wires shall be green.

8. The same colors shall be used for the same phases throughout the entire project.

1.10 PROTECTION AND CLEANING OF EQUIPMENT:

A. All electrical equipment, upon receipt, shall be adequately stored and protected from damage.

B. After installation, all electrical equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent entrance of foreign materials.

C. The interior of boxes and cabinets shall be left clean. Exposed surfaces shall be cleaned and plate surfaces polished.

1.11 OPERATION AND MAINTENANCE MANUALS:

A. The Contractor shall furnish the Owner with three (3) copies of complete operating and maintenance manuals. Manuals shall include all equipment, maintenance instruction, parts list, warranties, schematic diagrams of control systems, and lubrication charts.

B. Manuals shall contain only that information which specifically applies to this project, and all unrelated material shall be deleted. During the instruction period, herein specified, this manual shall be used and explained. Each copy of manual shall be clearly indexed and include a directory of all subcontractors and maintenance contractors, indicate the area of their responsibility, and list the name and telephone numbers of the responsible member of each organization. This material shall have a clear plastic protective shield over each sheet of data.

C. Each manual shall be bound in an expandable plastic covered hard bound binder. Binders shall be three (3) straight post type or ring type binders. The manual's front cover and side cover shall be stamped "Operation and Maintenance Manual -- Electrical Systems" along with the project title.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS:

A. A competent Engineer shall be provided by the Contractor to instruct operating personnel in the operation and maintenance of equipment and systems.

1.13 SPARE PARTS DATA:

A. The Contractor shall furnish a complete list of recommended spare parts and supplies for the equipment furnished with current unit prices and source of supply.

1.14 TESTS:

A. The Electrical Subcontractor shall perform all tests at the completion of the work and the results furnished to the Owner and Engineer in writing. Tests shall include, but not be limited to: all systems test free of shorts or grounds, proper neutral connections, ground system resistance, secondary voltages at main distribution panel, power panels and lighting panels, all lighting fixtures with lamps in place for 10 hours.

B. Upon completion of all work, the Electrical Subcontractor shall furnish, in duplicate, certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized Factory Engineers or agents have inspected and tested the installation of their respective systems and found same to be in satisfactory operating condition.

C. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests.

1.15 GUARANTEE:

A. The Contractor shall guarantee equipment and performance of the installation and equipment in accordance with the GENERAL CONDITIONS.

B. Lamps shall be furnished and installed in each lighting fixture as soon as fixtures are properly hung. Replace all lamps that fail within one year after final acceptance at no additional cost. If the Contractor fails to replace lamps during the guarantee period, after a second request the Owner may replace lamps and back-charge Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specification shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be U.L. listed wherever such approved materials and equipment is available.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his cost and expense. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be executed in full accordance with the National Electrical Code and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, this Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

B. Load Balance. Check the load balance on the phases of the various systems and reconnect where necessary as approved by the Engineer to provide equal division of the loads between the phases of the various systems.

C. Before starting the work, confer with all other trades relative to the location of pipes, and apparatus or fixtures to be installed by them and select locations for the work which will avoid possible conflicts with the work of other trades involved. All differences or conflicting conditions concerning the work shall be called to the attention of the Engineer for adjustment before starting work. For such work performed or materials installed in violation of the above clause the work shall be readjusted to the complete satisfaction of the Engineer at the sole expense of the Electrical Subcontractor.

D. A concrete housekeeping pad shall be furnished and installed for all floor-mounted equipment. The pad shall be 4-inches high and sized to extend 4-inches beyond the equipment. The pad shall be poured dead level and the top scored from front to back on 18-inch centers with a parting tool. All edges shall be finished with an edging tool. The Contractor should refer to Division 3, Cast-In-Place Concrete for additional requirements.

E. Cleanup

1. This Contractor shall cooperate with other workmen and with the General Contractor in the daily removal of debris from the work site.

2. This Contractor shall leave "broom clean" all areas where he has interrupted or completed his work.

3. He shall cooperate with the General Contractor in good housekeeping procedures.

4. At the completion of his work, prior to the final inspection, this Contractor shall clean all devices, plates, fixtures, glassware, switches, cabinets, exposed conduits, fittings, etc. and shall have the premises in a thoroughly clean condition.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Concrete equipment bases.
6. Cutting and patching for electrical construction.
7. Touchup painting.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

F. RSC: Rigid Steel Conduit galvanized

1.04 SUBMITTALS

A. Product Data: For electricity equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.06 COORDINATION

A. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

B. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.

B. FMC: Zinc-coated steel.

C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.

D. RSC: Zinc-coated steel.

E. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

F. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

G. Raceway Fittings: Specifically designed for the raceway type with which used.

2.02 CONDUCTORS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

B. Conductors, Larger Than No. 10 AWG: Stranded copper.

C. Insulation: Thermoplastic, rated at 75 deg C minimum.

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

D. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

E. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

F. Expansion Anchors: Carbon-steel wedge or sleeve type.

G. Toggle Bolts: All-steel springhead type.

H. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over-laminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.05 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Exposed: RSC.
2. Concealed: RSC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following raceways for indoor installations:

1. Exposed: IMC.
2. Concealed: IMC.
3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: RSC.
5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.03 RACEWAY AND CABLE INSTALLATION

A. Install raceways and cables at least 6 inches away from heat generating equipment.

B. Use temporary raceway caps to prevent foreign matter from entering.

C. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

D. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

E. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

F. Install signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

G. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.04 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed.

E. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed.

F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.05 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.06 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.07 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

H. Simultaneously install vertical conductor supports with conductors.

I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

J. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

K. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
   1. New Concrete: Concrete inserts with machine screws and bolts.
   2. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
   3. Steel: Welded threaded studs or spring-tension clamps on steel.

      a. Field Welding: Comply with AWS D1.1.

   4. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
   5. Light Steel: Sheet-metal screws.
   6. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.08 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

   1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
   2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
   3. Colors: As follows:
      a. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.

3.09 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.10 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Cutting and patching for electrical construction.
8. Touchup painting.

3.11 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements as recommended by manufacturers.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 16123

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES

A. Available Manufacturers:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper, solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THHN-THWN, XHHW, UF complying with NEMA WC 5 or 7.

2.03 CONNECTORS AND SPLICES

A. Available Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway

C. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.

A. Underground Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

3.02 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."

F. Identify and color-code conductors and cables according to Division 16 Section Basic Electrical Materials and Methods.

3.03 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.04 FIELD QUALITY CONTROL

D. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

E. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RNC: Rigid nonmetallic conduit.

H. RSC: Rigid Steel Conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

C. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING

A. Available Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
4. LTV Steel Tubular Products Company.
5. Manhattan/CDT/Cole-Flex.
6. O-Z Gedney; Unit of General Signal.
7. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

F. Plastic-Coated IMC and Fittings: NEMA RN 1.

G. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Certainteed Corp.; Pipe & Plastics Group.
4. Condux International.
5. Electri-Flex Co.
6. RACO; Division of Hubbell, Inc.
7. Spiralduct, Inc./AFC Cable Systems, Inc.
8. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

E. LFNC: UL 1660.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Hoffman.
4. Hubbell, Inc.; Killark Electric Manufacturing Co.

5. O-Z/Gedney; Unit of General Signal.
6. RACO; Division of Hubbell, Inc.
7. Robroy Industries, Inc.; Enclosure Division.
8. Spring City Electrical Manufacturing Co.
9. Thomas & Betts Corporation.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

2.05 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: RSC.
2. Concealed: RSC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or 4.

B. Indoors:

1. Exposed: IMC.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
3. Damp or Wet Locations: Rigid steel conduit.
4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 4.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits embedded in or in contact with concrete.

3.02 INSTALLATION

A. Complete raceway installation before starting conductor installation.

B. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

C. Install temporary closures to prevent foreign matter from entering raceways.

D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

E. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

F. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

G. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

H. Tighten set screws of threadless fittings with suitable tools.

I. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations.
2. Where otherwise required by NFPA 70.

M. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

N. Flexible Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

O. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

P. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

THE FIRST DUTY IS TO REMEMBER

In 1983 the 24th Marine Amphibious Unit (24th MAU) was assigned to the Multinational Peacekeeping Force (MNPF) in Beirut, Lebanon. The 24th MAU consisted of four elements: command, ground combat (1st Battalion, 8th Marine Regiment - Battalion Landing Team), aviation combat (Marine Medium Helicopter Squadron – 162 REIN, HMM-162), and combat service support (MAU Service Support Group 24 – MSSG-24). On May 29, 1983, all major elements of the 24th MAU landed ashore at first light, commenced motorized patrols immediately, and, by noon, assumed their new positions. The BLT 1/8 and the attached units established their headquarters in the former government of Lebanon's Aviation Administration Bureau. A bombed-out, four story building at the Beirut International Airport, this building was considered one of the strongest in Beirut because of the reinforced concrete construction. Their mission was to continue facilitating the withdrawal of foreign fighters from Lebanon and to help restore the sovereignty of its government at a time when sectarian violence had torn apart the Mediterranean nation.

At 6:22 on Sunday morning, October 23, 1983, a suicide bomber drove a 19-ton truck through the southern perimeter of the Marine compound at Beirut International Airport, speeding past a sentry post and entering the lobby of the BLT 1/8 headquarters. After a brief and ominous pause, the suicide bomber detonated the trucks twenty-one-thousand-pound explosive payload, causing a massive explosion, lifting the building into the air, and collapsing the structure.

The compressed gas-enhanced device caused the largest non-nuclear explosion on record at the time, leaving 241 U.S. service members to perish in a mountain of rubble. Two hundred and twenty Marines, 18 Navy sailors, and three Army soldiers were killed that day and more than 100 others were injured. It was the worst single-day death toll for the Marines since the World War II Battle of Iwo Jima. The Beirut Bombing marked the true start of the global war on terror.

On that tragic day, the State of Rhode Island lost nine of its own. In 2016, a commission was established by the Rhode Island House of Representatives to build a monument in memory of The Rhode Island Nine.

On this day, October 23, 2019, the State of Rhode Island pays tribute to our nine fallen and brave Marines.

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #1

TEXT HEIGHT: 1/4" WITH BRAILLE AT 5/8" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #2

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #3

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #4

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #5

24"

$\frac{1}{2}$" MARGIN

$10\frac{3}{4}$"

3" x 2.5" 8TH MARINES INSIGNIA

3" X 2.5" MARINES RANK INSIGNIA

CPL. JAMES FRANCIS SILVIA, USMC - BORN 05/26/63. HOMETOWN MIDDLETOWN, RI. FOOD SERVICE SPECIALIST, GRADUATED IN 1981 FROM MIDDLETOWN HIGH SCHOOL, WHERE HE WAS ON THE FOOTBALL AND TRACK TEAMS. WAS A COOK IN THE MARINES AND PLANNING ON ENTERING CULINARY ARTS SCHOOL AFTER DISCHARGE. HIS BROTHER-IN-LAW, CORPORAL STEPHEN E. SPENCER, ALSO DIED IN THE BEIRUT BOMBING. AT THE TIME OF HIS DEATH, LEFT HIS MOTHER, MRS. PATRICIA FARRELL, AND HIS FATHER, JOSEPH.

TEXT HEIGHT: 1/4" WITH BRAILLE AT $\frac{5}{8}$" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #6

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #7

TEXT HEIGHT: 1/4" WITH BRAILLE AT 5/8" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #8

TEXT HEIGHT: 1/4" WITH BRAILLE AT ⅝" BETWEEN LINES
TEXT FONT: SANS SERIFF OR OTHER ADA ACCEPTABLE FONT

SCALE: 6"=1'-0"

BRONZE MARINE BIOGRAPHY PLAQUE #9

9.5” TYP.

12” TYP.

MARINE #1 SGT. TIMOTHY ROBERT GIBLIN

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #2 CPL. RICK ROBERT CRUDALE

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #3 CPL. EDWARD SALVATORE IACOVINO

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #4 CPL. DAVID C MASSA

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #5 CPL. THOMAS ALAN SHIPP

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #6 CPL. JAMES FRANCIS SILVIA

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #7 CPL. EDWARD SOARES JR.

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #8 CPL. STEPHEN E. SPENCER

SCALE: 1”=1”

9.5” TYP.

12” TYP.

MARINE #9 LCPL. THOMAS ADRIAN JULIAN

SCALE: 1”=1”

10” TYP.

10” TYP.

HMM-162 PATCH FOR ENGRAVING

SCALE 1”=1”

10” DIAMETER MAX.

UNITED STATES MARINE CORPS
EAGLE, GLOBE, AND ANCHOR FOR ENGRAVING

SCALE: 1”=1”